# Advanced Livestock Production & Management

## Student Reference

10-4020-S

In cooperation with
Agricultural Education Department of Practical Arts and Vocational-Technical Education
College of Education and College of Agriculture, Food and Natural Resources
University of Missouri-Columbia

Agricultural Education Section Division of Vocational and Adult Education
Department of Elementary and Secondary Education, Jefferson City, Missouri

MISSOURI AGRICULTURAL EDUCATION

10-4020-S

# ADVANCED LIVESTOCK PRODUCTION AND MANAGEMENT

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Produced by:
Instructional Materials Laboratory
University of Missouri-Columbia
10 London Hall
Columbia, Missouri 65211

Volume 32
Number 2

Catalog Number 10-4020-S
June 2000

Available from:
Instructional Materials Laboratory
University of Missouri-Columbia
10 London Hall
Columbia, MO 65211
573-882-2883



The activity that is the subject of this report was supported in whole or in part by funds from the Department of Elementary and Secondary Education, Division of Vocational and Adult Education. However, the opinions expressed herein do not necessarily reflect the position or policies of the Missouri Department of Elementary and Secondary Education or the Division of Vocational and Adult Education, and no official endorsement should be inferred.

# ACKNOWLEDGMENTS

Recognition is given to advisory committee members for providing their valuable time and suggestions in developing this *Advanced Livestock Production and Management* curriculum. The committee consisted of Tammy Bartholomew, Jim Bellis, Micah Bristow, Quentin Combs, Bill Herring, Vance Keaton, Tim Larrick, Paul Light, Jesse Lyons, Gene Milligan, Richard Roller, Harley Schlichting, Barry Steevens, Wes Strange, and Dan Tvrdy.

Appreciation is expressed to the following staff members of the Instructional Materials Laboratory for their efforts in producing this material: Dana Tannehill, Director; Dan Stapleton, Associate Director; Veronica Feilner, Project Coordinator; Marie Korte, Editor; Bonnie Painter, Assistant Editor; Janis Levsen, Assistant Editor; Cheryl Unterschutz, Graphic Designer; Chris Casey, Graphic Artist; Theresa Wiehagen, Graphic Artist; and Jill Clark, Jamie Keith, and Allison Cadle, Editorial Assistants.

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# FOREWORD

The development of the *Advanced Livestock Production and Management* curriculum guide is the result of suggestions by the MVATA Teaching Aids Committee. The Advanced Livestock Production and Management Advisory Committee suggested the topics to be included and reviewed the materials.

This curriculum contains ten units. Topics include current and future issues in animal agriculture; a description of beef, dairy, swine, sheep, horse, and poultry enterprises; livestock selection; breeding procedures; parturition; health; facilities and equipment; animal feeding; herd/flock management; and marketing. An instructor guide can be purchased separately.

During the summer of 1981, the Missouri State Board of Education formally adopted the concept of "Instructional Management Systems" (IMS) as a priority for the 1981-82 school year. The Missouri Commissioner of Education described the IMS concept as a practical way of "organizing for excellence" in education. To meet the demand for greater productivity and accountability, the director of Vocational Education applied the elements of IMS to form the Vocational Instructional Management System (VIMS). The VIMS process provides a framework to use in planning and organizing to assure excellence in Missouri's vocational education system by focusing greater attention on the management of teaching and learning. The instructor guide for this student reference incorporates the needed component parts to aid agriculture teachers in the implementation of VIMS.

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# ADVANCED LIVESTOCK PRODUCTION AND MANAGEMENT

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## *Lesson 1: Current and Future Issues*

Livestock production is an important part of the agricultural economy in the state of Missouri and the United States. Livestock operations provide food and clothing to the people of the United States, and they should understand the importance of animal agriculture and the issues surrounding the livestock industry. Anyone involved with animal agriculture should be aware of the issues the industry faces and the values of groups like People for the Ethical Treatment of Animals (PETA). Producers should be prepared to respond to these issues and become involved in the development of policies that affect livestock operations.

### Importance of Agricultural Literacy

It is very important for people to be agriculturally literate. Today, consumers are often unaware of how their food and fiber for clothing are produced. More of the population of the United States lives in urban and suburban areas than in rural areas. Nearly 90 percent of the population is two or three generations removed from direct contact with food and fiber production. They are also unaware of the impact that agriculture has on the general welfare and standard of living in the nation. Because of the efficiency of the American agricultural producer, consumers only spend about 14 percent of their disposable income on food. Consumers need to be educated about the activities of producers in order to appreciate the benefits they provide. Increased knowledge about agricultural production, processing, marketing, distribution, regulation, and research will encourage consumers to support U.S. agriculture and the producers that supply them with food and fiber.

Organizations such as the National Beef Industry Council, the National Pork Producers Association, and the American Farm Bureau are working to educate the general population about agriculture's contributions to the food system, the economy, and the interaction between agriculture and the environment. Different organizations and programs have specific goals. However, they may collaborate to strengthen their overall impact. Programs may emphasize the importance of agriculture by producing curriculum and classroom resource materials, teaming producers and consumers, and providing pre- and in-service training for teachers. All of these programs are helping to advance the knowledge of agriculture.

### Animal Rights and Animal Welfare

Improving agricultural literacy may affect people's responses to animal activists, including animal rights and animal welfare groups. People sometimes think that animal welfare and animal rights are the same thing. However, the positions of these groups are different.

Animal rights activists believe animals have the same rights as humans, so humans do not have the right to use them as a resource. Animal rights activists often focus on activities like castration and dehorning as inhumane because they are performed without anesthesia. They are also critical of the conditions in which animals are raised, like confinement housing for swine and poultry. They promote vegetarianism. Activists have carried out many protests, mailings, and demonstrations against animal agriculture. They also have web sites on the Internet that are critical of livestock production.

Animal welfare activists support the humane treatment of animals. People with an interest in animal welfare believe that animals should have all their needs met in a comfortable environment. They frequently publicize and document cases of animal abuse in an effort to get laws changed to protect the welfare of animals. They may not oppose animal agriculture if management practices are carried out in a humane manner.

Livestock producers should understand the basic position of both of these groups. Producers involved in animal agriculture are concerned with the well-being of their animals. The treatment of the animals will affect their growth and production, which will affect the profitablity of the operation. Therefore, providing proper care and management is in the best interest of the producer. Producers should help to educate consumers about livestock production to emphasize their concern for the welfare of their animals and help prevent perceptions of abuse and mistreatment.

### Environmental Concerns

Environmental concerns cover a wide variety of topics. Issues affecting animal agriculture include manure management, water quantity and quality, and the loss of wildlife habitats. Environmental

activists publicize these issues and often attempt to pass legislation that will affect animal agriculture.

Manure management issues are a concern for any livestock operation, but they become a major concern when dealing with intensive agricultural confinement systems such as feedlots and confinement swine facilities. Potential problems include odor control and improper manure management practices leading to pollution. Producers must take measures to prevent problems associated with manure management.

Water quantity and quality issues also affect animal agriculture. Many activists are concerned about the quantity of water it takes to raise an animal. They believe that water resources could be used more effectively for other things, such as growing crops. The issue of water quality is tied to manure management and the contamination of the water supply by manure. Groundwater contamination may occur as a result of runoff from animal feedlots or lagoon overflows that enter streams or by improper application of manure as fertilizer. To address these concerns, producers must manage their water supply effectively. To prevent problems, they may seek help from local Extension offices for the proper planning of manure storage facilities and drainage systems.

The destruction of wildlife habitats is another issue that has an impact on livestock production. Many activists believe that livestock fight with wildlife for scarce resources and thus cause habitat loss. Other people argue that agricultural enterprises threaten already endangered species. For example, some species of fish in Missouri are thought to be endangered as a result of runoff from animal wastes. Producers should understand the ramifications of having an endangered species found on their property and what regulations may affect them. Livestock producers should attempt to manage their operations to promote the well-being of both livestock and wildlife.

## Food Safety Issues

One of the most important issues facing producers involved in animal agriculture is the food safety concerns of consumers. Most of these concerns have to do with bacterial and chemical contamination of the food supply. Highly publicized cases of bacterial contamination with incidents of people becoming ill have caused questions about the safety of the meat supply. For example, illness can be caused by the presence of *E. coli* in undercooked meat, listeria in hot dogs and deli meats, and salmonella in raw and dried eggs and poultry products. Consumers have also expressed concern about the presence of chemical residues in meat and milk products.

Although incidents do occur, the food supply in the United States is among the safest in the world. Concerns about food safety can be addressed by following proper management practices outlined by livestock associations like the National Pork Producers Association. They sponsor quality assurance programs aimed at assuring the wholesomeness of the products of animal agriculture. The programs educate producers about management practices, such as the proper uses, dosages, and withdrawal times for antibiotics, hormones, and vaccines. Producers should also promote safe food preparation practices to ensure the safety of consumers.

Some producers are choosing to meet the concern about food safety by becoming involved in organic farming. One basic definition of an organic product is a product produced without the use of chemicals or hormones. Producers have begun to market both meat and milk produced organically. Consumer demand, especially in urban areas, has been instrumental in the expansion of organic farming. Grocery stores may have a special section just for these products, which often sell for a much higher price.

## Communication and Information Technology

Advances in communication and information technology affect opportunities for agricultural producers. One of the most important considerations in developing an agricultural enterprise is determining if markets exist for the product a producer plans to raise. Over the last few years, improvements in technology have made it possible to market animals in new ways. For example, cattle auctions via satellite feeds are becoming a popular way to market some cattle. This method of marketing gives the producer an opportunity to sell animals to customers throughout the United States and internationally. Producers are using the Internet to market livestock by either advertising animals they have for sale on special web pages or developing their

own web pages to provide information about their operations. Web pages are also useful for producers who develop niche markets for their products, such as a beef producer who raises beef without feed additives, slaughters and processes the carcasses, and sells the product under its own brand name.

Information technology can also assist producers in becoming better managers. The Internet provides easy access to the web sites of college animal science departments, university extension programs, and livestock associations, all of which can provide information on management practices that may increase profits. Information on animal production regulations is also available on the Internet. As technology continues to evolve, more opportunities will be made available to producers willing to embrace change.

### Scientific Advances

A number of scientific advances that have or could have an important impact on animal agriculture have occurred in recent years. These advances are related to the field of biotechnology. Biotechnology has led to the development of supplemental hormones like BST, which is used in the dairy industry to increase the amount of milk produced by cows. It has also been used to develop more effective vaccines for preventing diseases in livestock. Various types of cloning have been practiced successfully, including the cloning of a sheep from a single cell take from an adult animal. Some of the developments in biotechnology have already had an effect on productivity. Producers will need to make an effort to remain aware of these advances to ensure that they are producing livestock as effectively and efficiently as possible.

Because of scientific advancements in the field of biotechnology, producers will also have to increase their efforts to educate consumers about the effect of these developments on food production. Consumers in America and especially Europe are questioning the safety of products that have been produced using biotechnology. Producers will have to assure consumers that biotechnology can be applied to animal agriculture safely.

### International Standards of Operation

International standards of operation may have an impact on animal agriculture in the future. ISO 9000 is a series of international standards that was developed in the late 1980s based on the input of 91 participating countries. Their goal was to outline standards to encourage international trade by establishing set standards for quality. The standards were developed in response to pressure from the European Community to set minimum quality standards for imported products. The ISO 9000 standards set guidelines for quality management and quality assurance. They are concerned with the quality of the processes used to produce a product and how these processes affect the product's quality. ISO 9000 standards for animal agriculture would therefore cover some of the same areas addressed by current quality assurance programs, like the Beef Quality Assurance program sponsored by the Missouri Cattlemen's Association. Producers would have to show thorough documentation of adherence to quality assurance processes to be able to export their products to countries that follow ISO 9000 standards.

### Summary

Producers must understand the various issues that can have an impact on markets for the products of animal agriculture. The issue of animal rights or animal welfare, environmental concerns, food safety issues, and concerns surrounding the use of biotechnology may affect the market for animal products. Increasing agricultural literacy may help to alleviate some of the concerns of consumers. Producers should also be aware of the benefits of biotechnology, developments in communication and information technology, and new international standards for production because they all may have an impact on the methods used in production.

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## *Lesson 1: Missouri's Livestock Industry*

Agricultural production plays a vital role in the economy of Missouri and the lives of its citizens. Livestock production is an important part of Missouri's agricultural industry. People in Missouri raise all sorts of livestock, including everything from emus to beef cattle.

### Why Raise Livestock?

In ancient times, people hunted animals and gathered plants and other edibles to supply themselves with food. Later, animals were domesticated and raised to supply food and clothing for their owners. This practice gave people a more constant and reliable source of food. The domestication of animals has since evolved into a complex and dynamic modern livestock industry. Improvements in technology, changes in consumer demands, and improvements in overall efficiency all have had a profound effect on the livestock industry.

In spite of the changes that have occurred over the years, some basic reasons for raising livestock remain the same. Animals provide people with food, fiber for clothing and other uses, and work. The different types of livestock raised by producers provide milk, meat, and eggs. They also provide wool and leather for clothing. Some people still use animals for work. They use horses for transportation around farm facilities or when working with cattle and sheep.

Many people raise livestock as a business to make a profit. The goals and scope of livestock businesses vary. Some producers may attempt to supplement income earned in other ways while others support their families entirely with the earnings they receive from livestock production. Modern commercial livestock enterprises in the United States have grown to be multi-million dollar businesses that employ thousands of people with skills and experience related to raising livestock.

Some people raise livestock for recreational purposes. Most horse owners purchase horses because they enjoy riding and working with them. Horses are also important for sporting events such as horse and harness racing, equestrian competitions, and rodeos. Some individuals may raise livestock because they enjoy showing their animals in livestock shows.

### Livestock Species Raised in Missouri

Missourians raise a large variety of livestock species, but only a few of these species constitute large commercial sales. Common commercial livestock species raised in Missouri include dairy cattle, beef cattle, sheep, swine, and poultry, especially chickens (including layer hens and broilers) and turkeys. Other livestock animals raised within the state include horses, mules, llamas, rabbits, dairy and meat goats, and other poultry species including bantams, ducks, geese, emus, and pigeons.

### Livestock Production and Missouri's Economy

According to *Missouri Farm Facts 1998*, a publication of the Missouri and U.S. Departments of Agriculture, farm cash receipts in Missouri were almost evenly split between crop and livestock production. Total cash farm receipts reached $5.56 billion in 1997, the first time receipts surpassed $5 billion. Among the states, Missouri was thirteenth in the nation in farm cash receipts. Livestock sales accounted for $2.8 billion of the receipts. Meat animals accounted for 60 percent of the total receipts, while poultry and eggs brought in 27 percent and dairy products 12 percent. The remaining 1 percent of farm receipts were generated by speciality livestock farms.

Missouri ranked eleventh in the nation in farm exports, with cash receipts from exports reaching $1.54 billion in 1997. Important export items related to livestock production include poultry and poultry products and dairy products. Missouri ranked ninth in the nation in poultry-related exports and eleventh in exports of dairy products.

Missouri ranked high among the states in cattle production. In 1997, the state was second in the nation in the number of cattle operations with 69,000 operations. Missouri also ranked second in beef cow operations, beef cow numbers, and calf crop. Missouri ranked eighth in the nation in the number of milk cow operations. As of January 1, 1998, the number of cattle on Missouri farms totaled 4.3 million head. Cash receipts from cattle and calves equaled $901 million.

Missouri also ranked high in other areas of livestock production. The state was ranked sixth in the nation in 1997 in the number of turkeys raised, producing 22 million turkeys with a value of

$235 million. Missouri ranked seventh in the number of hogs and pigs and in the number of hog operations. Cash receipts from hogs and pigs were $778 million. The state ranked tenth in the number of broiler operations and in broiler production. Broiler production totaled 1.08 billion pounds, and the value of production was $403 million. Missouri ranked twelfth in the number of sheep operations. Cash receipts from sheep and lambs equaled $3.5 million.

The amount of products generated by livestock production in the state is significant. The state was fourteenth in egg production, providing 1.72 billion eggs with a production value of $84 million. The state ranked sixteenth in both milk and red meat production. Cash receipts from milk marketing totaled $319 million; 2.37 billion pounds of milk was marketed. Missouri ranked twenty-first in wool production. The value of wool production was $228,000.

## Summary

People in Missouri raise livestock for a variety of reasons. Some people raise animals for recreational purposes, while many other raise livestock as a business. However, livestock are primarily raised because they provide humans with food, fiber, and work. Common commercial livestock species raised in Missouri include dairy and beef cattle, swine, sheep, and poultry, chiefly consisting of chickens and turkeys. Other animals raised on Missouri farms include horses, mules, llamas, rabbits, goats, and other types of poultry. Half the farm cash receipts for the state comes from livestock and the state ranks high nationally in many areas of livestock production.

## Credits

Gillespie, James R. *Modern Livestock and Poultry Production.* 5th ed. Albany: Delmar, 1997.

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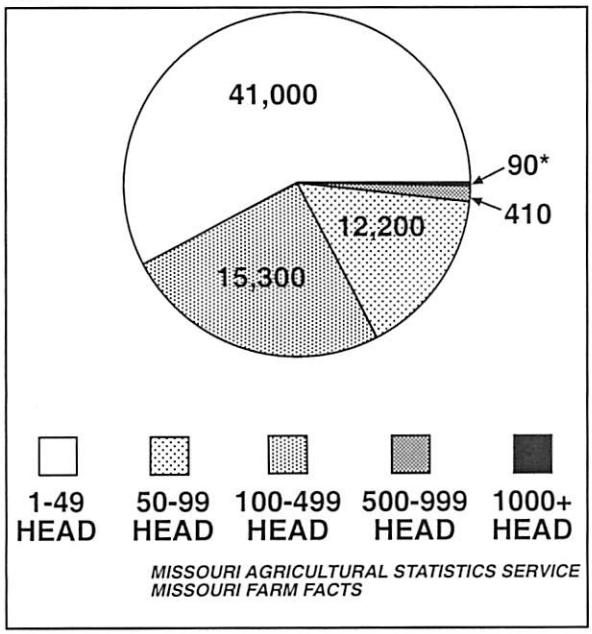
## *Lesson 2: Beef Enterprises*

As discussed in Lesson 1, the beef industry forms the largest sector of animal agriculture in Missouri. Missouri had 69,000 cattle operations with beef or milk cattle in 1997. Of these operations, 60,000 had beef cows. Figure 2.1 indicates that most of the production on all cattle operations were from small herds of less than 50 head. A 1996 study by the University of Missouri Agricultural Economics Department indicated that the Missouri beef industry supported 156,000 jobs in Missouri. The primary product of beef enterprises is the sale of meat for human consumption, although beef by-products, such as the hides, bones, blood, and internal organs, also have value.

*Figure 2.1 - Missouri Cattle Operations by Size, Group, 1997*




### Types of Beef Enterprises

Beef enterprises can be separated into four separate phases of production. The seedstock producer raises breeding stock in the form of bulls, heifers, or cows. The cow-calf producer raises animals sold for additional feeding. The stocker-yearling producer primarily feeds cattle for growth before they are sent to the feedlot, while the feedlot operator feeds animals in small pens or fenced areas until they are finished and ready for market.

Seedstock producers may also be referred to as purebred breeders. The purpose of the seedstock enterprise is to raise genetically superior females and herd bulls for sale to cow-calf producers. The purebred breeder is usually a beef producer who has selected a particular breed of beef animals to raise based on a personal preference or belief that this particular breed offers some advantage to cattle producers.

Cow-calf producers mostly operate in the Plains or Corn Belt states. Missouri is one of the Corn Belt states but also has large areas suited for forage production. This location, with its availability of grain and forages and its temperate climate, is the reason Missouri is a leading state for cow-calf production. The cow-calf producer generally raises calves for sale to other beef operations, although producers may retain ownership of the cattle until finishing or market. Most producers breed high quality grade cattle. The cows are bred to calve in late winter or early spring, with the calves being sold in the fall. This reproductive cycle takes advantage of the warm summer growing season for pasturing animals. Natural mating is typically used with grade cow-calf systems. Some beef producers use artificial insemination with more expensive females, which allows access to a wider variety of top quality bulls.

The stocker-yearling operator is also referred to as a backgrounder. Backgrounding involves raising the calf from the time it is weaned from the mother cow to the feedlot phase. The animals begin this period at 400 to 600 pounds and enter the feedlot at 700 to 900 pounds. Backgrounding is essential to add weight to the calf before it enters the final feeding phase and is sent to a feedlot. Producers in this phase of beef production use less expensive forages (like annual grasses) to add weight to the calf. Supplemental grain may also be fed to increase the rate of gain and prepare the calves to enter the feedlot phase earlier.

The feedlot operator completes the grow-out phase of beef production. The states of Nebraska, Kansas, Oklahoma, and Texas have the largest numbers of beef cattle feedlots. Missouri has only a few true feedlots. This type of beef producer feeds out calves to market weight. The finishing process involves the feeding of more concentrates, which are high energy feeds such as corn, milo, and oats. About 90 percent of all market cattle pass through a commercial feedlot.

## Resources Needed for Beef Enterprises

The selection of a type of beef enterprise is based on the resources available for the operation. A producer must have certain essential resources to be successful in beef production. The five basic resources needed are markets, land, labor, capital, and management.

Markets - Beef enterprises must have markets available for production to be successful. Producers must have a market for their animals close enough to hold down transportation costs and avoid large losses from stress on the animals during shipping.

Land - The land in Missouri includes plains, hilly forested areas, and gently rolling hills. Much of the land supports good grazing for beef cattle. Although beef cattle enterprises are located throughout the state, the size and type of operation varies greatly with the potential uses and price of the land. Most beef production takes place away from the populated and heavily forested areas of the state. Missouri has very few feedlot operations, in part because the population density conflicts with animal operations that may cause environmental issues such as odors in the air and animal waste entering streams. Most of the slaughter beef animals are shipped west to other states.

Capital - Capital refers to the money necessary to establish and support a beef enterprise. Many factors affect the amount of capital needed, including the size and type of operation. For example, seedstock producers tend to have higher capital requirements per animal than other enterprises, while backgrounders typically have the least amount of capital invested in the beef operation. Feedlots with large numbers of cattle tend to have large capital requirements, in part because of the cost of the feed purchased to finish the animals.

Labor - Labor needs for beef enterprises vary depending on factors such as the type of enterprise and herd size. Backgrounders have the lowest labor requirements. Operations with breeding herds require more labor to work with breeding and calving. Because feedlot enterprises may be large, labor requirements can be high. Using labor-saving equipment whenever possible can reduce the amount of labor needed for a beef enterprise.

Management - Good management skills are essential for any type of livestock enterprise. Just as backgrounding requires less capital and labor, fewer management skills are necessary for stocker-yearling enterprises. However, skills in buying and selling animals and diagnosing and treating illnesses are important. Seedstock and cow-calf producers must be able to manage breeding and calving efficiently. Managing a large feedlot requires more management skills to manage labor, maintain herd health among concentrated numbers of animals, and ensure that animals are fed for optimum performance.

## Capital Requirements

Capital investments in agricultural operations are large. Statistics show that it takes about $17.50 in farm assets to produce $1.00 of farm income. The average U.S. farmer or rancher has about $370,000 invested in land, equipment, animals, working capital, and buildings. A livestock operation requires both a large amount of capital and a knowledge of financing. Credit is the lifeblood of the livestock business. Without it most large operations would not be possible because few people are able to provide all the capital they need.

The amount of capital needed varies depending on the size of the operation, location, and ownership of resources versus leasing. Kansas State University data from 1997 shows that a producer with a herd of 100 cows has an average investment of $352 per cow, including costs such as buildings, improvements, and the cow-herd share of equipment use, but not including the cost of land. As the number of cows increases, the cost per cow decreases. Location affects costs because the value of land varies greatly across the United States, which will affect the level of capital investment required. A beef producer who owns the land, buildings, and equipment would also have a higher capital investment than a producer who leases these items on a contract basis.

The type of livestock enterprise also affects the amount of capital required. On average, backgrounding operations have the lowest capital investment requirements because of the nature of the enterprise. However, the least expensive type of beef operation, when looking at expenses per animal would be the feedlot operation. Although the initial capital outlay can be extremely high, large numbers of animals are produced, so less land, fewer buildings, and less equipment are

*Figure 2.2 - Beef Cow/Calf Operating Expenses, Spring Calving (1999)*

| | Per Cow |
|---|---|
| Purchased feed: | |
| Corn: .85 bu. @ $2.00/bu. | $ 1.70 |
| Soybean meal: 15.75 lbs. x $150/ton | 1.18 |
| Salt and additives: 91.25 lbs./yr x $40/T. | 14.83 |
| Grass hay: 2.5 T. x $40/T. (estimated cost of production) | 100.00 |
| Total feed costs (not including pasture) | $ 117.71 |
| Machinery costs, feed preparation, etc. | $ 30.90 |
| Veterinary and medicine: | |
| Production vet. products | 17.78 |
| Vet. services | 5.92 |
| Disease treatment | 1.60 |
| Other livestock materials and services (commissions, yardage, hauling costs, bull depr.) | 25.75 |
| Utilities, insurance, repairs, misc. | 15.00 |
| Operating interest | 9.66 |
| Total non-feed variable costs | $ 106.61 |
| Total variable costs | $ 224.32 |

Variable costs do not include a charge for labor, pasture, interest on investment in the breeding herd, or breeding costs (AI or natural). Other fixed costs such as real estate and property taxes, building insurance and repairs, and other expenses may be estimated for each individual farm situation.

*Adapted from a publication prepared by Vern Pierce, Beef Economist.

needed per animal sold. Seedstock enterprises have a higher investment per animal than any other type of beef enterprise. The purebred animals used for breeding are expensive to purchase. Producers have additional investments in marketing and advertising that other beef producers do not have. They may also invest more capital in equipment, facilities, and possibly the quality of feed than other types of cattle producers.

Costs for beef cattle operations include both operating expenses and ownership expenses. Ownership expenses are fixed costs. Fixed costs are incurred regardless of the level of production or use; they include costs like interest on loans, depreciation, insurance, and property taxes. Operating expenses are referred to as variable costs because they change in proportion to the number of animals produced. Operating expenses for beef enterprises include the cost of the animals and items such as feed, labor, veterinary expenses, fuel, and utilities. Operations with breeding herds will also have operating expenses associated with breeding. Figure 2.2 shows some operating expenses for a cow-calf operation.

Feed costs are typically the highest expense for any beef operation. Although beef enterprises often use pasture to provide feed, additional feed in the form of salt and minerals is provided during the grazing season. Grain and protein supplements may be supplied to increase production. Roughage must also be provided to cattle during the winter when forages are not available in pastures.

## Labor Requirements

Labor for a livestock enterprise is divided into direct and indirect labor. Direct labor is directly related to the beef enterprise, such as time spent working with the animals during calving, weaning, or feeding. Indirect labor is indirectly related to the enterprise, such as time spent repairing fences or harvesting crops.

When determining the total number of hours of labor required for a beef enterprise, the number of direct labor hours per unit of livestock must be determined. In the beef enterprise, labor is figured on a per animal basis. After the direct labor hours are estimated, the indirect hours can be

calculated. Generally, indirect labor is about 30 percent of the direct labor requirements.

The number of hours required per animal for a beef cattle enterprise depends on three main factors: the type of enterprise, herd size, and geographic location of the beef operation. For example, a beef cow in a 45-cow herd on a cow-calf operation in the Midwest requires about 18 hours of labor per year per head. Some factors can cause these estimates to vary; for example, accidents, repairs, and severe weather could increase the time it takes to do a particular job. Cattle herds in the western United States that are larger generally require less labor per cow because less time is spent on management activities for each animal. As already mentioned, stocker-yearling operations generally require less labor than cow-calf or seedstock operations, while large feedlots may hire 15 to 30 full-time workers to carry out the activities of the enterprise.

## Returns for Beef Enterprises

Returns in the beef industry vary greatly from year to year. Expenses for raising the animals, or input costs, vary less than market prices. The goal is to sell the animal for a price that exceeds the break-even price to generate a profit. Break-even price is the price at which income equals costs, leading to neither a profit nor a loss. Table 2.1 shows the potential returns for a 650-pound feeder steer that was finished and marketed at 1,100 pounds. The return per animal (i.e., profit) of $47.42 shown on the table changes with the variable expenses. Some producers may operate on a lower cost basis, increasing the potential profit per animal.

## Risks in Beef Enterprises

Beef enterprises face risks that could affect profit or loss in the enterprise. These risks will vary with the type of enterprise. For example, running feeder cattle bought to graze excess summer pasture usually has lower risks than a large feedlot operation requiring large amounts of capital. The amount of risk for an enterprise can be determined by looking at revenue and cost risk factors.

Revenue risk - Total revenue equals the unit price for a commodity like beef multiplied by the quantity sold. Revenue risks involve both price changes

*Table 2.1 - Estimated Returns*

| | Per Cwt. at Market | Per Head at Market |
|---|---|---|
| Gross Income | | |
| 1,100 pound steer | $ 76.00 | $ 836.00 |
| Operating Expenses | | |
| Feed grains (4.43 bu. corn @$2.40/bu.) | $ 10.63 | $ 116.93 |
| Supplement (25 lb. @ $.15 per lb.) | 3.75 | 41.25 |
| Hay, silage, minerals | 1.43 | 15.73 |
| Total Feed | 15.81 | 173.91 |
| Feeder purchased @$85/cwt | | 552.50 |
| Equipment and buildings | .34 | 3.74 |
| Fuel and electricity | .42 | 6.62 |
| Hired labor | .83 | 9.13 |
| Veterinary and medicine costs | .59 | 6.49 |
| Marketing and hauling | .14 | 1.54 |
| Interest on operating capital | 3.15 | 34.65 |
| Total All Costs | $71.51 | $788.58 |
| Return Above Costs (Profit) | $4.49 | $47.42 |

and changes in quantity, as measured by factors such as daily gain. Total revenue may be affected by animal death rates, livestock weight, livestock quality, available markets at any given time, and weight shrinkage during transportation.

Cost risk - Total costs equal all of the individual costs for an operation added together. Cost risks involve increases in costs. Examples include changes in feed costs, interest rates, feeder and breeding livestock prices, transportation costs, and overhead costs such as insurance.

Some risks such as health problems that affect death rates may be controlled through good management, while other risks, such as weather extremes that reduce feed intake, are outside the control of management. To reduce risk, producers need experience, information, and training in marketing and production techniques.

Producers can adopt some special strategies to reduce risk. Diversification is described by the old adage, "Don't put all of your eggs in one basket." Diversification is becoming involved in other enterprises, such as adding hogs to the beef cattle enterprise. Another method of reducing risks is to sell beef animals using special marketing strategies. Forward contracting guarantees a certain price for a given number of animals. Hedging on the futures market will allow producers to reverse their position on the futures market to protect against a loss. The producer pays a premium to protect against price losses but can profit if the price rises. Insurance provides a third method of reducing risk. The purchase of insurance policies can change a small chance of a large loss into a sure chance of a small cost. Although insurance is not available for price risks, producers may insure against other problems, including losses from lightning, accidents involving liability, and building damage affecting livestock housing. The buildup of cash reserves or credit lines with a lending institution can also reduce risk. They allow livestock producers to meet changes in the costs of raising livestock. In addition, ready cash will allow producers to take advantage of opportunities for profit, such as adding additional animals to the herd.

## Summary

The beef industry is the largest single sector of animal agriculture in Missouri, with the state ranking second in the nation in cattle operations. The beef industry also has a large impact on the agricultural economy of the state. Many factors affect the amount of resources needed and the returns expected from the beef enterprise. The producer's ability to manage these resources and reduce risk will determine the annual profit for an enterprise.

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## *Lesson 3: Dairy Enterprises*

Milk is the primary product of the dairy industry. Secondary dairy products made from milk, such as ice cream, butter, cheese, or yogurt, are generally made off the farm in processing plants. Nationally, dairy enterprises produce 4,100 pounds of milk daily and about 1.5 billion pounds of milk annually.

### Types of Dairy Enterprises

The basic type of dairy enterprise is the dairy farm, which produces milk. Operations vary in size and form. The number of cows per dairy farm in the United States range from less than 30 cows to more than 5,000 cows kept in confinement in a dry lot system, mostly in the western and southwestern United States. However, the average dairy enterprise in the United States has 100 milking cows, 30 dry cows, 30 heifers, and 25 calves. Producers typically raise one breed of cows that are bred for high milk production. Artificial insemination is typically used instead of natural mating because of the high labor requirements associated with maintaining a herd sire. Also, many dairy breed associations sell quality semen at affordable prices for use in artificial insemination programs. Producers farm an average of 250 acres of land and raise a large percentage of the forages used for feed. Producers also use a management intensive grazing system, which involves moving or rotating the herd between smaller pastures every two to three days, allowing for pasture regrowth. The average dairy producer works in a partnership agreement with another person, commonly a family member, so that labor and resource management is shared. They generally market their milk through a cooperative.

Diary enterprises may produce either Grade A or Grade B milk, which is further divided into four classes. Grade A, Class I milk is suitable for drinking, but Grade A milk can be used for all classes of milk products. Grade B or manufacturing (Grade C) milk is suitable only for Class II to IV, which include manufactured dairy products like ice cream, butter, and cheese. Manufacturing grade milk may be produced with less regard for sanitation and quality, although it must be disease-free.

In the dairy industry, very few male calves are raised to maturity because of the benefits of artificial insemination. Instead, males are usually sold for meat. Producers that raise veal as a second product on their farms grow bull calves to 350 to 420 pounds before selling them. Veal sells for a high price because of the meat's tenderness. Keeping bull calves for veal may be profitable for some producers if they have the extra resources needed.

Beef is a major by-product of the dairy industry. Some producers may castrate their bull calves and grow them out as steers for beef. Older cows and heifers that are not used as replacements are also sold for beef. The beef is not sold at as high a price as that from beef cattle, but it does provide another source of income for the dairy producer.

Many dairy producers opt to raise replacement heifers along with their dairy herd. However, producers that do not have the resources to maintain a dairy herd may raise replacements to sell to dairy farms if a market exists in their area. The producer buys heifer calves, rears them, breeds them, and then sells them just before they give birth. A producer may also raise replacement heifers under a contract system. Under a contract, the animals are owned by the dairy producer, who pays the grower for his or her services. The grower receives heifer calves from the producer and rears and breeds them. The grower sends them back to the dairy farm just before they calve.

### Resources Needed for Dairy Enterprises

When considering operating a dairy enterprise, the available resources should be evaluated, taking into consideration markets, land, labor, capital, and management. Only a producer with sufficient resources should go into dairying.

Markets - In the past, being close to a local market of consumers has been an important factor in establishing a dairy farm. Because of improvements in processing techniques and more rapid transportation, proximity to consumers is less of an issue. A dairy producer should make sure that a cooperative marketing association or a processor exists in the area to serve as a market for the milk produced. Sale of milk directly to consumers make up only a small proportion of the milk marketed.

Land - Herds of 100 cows or larger are more likely to be financially successful. To maintain a herd of this size, viable land is needed. Cows should have

*Figure 3.1 - Estimated Production Costs (1999)*

PROJECTED ANNUAL DAIRY COW PRODUCTION COSTS (1999)

| | |
|---|---|
| OPERATING COSTS | |
| Feed (includes waste) | |
| Grain ration | $ 709 |
| Hay and haylage | 329 |
| Silage and green chop | 62 |
| Pasture | 30 |
| Total Feed Cost | $1,130 |
| Veterinary and medicine | $ 72 |
| Other livestock materials and services | 220 |
| Machinery costs, feed preparation, etc. | 115 |
| Utilities | 55 |
| Other (insurance, property taxes, real estate repairs, and misc.) | 67 |
| Operating interest, 9% | 75 |
| Total Cash Costs Except Labor | $1,734 |
| LABOR | $ 365 |
| TOTAL ALL VARIABLE COSTS | $2,099 |
| OWNERSHIP COSTS | |
| Real estate interest, depreciation, and taxes | $ 75 |
| Breeding herd investment | 75 |
| Machinery and equipment interest and depreciation | 58 |
| Total Fixed Costs | $ 208 |
| TOTAL ALL COSTS | $2,307 |

Note: The cost of replacement heifers is not included.
*Adapted from a publication prepared by Ken Bailey, Dairy Economist.

some pasture to graze on if they are not in a dry lot. Producers will also need land to raise roughage and grain to feed the cows, unless they purchase their feed, which is generally more costly than raising their own. If a producer plans to produce roughage or graze the cows, they will require 3 to 4 acres of excellent pasture or 4 to 8 acres of marginal land per cow. For intensive grazing, 1 to 2 acres of pasture is needed per cow. Raising grain requires an additional 1½ acres per cow. Some producers raise their cows on small dry lots to minimize the amount of land needed. Land is also needed to spread the animal wastes produced by the dairy herd. If the operation has a lagoon system, each acre can support five cows, but if the producer uses a scraping sysem to dispose of livestock wastes, an acre of land is needed for each cow.

Labor - Even though dairy producers use special milking equipment, the milking process is labor intensive. Cows are large and difficult to handle and they must be milked two to three times a day, every day. Also, the milking parlor must be kept clean and free of manure. Growing and harvesting forages for dairy operations also require additional labor.

Capital - A large capital investment is needed to begin a dairy enterprise. Capital is needed for cows, land, facilities, specialized milking and milk handling equipment, equipment for planting and harvesting forages and crops, feed, labor, semen, and other operating expenses.

Management - Proper management is essential to the success of a dairy enterprise. Producers must

be knowledgeable about both livestock and crop production because most of them grow crops for feed in addition to working with the dairy herd. Successful dairying requires managers to understand the different aspects of dairy production, including feeding, milking, sanitation, and caring for animals, and in raising crops. One of the best ways to learn about proper dairy management is by working on a dairy farm. Training and experience in dairying will shorten the time it takes to develop a productive herd of dairy cattle.

## Capital Requirements

As already stated, dairy enterprises require a great deal of capital. The average capital investment for a 100-cow operation is $3,000 to $5,000 per cow. Capital is needed for investment and expansion and the associated fixed costs of interest, taxes, and depreciation, as well as for operating costs. Examples of variable operating costs include fuel, supplies, seed, fertilizers, feed, breeding livestock and semen, labor, and other daily expenses. Figure 3.1 breaks down the annual production costs.

A large investment is needed to purchase land and use it for growing crops. If the dairy producer grows crops, the machinery for tilling, planting, and harvesting must also be purchased. Producers can reduce the capital requirement for land ownership by renting rather than purchasing it. The cost of a fully owned dairy operation can be reduced by as much as 20 to 30 percent by raising only forages so that the need for expensive grain harvesting machines is reduced.

Cows are another major investment. Money is needed to buy or raise replacement heifers. Purchasing animals from high-producing herds is worthwhile because the cows have the potential to produce enough milk to make up for the extra amount paid for them.

Other significant investments in a dairy operation include the capital required for buildings and equipment. Facilities and equipment are needed for manure handling, herd housing, feed processing and handling, and milking. A milking center consists of a milking parlor complete with automatic milking machines, a bulk tank room, and a holding pen for cows waiting to be milked. Grade A milk production has stricter facility requirements than the production of Grade B milk. However, most producers design facilities that will meet Grade A milk standards because Manufacturing Grade milk sells for a lower price. Equipment will need to be upgraded on a regular basis. The cost of replacement equipment should be considered in financing for dairy operations.

Feed is the most significant operating cost of dairy operations. Feed costs average around 50 percent of the cost of milk production. Most of the feed may be raised on the farm but it still represents a significant investment because of the equipment and labor required. Supplements generally account for only a small proportion of feed costs on most dairy operations, although the cost can be considerable for larger herds.

Labor represents a higher percentage of the costs of dairy operations than in most other types of livestock operations. Labor makes up about 15 to 20 percent of the total costs of dairy operations. This figure is increased if employees are offered benefits such as insurance and housing.

## Labor Requirements

As previously stated, dairy production is extremely labor intensive. Dairy herds must be milked at regular intervals two to three times a day throughout the year. Variations in milking schedules will decrease milk production because dairy cows are sensitive to abrupt changes in routine. A general estimate of annual labor requirements in dairy enterprises provides the following statistics. Every year, it takes about 12.5 hours per cow to clean equipment, 6.5 hours per cow to keep up and care for the barnyard, and 49 hours per cow for milking, feeding, and caring for livestock. A total of 68 hours of labor is spent on one cow each year. In an average-sized herd of 80 cows, 68 hours per cow adds up to 5,400 hours for the dairy herd, or 680 eight-hour days. This value does not include the time spent on crop production, harvesting, and processing.

On many dairy operations, the producer and his or her family provide most of the labor. Depending on the size of the operation, full- or part-time employees may be hired to help with milking and other activities. Labor must be well managed for an efficient operation. To produce quality milk, workers must understand proper milking procedures. They should be trained to provide good sanitation by cleaning equipment and udders thoroughly. They should also be trained to

recognize signs of udder infections and know how to prevent infections from spreading.

## Returns for Dairy Enterprises

The major source of income for a dairy producer is the sale of milk. Other returns come from the sale of animals for beef or veal. If the returns from production exceed the costs of the operation, a dairy farm can make a profit. Good management is the key to profits. Producers who achieve above average milk production, manage production efficiently, manage debt levels, and per cow investments carefully are more likely to profit. Because feed costs are a significant proportion of the costs of dairy enterprises, an operation has the potential to make a profit if the income generated by the herd exceeds feed costs and other costs are kept to a minimum.

Milk prices are generally set on a hundredweight (cwt.) basis; a hundredweight equals 100 pounds of milk at 3.5 percent butterfat. The majority of fluid milk is marketed and priced under federal market orders. They establish the minimum prices that processors must pay for different classifications of milk for different uses. Grade A, Class I milk receives the highest prices. Some Grade A milk may be sold in lower price classes if the supply of milk exceeds the amount needed for fluid use. The milk is pooled so that the producers share equally the prices received for the different classes of milk. In addition to setting prices through federal market orders, prices may be established through bargaining between a milk marketing cooperative and a processor.

## Risks in Dairy Enterprises

As with any type of livestock enterprise, running a dairy operation entails a certain amount of risk. The potential always exists that the operation may not make enough money to meet its debts and may be forced out of business. Failing to make a profit can be a result of several factors. Some problems, including inefficient production, illnesses in the herd, and poor management of the costs of operation can be avoided with good management. Other factors that are outside the control of the producer include a hot summer that decreases milk production, a drought affecting feed production, changes in milk prices, or a processor declaring bankruptcy.

## Summary

Dairy enterprises produce milk as their primary product, although they also sell their animals for beef and veal. The resources needed for a dairy farm include a market for their milk, land for the facilities and for growing feed, labor, capital, and good management. Capital requirements are high for dairy enterprises because of the specialized milking facilities and equipment needed in addition to the cost of land, cows, feed, and labor. Because dairy operations are extremely labor-intensive, labor costs make up a more significant proportion of their operating costs than in other types of livestock enterprises. The returns for dairy enterprises will vary from year to year and enterprise to enterprise. If the returns from production exceed the costs, the operation will make a profit, but good management is the key to profits. The risks involved in running a dairy farm can be reduced to some extent with good management, but some factors affecting profits are beyond the control of the producer.

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## *Lesson 4: Swine Enterprises*

In the past, most of the nation's swine enterprises were located in the area of the country known as the Corn Belt, which includes Iowa, Illinois, Indiana, and Missouri, because corn is the primary feed for hogs. Swine producers were so successful in this region that many people also referred to it as the Hog Belt. Recently, however, the swine industry has expanded into other areas of the country, including Arkansas, Texas, and North Carolina. Corporate swine production has been the cause of much of this shift in production.

### Types of Swine Enterprises

Swine production can be broken down into four types of enterprises: farrow-to-finish, feeder pig, feeder pig finishing, and purebred breeding operations. Breeding operations are also referred to as seedstock operations.

Farrow-to-finish enterprises are the most common type of swine enterprise. Producers keep a breeding herd that are bred to farrow regularly and raise the piglets until they reach a market weight of 240 to 260 pounds. Swine are often raised in a confinement system with specialized facilities for farrowing, growing young pigs, and finishing animals out to market weight. These facilities may be sophisticated in terms of equipment, with automated ventilation, feeding, and manure handling systems. Pigs may also be raised on pasture or in low-intensity confinement systems with simple buildings that provide basic shelter for the animals. In these types of operations, the pigs are generally a supplementary source of income for the agricultural enterprise.

Feeder pig enterprises produce pigs that are sold to other producers who will finish them out for market. Producers maintain a breeding herd and raise the pigs until they reach 40 to 60 pounds. Large feeder pig producers maintain 200 or more sows in confinement facilities that provide a controlled environment. Smaller feeder pig operations may be operated to supplement other earnings of an agricultural enterprise. They require simpler facilities, including a farrowing house/nursery, while the breeding herd may be kept in lots.

Feeder pig finishing enterprises raise feeder pigs for market. They purchase pigs from feeder pig producers and finish them out to market weight. They therefore do not need to maintain a breeding herd. Feeder pig finishing can take place in either environmentally-controlled confinement facilities or open-faced buildings with lots.

The producer of purebred breeding stock raises genetically superior animals to supply commercial pork producers who maintain breeding herds. Seedstock producers select the best animals they produce for sale or addition to their breeding herd. They sell the others as feeder pigs or finish them for market.

The trend in swine production is away from small independent swine operations to large, vertically integrated corporate enterprises. They are large-scale operations whose goal is to produce pork efficiently. An integrator may control different phases of production, owning the farrow-to-finish swine operation, feed mills, and even processing plants. Some integrators are involved in contract production. Individual producers contract with the integrator to farrow or feed out pigs for them. The corporation owns the pigs and supplies feed, medications, and management recommendations. The producer provides the land, facilities, utilities, labor, and management of the animals.

Other contracting options exist for individual producers. Rather than contracting with a corporate enterprise, a producer of market hogs may contract with a processor that will buy the hogs produced. The producer is the owner of the hogs with this type of contract. In addition, producers may contract with each other. For example, a feeder pig producer might have a contract with a finisher who will purchase the pigs. Several producers might also form a network and cooperate with each other to decrease production costs and improve profits.

### Resources Needed for Swine Enterprises

To begin or maintain a swine enterprise, producers must have the five basic resources needed for production: markets, land, labor, capital, and management. Without these resources, an operation cannot begin or remain in business.

Markets - Markets should be accessible for a hog producer. Farrow-to-finish and feeder pig finishing operations should determine whether a market exists in their area. Most finished hogs are sold to a processor. Feeder pig producers should make

sure they have a finisher market nearby. If a feeder pig producer must ship the hogs a long distance for finishing, transportation costs and losses from animal stress may outweigh the returns. Contracting with an integrator may also be an option in some areas; producers should check whether a market exists for their production services.

Land - Very little land is needed for swine enterprises, particularly if hogs are kept in complete confinement. If a producer wishes to raise corn for feed, more land is required. The location of the land should be considered, however, because of the odors caused by swine production. The proximity of neighbors and the prevailing winds should be considered before beginning a swine enterprise, especially for large operations.

Labor - The amount of labor needed to operate a swine enterprise depends on the size and type of operation and its level of automation. The need for labor can be reduced by using automation. Raising hogs in confinement can also reduce the amount of handling needed. However, hired labor is necessary in any large swine enterprise. Smaller swine enterprises may be able to maintain production using only family labor.

Capital - The amount of capital needed to operate depends on the size and type of swine enterprise. Capital is needed for facilities and equipment. Farrow-to-finish operations generally have higher capital needs because all phases of production are carried out within the operation. High volume confinement operations also require more capital.

Management - Experienced, well-trained, and well-educated management is certainly a resource for any type of swine production system. Producers with large operations must be committed because swine production is a demanding, year-round process. Financial and livestock management skills are important for the successful operation of any swine production system, but large farrow-to-finish enterprises require more training in management.

## Capital Requirements

Starting a swine enterprise requires a considerable investment no matter what type of enterprise is chosen. However, different types of hog production require different levels of investment. Generally, as each phase of production is eliminated from the operation, fewer inputs are needed. Farrow-to-finish operations are typically the most costly. Feeder pig operations have to maintain a breeding herd, so they tend to require a higher level of investment than swine finishing enterprises.

The size of the operation will also affect the amount of capital required. Large confinement operations have the highest capital requirements. The confinement facilities are expensive to build and maintain because of their sophisticated design and equipment, including self-cleaning slatted floors; automatic feeding, watering, and ventilation systems; and specialized manure handling equipment.

As in other types of livestock operations, all swine enterprises spend capital on both fixed costs and variable operating costs. Examples of fixed costs include real estate taxes, interest, insurance, and depreciation. Operating costs include animals, feed, medical charges, labor, repairs, and utilities. Figure 4.1 shows estimated costs of production in 1999 for a farrow-to-finish operation.

The highest operating cost for swine enterprises is feed costs. The cost of feed is about 60 percent of the total costs of production for farrow-to-finish operations, 50 percent for feeder pig operations, and 70 percent for finishing operations. Some producers may opt to grow their own feed, which will allow them to avoid paying the high cost of commercial feeds. However, the operation must have suitable land, equipment, and labor resources for the production of corn or other grains.

Another significant expense of swine enterprises is the animals themselves. Seedstock producers particularly need more capital to invest in quality purebred breeding stock. Farrow-to-finish and feeder pig producers will also need to purchase quality replacement animals for their breeding herds. Most of the operating costs of feeder pig finishers comes from the purchase of feeder pigs.

Depending on the type of enterprise, labor may be another large variable cost for swine operations. While smaller operations may only require family labor, large operations generally depend on hired labor. The cost will vary; finishing operations generally require less labor than do farrow-to-finish, feeder pig, and seedstock operations, all of

*Figure 4.1 - Estimated Costs of Production*

PROJECTED FARROW-FINISH SWINE PRODUCTION COSTS (1999)
Selling 15 260-pound pigs/sow

| | Per Sow (41 cwt.) |
|---|---|
| ESTIMATED OPERATING COSTS | |
| Commercial, 3,050 pounds x 13.5> | $ 412 |
| Grain, 11,500 pounds x 4> | 460 |
| Total Feed Costs | $ 872 |
| Veterinary and medicine | $ 55 |
| Livestock materials and services | 25 |
| Equipment operation and machine hire | 62 |
| Utilities, insurance, miscellaneous | 64 |
| Personal property taxes | 5 |
| Real estate repairs and maintenance | 47 |
| Operating interest (½ operating costs x .09) | 51 |
| Total Cash Costs Except Labor | $1,181 |
| ESTIMATED OWNERSHIP COSTS | |
| Real estate interest, depreciation, taxes | $ 82 |
| Interest on breeding herd | 14 |
| Machinery and equipment interest depreciation | 43 |
| Total Fixed Costs | $ 139 |
| Estimated Labor Cost (25 hours @ $7.50) | $ 188 |
| ESTIMATED TOTAL COSTS | $1,508 |

Note: The cost of purchasing replacement animals is not included.
*Adapted from a publication by Ron Plain, Extension Economist.

which have labor intensive activities of breeding, farrowing and raising young pigs.

Contracting with an integrator will reduce the amount of capital required for the swine enterprise. The contracting firm supplies feed and animals, which are among the highest costs of swine operations. The contract therefore reduces the financial burden on the producer, although she or he will still need to obtain financing to build the facilities required by the integrator for production.

## Labor Requirements

Different types and sizes of swine operations have different labor requirements. Table 4.1 on the following page shows the labor requirements for different types of production systems. Smaller operations may not need to rely on hired labor. However, a large-scale farrow-to-finish operation must invest in specialized labor to handle different phases of production, including breeding, farrowing, growing, and finishing. Feeder pig and seedstock enterprises may also hire specialized labor to deal with the breeding herd and farrowing. Finishing systems require less specialized labor because fewer activities are involved in finishing the hogs for market. In large-scale swine production, the amount of labor needed is reduced by automation and confinement systems.

## Returns for Swine Enterprises

Proper management and wise business practices are reflected in the returns for any swine enterprise. In general, if the returns for a hog exceed the costs of producing the animal, a producer can make a profit. Wise management of

*Table 4.1 - Labor Requirements*

| Type of Enterprise | Hours of Labor |
|---|---|
| Breeding herd enterprises | Hours per sow unit (sow and related animals) |
| Feeder pig operation | 26 |
| Intensive feeder pig operation | 18 |
| Farrow-to-finish operation | 45 |
| Intensive farrow-to-finish operation | 28 |
| Finishing enterprises | Hours per 100 pigs |
| Feeder pig finishing operation | 100 |
| Intensive feeder pig finishing operation | 80 |

Source: Pork Industry Handbook

all of the inputs of production greatly increases the chances of generating returns for any type of swine operation. A good manager will operate efficiently to maximize production while reducing costs. Profits for feeder pig producers depend on their ability to farrow, wean, and grow a large number of feeder pigs, while profits for finishing enterprises depend on the producer's ability to produce animals of sufficient weight and leanness.

While the capital requirements for large-scale intensive swine production are higher, they are often more profitable as well. They are more likely to generate profits because production occurs on a large scale.

Contracting can guarantee returns for swine operations. They often provide more regular payments to producers and generate a stable income. Returns from feeder pig production are usually paid based on the number of pigs produced. Returns for hog finishing are generally paid on a per pound basis. Efficiency bonuses may also be available with some contracts. If the payments cover the operation's costs, producers will make a profit. However, producers will not be able to benefit from an increase in market prices for their hogs because they are paid an agreed price.

## Risks in Swine Enterprises

While good management can help produce profits, risk is associated with operating a swine enterprise. In 1998, prices for market hogs fell to such low levels that some producers could not repay their debts. Like dropping market prices, other factors beyond the control of the producer can affect his or her ability to operate, such as rising feed costs or increased competition from other swine operations. In addition to these factors, management decisions can also lead to losses. Inefficient production and overextending the operation financially can cause enterprises to fail.

Contract production reduces the risks associated with operating a swine enterprise. Producers with a contract are protected from decreases in market prices for hogs and increases in feed costs. However, contract producers should be aware of factors that may affect their returns, such as the financial health of the contractor and the terms of their contract, including termination clauses and potential underutilization of swine facilities.

## Summary

The pork industry consists of four types of enterprises: farrow-to-finish, feeder pig, feeder pig finishing, and seedstock operations. The industry is changing from independent production to vertically integrated corporations and contract production. However, all swine enterprises require the five basic resources needed for all livestock production: markets, land, labor, capital, and management. Capital and labor requirements for swine production can be quite high, depending on the size and type of operation. Large-scale confinement operations generally require more investment and workers. Returns for all swine enterprises depend on proper management that can keep production levels high and costs low. Proper management can help to reduce risk, but

some factors that can cause a swine enterprise to fail, like falling prices or increasing feed costs, are outside the control of producers.

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## *Lesson 5: Sheep Enterprises*

Unlike the swine industry, the sheep industry does not have large, vertically integrated production systems. Instead, sheep are raised by independent producers. According to *Missouri Farm Facts 1998*, the state had 2,100 sheep operations in 1997, with a combined total of 65,000 sheep and lambs. The primary product of the sheep industry is lamb. All sheep, however, produce wool, which is a secondary product of the industry.

### Types of Sheep Enterprises

Sheep production in the United States is divided into two different types of management: farm flocks and range flocks. Range production occurs in the western Plains region of the country. Operations consist of large flocks of sheep that graze on open rangeland. The range flock has a few breeding flocks that produce lambs. Lambs are sold following weaning for finishing, which may be done by other range producers or on a feedlot.

Farm flock sheep production is found in Missouri. These enterprises consist of smaller flocks raised on much less acreage than in range production. Farm flock enterprises include seedstock operations and commercial lamb production.

Seedstock operations produce purebred sheep for sale to commercial producers as commercial rams and replacement ewes. Producers maintain a quality purebred breeding flock. The best offspring are selected for addition to the breeding herd or for sale to commercial producers. Lambs are culled from the herd as market lambs.

Operations involved in commercial lamb production are the most common type of sheep enterprise in Missouri. They are concerned with raising quality lambs for meat production. They maintain a breeding herd, most often consisting of crossbred ewes and purebred rams. These enterprises most commonly raise the lambs from birth to market either on pasture or in a partial confinement system combining pasture with dry lots. However, some operations may raise lambs from birth to weaning and then sell them to feeder lamb finishers. Farm flock producers also market cull ewes and rams.

Very few farm flock operations produce only wool, although many breeds do exist that are bred for wool production. However, many producers who do not focus on wool production will shear their sheep and market the wool. Many farm flock operations profit from both meat and wool production. To reduce the labor involved in producing lambs, other producers raise hair breeds of sheep, like the Katahdin, to eliminate the need to shear the flock and market the wool.

### Resources Needed for Sheep Enterprises

As with other types of livestock operations, the five basic resources needed for sheep production are markets, land, labor, capital, and management. These resources are necessary for the success of any sheep enterprise.

Markets - Having a market for lambs and wool is essential to the success of sheep enterprises. Larger producers will need markets available where they can sell large numbers of lambs to processors at one time. Producers with smaller flocks may be able to work out an agreement with a local meat processor by which they can sell a limited number of lambs directly to consumers. This approach works well with 20 to 50 lambs. It is especially useful in areas where markets for lamb may be affected by different ethnic populations that consume lamb more often.

Land - The amount of land needed for lamb production depends on the size and type of enterprise. Farm-flock producers require less acreage than range producers because they have smaller flocks. Also, ewe flocks may be on pasture four to eight months of the year and either forage on residue or occupy a dry lot for the rest of the year. Land for pasturing sheep does not have the same forage quality requirements as the pasture needed for other livestock because sheep graze on shrubs and other plants that cattle or horses may find unpalatable. The number of ewes per acre depends on pasture quality and management and the amount of rainfall.

Labor - The amount of labor needed for a sheep operation depends on the type and intensity of the production system. As with land, farm flock operations generally require less labor than range operations. However, labor needs can be high, particularly during lambing.

Capital - Land and labor requirements affect the amount of capital needed for a sheep enterprise.

The amount of capital a producer needs to begin or maintain a sheep operation increases as the number of head increases.

Management - Finally, sound management should be considered a resource for sheep producers. Wise management is required to oversee the other resources of the operation and to prevent large death losses. Management is especially important in purebred operations to ensure the production of quality animals.

## Capital Requirements

In comparison to other livestock species, sheep generally require a lower initial investment to begin production. Annual operation costs are also relatively low because of the nature of sheep enterprises. Because of the low level of investment required, raising sheep may provide a good way for producers to supplement other farm income. The capital requirements for different sheep enterprises depend on the type of enterprise, the number of head per farm, and the cost of feed and labor.

As in other livestock operations, sheep enterprises have both fixed ownership costs and variable operating costs. Examples of fixed costs include real estate taxes, depreciation, and interest on machinery and breeding stock. Examples of variable costs are feed, labor, medical costs, marketing, fuel, equipment repair and maintenance, and utilities.

Feed costs can equal up to 60 percent of the total costs of the operation. Sheep use pasture as their primary feed supply and usually do not require large amounts of purchased feeds. The production of forages and grains on site will reduce feed costs by limiting the need to buy commercial feeds.

Another significant expense for sheep enterprises is the cost of purchasing breeding stock. Because purebred operations need to buy and maintain quality purebred breeding stock, their costs are usually higher per animal than those of commercial lamb operations. Commercial lamb producers can reduce the cost of breeding stock by purchasing older ewes of four to seven years. The ewes still have some productive years left, but they will require more management.

## Labor Requirements

Generally sheep are not labor-intensive animals. They are relatively small and are content on pasture, even in cold winter months. If the sheep enterprise is not large, the producer may be able to maintain the operation using only family labor. Hired labor may be necessary for larger operations.

Additional labor may be required on a seasonal basis. Lambing is a labor-intensive period because regular observation is necessary. Someone may need to check on ewes and lambs three to five times a day, sometimes in the middle of the night. Having an attendant present during lambing is especially important for purebred operations because of the potential value of the lambs. Additional labor is often hired for shearing. If aid is required for shearing, it is best to contact skilled labor early.

## Returns for Sheep Production

Although the markets for lamb and wool in the United States are not as large as other livestock species, sheep operations can make a profit with good management of sheep and finances. Commercial lamb enterprises must generate enough returns from lambs, wool, and cull animals to exceed their expenses to make a profit. The most important profit factor in commercial operations is the number of lambs weaned per ewe. Other factors that affect profitability include the weaning percentage for the flock, their age at culling, production costs, and death losses. Table 5.1 shows averages for returns and costs of sheep enterprises in 1996.

Purebred seedstock operations require more time and capital to make a profit than a commercial operation. It may take up to five years, primarily because the producer will need to keep the better quality ewe lambs to build flock quality and quantity.

## Risks in Sheep Enterprises

Like other livestock enterprises, sheep operations face the risk that they may not make a profit and may lose money. Poor management of either the animals or the financial aspects of an operation may result in losses. It is very important that a producer be committed to giving sheep the management and care they need and to careful

*Table 5.1 - 1996 Sheep Enterprise*

| Sheep Enterprise * * * | Average Farm |
|---|---|
| Returns per $100 Feed Fed | $128.00 |
| Percent Lamb Crop | 145.00% |
| Feed Cost/100 Pounds Produced | $ 59.26 |
| Death Loss: % of Pounds Produced | 9.70% |
| $ Received/100 Pounds Sheep and Wool Sold | $ 89.08 |
| Pounds Fed per 100 Pounds Produced:<br>Concentrates<br>Hay and Dry Roughage | <br>333<br>660 |
| * * * KY and IL Averages<br>* Missouri FBMA Averages<br>Source: 1996 Farm Business Management Analysis - AgEBB | |

management of the operation's expenses. However, some factors that may affect profits are outside the control of even good managers. Examples of such factors are extremely hot weather that affects conception rates and pasture quality and decreases in market prices.

A significant risk in sheep production is predation by dogs and coyotes. Sheep are easy prey because they cannot defend themselves. If predators are a problem, producers should provide protection for the flock. Many operations have specially trained guard dogs to protect the flock. Electric fencing may also be used to deter predators.

## Summary

In Missouri, sheep are generally raised in relatively small farm flocks. Two basic types of enterprises are purebred seedstock operations and commercial lamb operations. The basic resources needed for sheep production are markets, land, labor, capital, and management. The amount of capital needed depends on many factors such as the type of operation, the number of head, and the cost of labor and feed, although sheep production generally requires a lower initial investment and overhead than other livestock operations. The producer may be able to run a sheep operation with only family labor, but additional workers may be needed, particularly during labor-intensive periods such as lambing and shearing. With good management practices and sound business decisions, producers can make a profit. However, raising sheep is never without some element of risk. The greatest risk in sheep production is losing money, which can occur because of poor management as well as other factors that are beyond the control of the producer. Another risk with sheep production is their vulnerability to predators.

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## *Lesson 6: Horse Enterprises*

The horse industry is very diverse. Activities include breeding, training, and riding horses, operating race tracks, showing horses, and operating public stables. A study sponsored by the American Horse Council in 1996 concluded that the horse industry as a whole contributes $112 billion to the U.S. economy and employs 1.4 million people. The horse industry has a direct economic effect on rural areas, generating $22.5 billion in revenues nationwide and employing 292,700 full-time employees.

### Types of Horse Enterprises

Unlike other livestock species, horses are not typically raised for food or fiber in the United States. The primary reason people raise horses is for recreation. As a result, large commercial enterprises are less common than other areas of animal agriculture.

Breeding enterprises typically raise a specific breed of horse to sell. Breeders maintain a number of purebred breeding animals. They raise the young horses until they are old enough to be sold, which typically occurs at three years of age or less. They may also use their stallions to provide stud services.

A very specialized type of horse enterprise is breeding and raising horses for racing. This type of enterprise tends to require more resources for production because of the specialized nature of their activities. Like other types of breeders, racehorse breeding farms keep a breeding herd. They sell their yearlings to people interested in raising and racing their own horses; racehorse breeders also keep and race their horses themselves. Breeding farms generally provide stud services to owners of broodmares.

Other types of horse enterprises include training farms and boarding stables. These operations do not necessarily involve ownership of horses. Instead, the owners provide special services for other people's animals. Training farms provide centers for training horses for specialized purposes, such as racing or show. Boarding stables house and often care for horses whose owners cannot or do not want to do so.

### Resources Needed for Horse Enterprises

As with any livestock operation, a horse enterprise must have certain resources to make production possible. The five essential resources are markets, land, labor, capital, and management.

Markets - Horse enterprises must have a market for their horses or services if they wish to make a profit. Breeding enterprises must determine the potential sales for the breed of horses they choose to raise. Breeders of race horses especially must determine whether a market exists for their animals because they tend to be more expensive to raise and purchase. Horse trainers must also decide whether a market exists for their specialized services. Boarding stables tend to be located near urban areas to meet the needs of horse owners who live in cities.

Land - The amount of land required will vary depending on the nature and size of the horse enterprise. Horses that graze and exercise on pasture require a certain amount of land to meet their needs. Less land is needed if other sources of feed and exercise are supplied to the horses.

Labor - The amount of labor needed for a horse enterprise depends on the number of horses being maintained as well as the amount of land owned by the operation. With less land, labor is needed to provide exercise for horses on a daily basis. Some types of horses, such as racehorses, require more exercise than animals that are not expected to perform frequently.

Capital - The amount of capital needed to begin or maintain a successful operation depends on the type of horse enterprise. The initial investment for a horse can often be expensive, especially for purebred animals used for racing, showing, or breeding. A sizable investment may also be required for land, facilities, and equipment.

Management - Good management is an important resource for horse enterprises. The capital outlay needed to purchase and maintain a horse makes it necessary to keep losses to an absolute minimum.

### Capital Requirements

Capital requirements for horse enterprises can vary greatly. A study in Oklahoma in 1993, reported that operations for breeding or raising

racehorses averaged about $250,000 invested in land, facilities, equipment, and horses, while horse training operations had an average investment of $183,000. Another study in 1992 indicated that the horse businesses surveyed had an average investment of $80,000 in facilities, equipment, and supplies, which did not include land and horse investment. In contrast, that same study concluded that owners with hobby interests had investments in facilities, equipment, and supplies that averaged $20,000.

As with any type of livestock, horse producers will have a variety of fixed ownership costs and variable operating costs. Operating costs include feed, medical costs, utilities, tack, supplies, bedding, labor, fuel, and repairs on equipment. Fixed ownership costs include insurance, taxes, interest, and depreciation on facilities, equipment, and horses.

Feed can be a significant expense. Suitable pasture or cropland for growing roughage for harvest can lower feed costs. The producer is then able to reduce the amount of expensive commercial feed she or he must purchase.

The cost of facilities may also be significant for horse enterprises. Owners of horse enterprises must provide safe, well-maintained, functional facilities. While several horses may be kept in one pen or pasture, horse enterprises may provide more elaborate barns with a number of individual stalls for stabling horses, depending on the size and nature of the operation. Operations with racehorses may have special facilities, such as tracks for exercising horses.

Maintaining a breeding herd is expensive. Quality registered purebred animals are costly; prices for the least expensive often range from $3,000 to $5,000. The annual cost of maintaining a broodmare in commercial production is estimated to be $3,500, including fixed and operating costs like sale fees, feed, medical care, labor, repairs on equipment, interest, and depreciation. Between $5,000 and $6,000 is needed for yearling production.

Boarding stables may have varying levels of expenses depending on the level of services. Some stables provide full-care board, including stall cleaning, feeding, grooming, and exercise, perhaps even training. Others are self-care stables, where the owners of the horses provide these services, as well as pay for their own feed and bedding.

### Labor Requirements

Labor needs for horse enterprises generally involve exercising, feeding, and grooming the animals. Pasture management and upkeep will require some labor, as will harvesting hay for feeding throughout the winter months. In many cases, the owner carries out these activities. However, larger operations and operations with special services, like full-care boarding stables, may hire workers to perform some of them. Speciality animals, such as racehorses, require greater amounts of labor in the form of training. Because of the large capital investment involved in owning horses, employees in horse enterprises should be skilled in working with horses; poor care can result in losses for the operation.

### Returns for Horse Enterprises

Often individuals become involved in horse enterprises because they enjoy working with horses. However, they also desire to make a profit. The goal for many horse enterprises is to produce returns that are higher than the amount paid out for expenses, which requires good management. Racehorse owners and some participants in equestrian competitions have the potential to earn valuable show winnings, sometimes amounting to hundreds or thousands of dollars. Specialty breeders can also make a large profit on the animals they produce.

### Risks in Horse Enterprises

Any horse enterprise can suffer large financial losses as a result of poor management of horses and unsound business practices. Proper management is crucial to receive any type of return from raising horses. Poor care can result in a horse that is unable to perform, leading to a loss of the capital invested in the animal. Good financial management is also necessary to avoid over-extending the horse operation. With speciality animals like racehorses and show horses, owners face the additional risk that a horse may not perform well enough to cover the high cost of their training and care.

## Summary

While most horses are raised for recreation in the United States, larger commercial horse enterprises do exist. Operating a horse enterprise involves five important resources: markets, land, labor, capital, and management. Capital is needed for the high initial cost of horses and facilities, as well as for maintaining the animal, which involves costs for items like feed, medical care, tack, and supplies. The labor involved in caring for horses includes exercising, feeding, grooming, and maintaining a pasture or land for growing hay. Labor may also include training the animal. The labor needs for horse enterprises depend on the size and nature of the operation, but it is important that labor is skilled because of the high initial investment required for buying horses. The level of return is also dependent on the type of horse enterprise. In some cases, racehorse owners and men and women involved in equestrian sporting events can make a large profit from winnings. However, good management is needed for any horse enterprise to produce returns that exceed the costs of the enterprise. Financial losses can be the result of poor management of horses and unsound business decisions. Owners of racehorses and show horses face the risk that a horse may not perform well enough to return a profit.

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## *Lesson 7: Poultry Enterprises*

The poultry industry is nearly 100 percent vertically integrated in the United States, with the majority of producers operating under contract. A few smaller farms exist to produce eggs and meat for niche markets. These enterprises are small in comparison to the huge corporations that currently dominate the industry.

### Types of Poultry Enterprises

Several types of operations make up the poultry industry. The three main types are commercial egg, broiler (chickens for meat production), and turkey operations. Poultry breeders and hatcheries are also important entities in poultry production systems because they provide the birds required for the other operations.

Commercial egg production involves maintaining a flock of laying hens. The size of the operation can range from 5 thousand to 2 million hens. The eggs are collected and stored at the operation before being shipped for market. Hens are kept until egg production becomes unprofitable and are then sold as "souper chickens," with the tough, low-grade meat used for processed foods.

Broiler and turkey production involve raising large batches of birds until they reach market weight and then sold for their meat. Broiler operations often have 25,000 to 170,000 birds per flock, with five to six flocks produced annually in the operation.

Almost all egg and meat production is done under contract in a vertically integrated poultry operation. In this system, a poultry processor or egg producing firm contracts with individual producers who manage the birds. A fully integrated broiler operation might consist of a processing plant, feed mill, hatchery, and several contract growers. This system provides contract growers the opportunity to participate in poultry production while allowing integrators to ensure a steady supply of their product and invest more money in the processing and marketing segments of the business.

Under the contract, the integrator and the contract grower each have certain responsibilities. The terms of individual contracts will vary, but generally the grower is responsible for providing the buildings, equipment, litter, utilities, and labor. The contracting firm provides the birds, feed, medication, and supervisory personnel to oversee production.

Contract poultry production has advantages and disadvantages for producers. With a contract, the producer assumes less risk. There are fewer management responsibilities and requires less operating capital because some management decisions and costs are covered by the integrator. However, a large investment is required to begin production, and the grower will need to make improvements in feeding, watering, heating, and ventilation systems to keep up with technological changes and increasing costs. The grower also has limited control over the birds and feeding system supplied to the operation. The producer has less independence in the management of the operation.

The National Broiler Council recommends that people interested in the poultry industry have certain characteristics. They should have the desire to raise birds, capital to build appropriate housing, labor resources, ability to meet contractual obligations, a business-like mind set, and an open attitude to innovations and new technology. These characteristics apply to broiler growers and producers involved in any type of poultry production.

### Resources Needed for Poultry Enterprises

As in any type of livestock operation, certain essential resources are needed for production if an enterprise is to be successful. Resources include markets, land, labor, capital, and management.

Markets - Because markets for poultry products are generally dominated by the large integrated poultry operations, producers generally need to consider whether a market exists for their services with an integrated operation. Usually integrators are only interested in contract growers located close to their centers of operation. If a producer operates independently, he or she must consider whether a market exists for the product. Producers who plan to sell their products in niche markets must be sure that their product is marketable in their area.

Land - Poultry production systems require relatively little land in comparison to other types of livestock operations because the birds are small and are raised in large poultry houses. However,

the location of the land is important; locating the operation away from populated areas is desirable.

Labor - The producer's family may be able to provide sufficient labor for production. Depending on the type and size of the operation, additional employees may need to be hired by the producer.

Capital - Because the producer supplies the facilities and equipment for production, capital requirements for poultry operations can be high. Specialty phases of production such as breeding and hatcheries need expensive incubation systems and breeding equipment. These types of operations require even more capital. Poultry producers must make sure they have secured adequate financing before beginning production.

Management - Poultry producers must be good managers to profit from poultry production. Some assistance in management is provided to contract growers by the supervisory personnel assigned to the grower by the integrator. Service people may assist the grower in making management decisions not covered by the contract.

## Capital Requirements

Capital requirements for poultry enterprises can be high. Capital is required to purchase land, build facilities, and buy the equipment needed for production. Capital is also needed to meet the annual fixed ownership and variable operating costs of the operation. Ownership costs include interest, taxes, and depreciation on buildings and equipment. Operating costs for contract growers include labor, litter, fuel, utilities, supplies, and repairs.

The costs of an enterprise will vary depending on the type of enterprise and its size. For example, a broiler house with 20,000 square feet of space equipped with fans and feeding, watering, and brooding equipment can cost between $100,000 and $110,000. A typical operation may have five or six houses. The annual cost of running each broiler house range between $20,000 and $25,000. Commercial egg operations with 50,000 hens may require an investment of more than $1 million.

## Labor Requirements

Labor is an important aspect of poultry production. The amount of labor required will depend on the type of enterprise and its size. The poultry producer and his or her family may be able to provide all of the labor required for some enterprises. Automation can reduce the amount of labor required per bird; it is estimated that automated equipment makes it possible for one person to care for 20,000 broilers per hour. With mechanical feeding and egg collection equipment, one person can care for more than 100,000 layers. However, for larger operations and during management-intensive phases of production, full- or part-time hired labor may be required. The producer should be sure to provide any training required by workers to ensure they perform their duties efficiently and safely.

## Returns for Poultry Enterprises

Most contracts set a rate at which producers are paid. For egg producers, a fixed amount may be paid per layer or per dozen eggs produced. Bonuses may be provided for efficient feed conversion, low death losses, or high numbers of salable eggs. Broiler producers may be paid a return based on the number of birds or the number of pounds of usable meat produced. Bonuses may be earned in broiler production for good feed conversion rates, low mortality, and high numbers of usable broilers. Because bonuses depend on good management, management skills are extremely important for profitability.

## Risks in Poultry Production

Because they generally provide a fixed minimum income, contracts provide growers with reduced risks for production and loss of income. The contracts insulate producers somewhat from price changes in the market. However, the grower must rely on the contract being renewed to be able to pay off loans and other debts and remain in business. If the contract is not renewed, the poultry producer may be forced out of business.

## Summary

The poultry industry is almost totally vertically integrated in the United States. The three most common types of poultry enterprises are commercial egg, broiler, and turkey enterprises, all of which are most commonly operated under contract with an integrator. Each type of enterprise requires markets, land, labor, capital, and management to operate successfully. Capital requirements are generally high for poultry

enterprises, although automation tends to reduce labor requirements. Returns for contract growers are based on production, with minimum returns guaranteed and bonuses provided if the producer meets certain standards. Risks are reduced in contract production because a certain income is guaranteed, but the grower must rely on the contract being renewed to be able pay off debts.

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## *Lesson 1: Livestock Terminology*

One of the most important skills good farm managers need is the ability to select sound livestock and poultry. Whether the animal is used for breeding, show, or production, selecting healthy, strong, and fertile livestock and poultry contributes to the overall production and well-being of the herd or flock.

### Basic Parts and Terms for Beef Cattle

Specific names are used to refer to different parts of an animal's body. For beef cattle, important terms for the head region include the muzzle, face, forehead, poll, neck, and throat. The top of the shoulder, crops, foreribs, back, loin, hip or hook, pin bones, rump, tail head, and switch follow a line along the spine from the head. The basic parts of the body are the dewlap, brisket, shoulder, foreflank, barrel, belly, ribs, heart girth, cod (or udder, in the female), rear flank, quarter, and twist. The front legs of beef cattle consist of the forearm, knee, cannon, dewclaw, pastern, and hoof, while the rear legs include the hock, pastern, dewclaw, and hoof. See Figure 1.1 for a diagram of the parts of a beef steer.

### Basic Parts and Terms for Dairy Cattle

When describing dairy cattle, many of the important body parts are the same as those of beef cattle, although some additional parts are of interest in dairy animals. The head region includes the muzzle, face, forehead, poll, neck, and throat. The back, chine, loin, hip or hook, rump, thurl, pin bones, tail head, and switch follow a line from the head back along the spine. Basic body parts are the dewlap, brisket, shoulder, barrel, ribs, heart girth, and rear flank. The front legs consist of the forearm, knee, cannon, dewclaw, pastern, and hoof, while the rear legs include the hock, pastern, dewclaw, and hoof. The external milk-yielding parts of the cow are the most important in dairy cattle. These parts are located beneath the rear flanks and between the hind legs. They include

*Figure 1.1 - Parts of a Beef Steer*

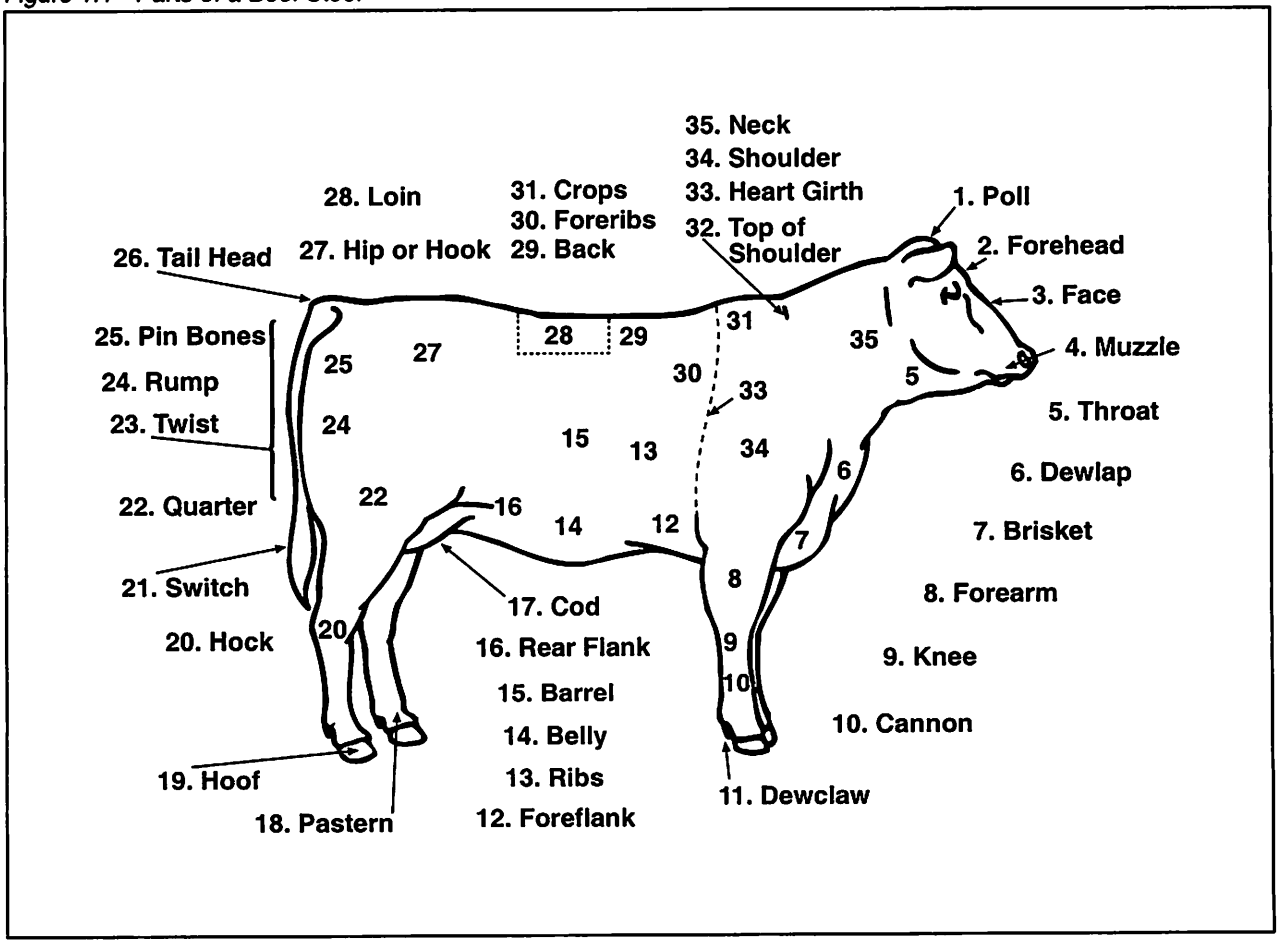
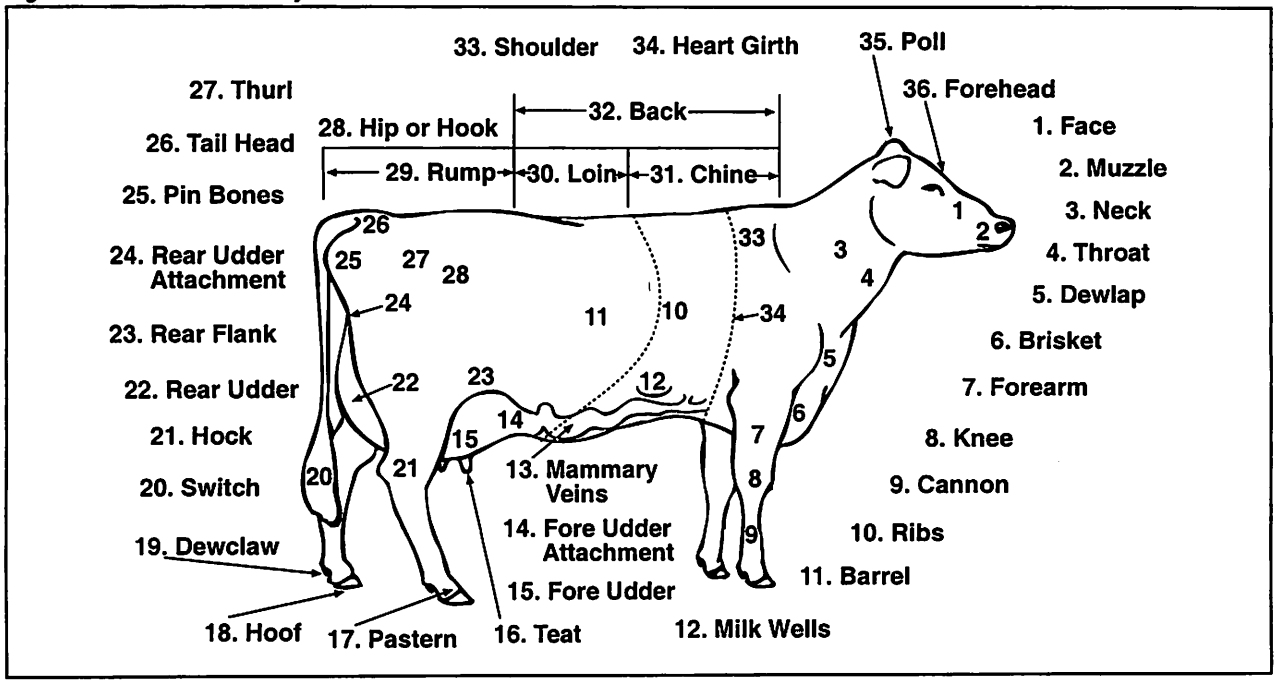


*Figure 1.2 - Parts of a Dairy Cow*




the teats, fore udder, fore udder attachment, rear udder, rear udder attachment, mammary veins, and milk wells. Figure 1.2 shows a diagram illustrating the external parts of a dairy cow.

## Basic Parts and Terms for Swine

While some of the names for the parts of swine are the same as those used for cattle, swine have some different parts as well. Important parts in the head area consist of the neck, jowl, snout, face, and poll. The top of the shoulder, back, loin, rump, and tail are found in a line down the spine from the head. Important parts located along the side of the body are the shoulder, side, and ham. Parts found along the underside of swine consist of the foreflank, belly, rear flank, and stifle. Terms to describe the front legs consist of the knee, pastern, dewclaw, and toe. Hind legs include all these parts and the hock. See Figure 1.3 for a diagram of a pig.

*Figure 1.3 - Parts of a Pig*

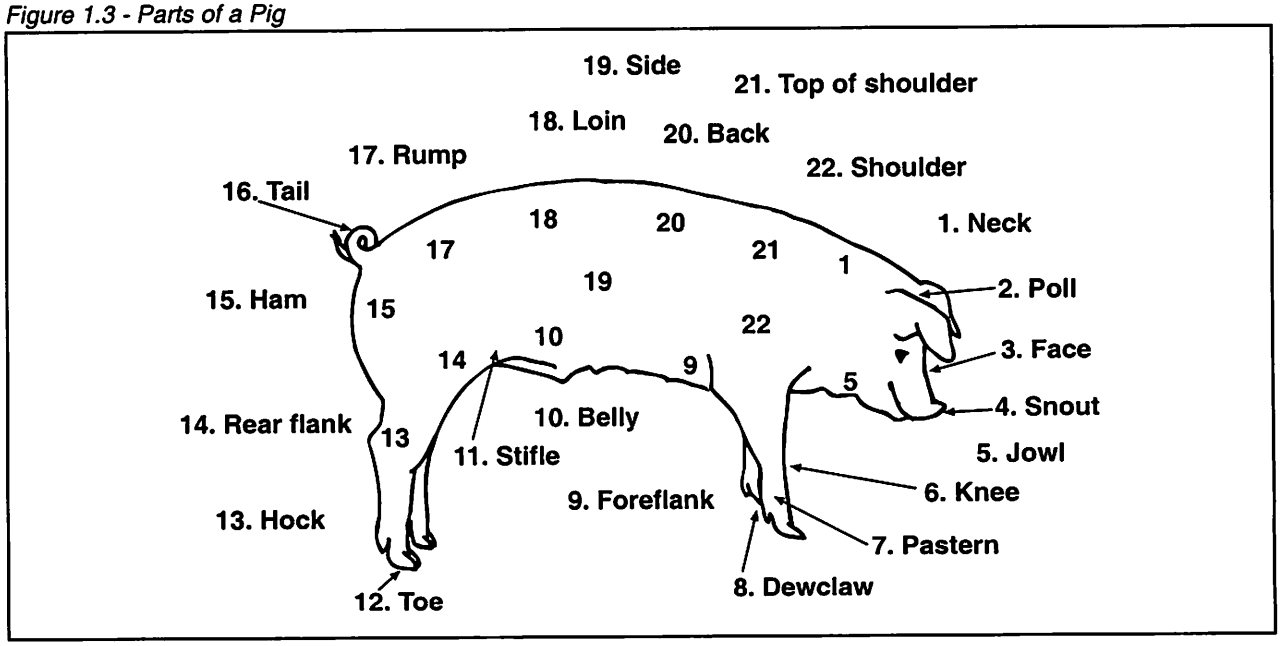
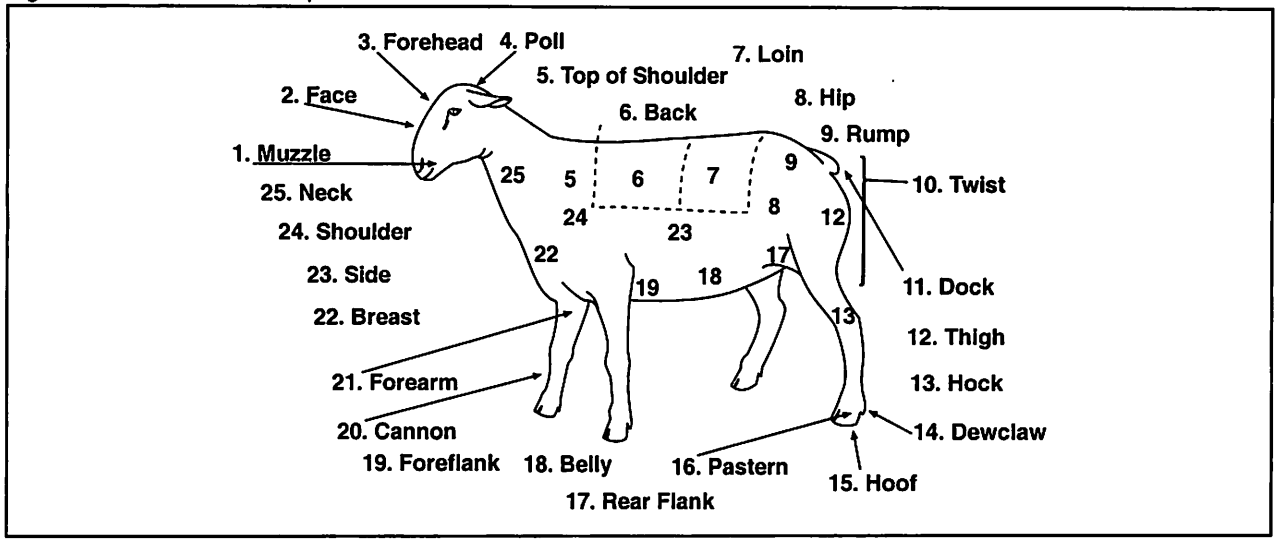


*Figure 1.4 - Parts of a Sheep*




## Basic Parts and Terms for Sheep

Terms for the parts of the head region of a sheep include the poll, forehead, face, muzzle, and neck. Along the spine are the top of the shoulder, back or rack, loin, hip, rump, and dock. The midsection of the body consists of the breast or brisket, shoulder, side or middle, thigh, and twist. The underside includes the foreflank, belly, and rear flank. The parts of the front leg are the forearm, cannon, pastern, dewclaw and hoof, while the rear leg consists of the hock as well as the pastern, dewclaw, and hoof. Figure 1.4 is a diagram of the parts of a sheep.

## Basic Parts and Terms for Horses

The parts of the head and neck of a horse include the neck, throat latch, muzzle, cheek, face, forehead, poll, and crest. Along the spine are the withers, back, loin, rump or croup, and tail. Terms for the parts of the midsection of a horse are point of the shoulder, shoulder, chest, forearm, girth, barrel, point of hip, thigh, and buttock. Along the underside of the animal are the abdomen, flank, and stifle. The front legs include the elbow, forearm, chestnut, knee, cannon, ergot, fetlock, pastern, coronet, and hoof. The back legs include the gaskin, hock, cannon, fetlock, pastern, coronet, and hoof. A diagram of a horse is shown in Figure 1.5.

*Figure 1.5 - Parts of a Horse*

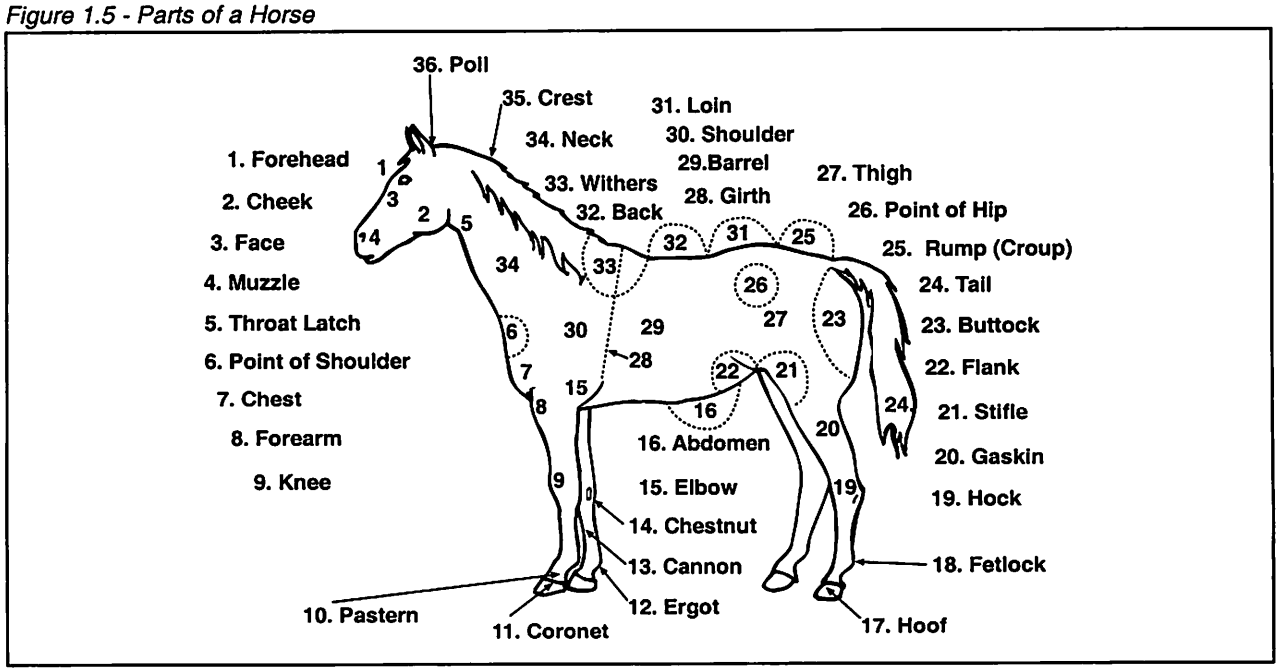
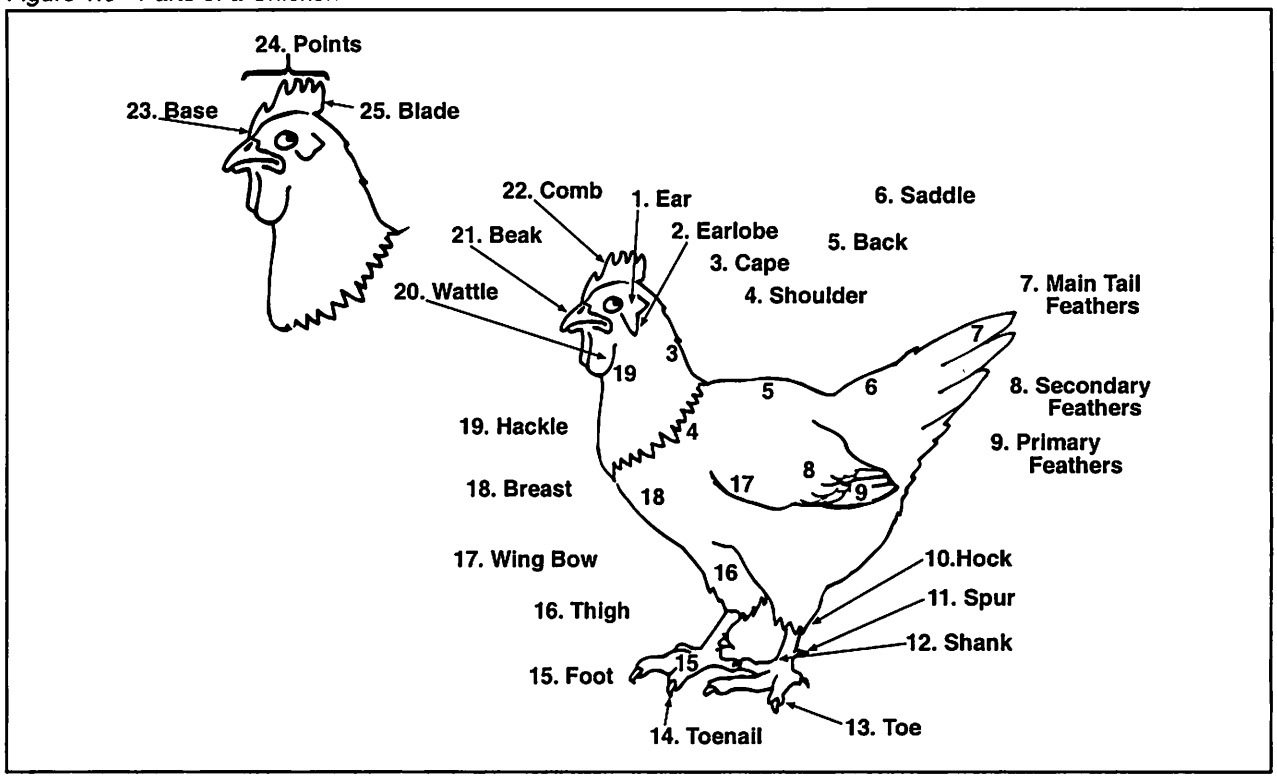


*Figure 1.6 - Parts of a Chicken*




## Basic Parts and Terms of Poultry

Because poultry are birds, their body parts differ significantly from the other species discussed in this lesson. The basic parts of a chicken's head are the ears, earlobes, beak, comb, and wattle. The different parts of the comb are the base, points, and blades. The neck area is called the hackle, while the back includes the cape, back, and saddle. Feathers in the wing area include the primary, or flight, feathers and the secondary feathers. Other important parts of a chicken are the breast, shoulder, wing bow, and main tail feathers. The parts of the leg are the thigh, shank, hock, spur, foot, toes, and toenails. Figure 1.6 shows a diagram of a chicken.

## Summary

The external parts of livestock and poultry are described using specific terminology. Many of the species discussed use the same terms for specific parts, such as the poll or brisket, although some of the terms are very different. Familiarity with these parts, especially the parts that are of major commercial importance, is crucial to be able to properly select animals to improve the entire flock or herd.

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## *Lesson 2: Selecting Livestock*

Livestock producers must choose the animals they use for breeding and production wisely. Selection has proven to be successful in the agricultural industries. Through selection, livestock have begun to produce more milk, meat, eggs, and wool in the last hundred years than ever before.

### The Importance of Selection

Through selection, the overall performance of livestock and poultry has been improved. Producers have selected animals for specific desired traits for breeding and have culled undesirable animals that produce poorly. The animals selected pass on their genetic traits to their offspring, while undesirable traits are phased out. The result of this process is increased levels of production in all species.

Proper selection is essential to increase profits from the herd or flock. By selecting quality animals for production or breeding, farm managers can improve the overall quality of the product and the efficiency of production for the enterprise. Selecting animals that will be productive will increase the profits of the producer.

### Selection Factors for Breeding Purposes

When a producer maintains animals for breeding, she or he must be able to recognize which animals to cull from their herd and which to keep or purchase for breeding replacements. Choosing animals with desirable traits for breeding will allow the producer to improve the herd or flock.

Selecting animals for breeding may involve looking at three separate factors: conformation, pedigree, and performance data. These factors call for both subjective and objective evaluation. Subjective methods of selection involve visual evaluation of the animal's appearance. Objective selection involves further evaluation of the animal by looking at pedigrees and performance data.

Conformation - An animal that has good conformation is more likely to produce more desirable offspring. Conformation refers to the type, form, and shape of the animal. A high-performing animal can be selected by looking at its skeletal structure, muscling, and fat deposits, all of which are indicators of performance. The animal's appearance can also provide an estimate of fertility; for example, the scrotal circumference of bulls can be used to evaluate their fertility. Appearance can indicate longevity of production as well.

In addition to simply observing the appearance of the animal, producers may use ultrasound to select breeding stock. An ultrasound machine uses high-frequency waves to show what is below the skin of an animal. It is mainly used to measure the loin eye area and fat thickness of beef, swine, and sheep. Ultrasound is helpful in selecting breeding stock with good meat characteristics.

Pedigree - A pedigree is a record of an animal's ancestry. An animal with a pedigree is a purebred animal. Many breed associations exist to determine the genetic standards an animal needs to be certified as purebred. These associations keep accurate breeding and performance records of registered animals, which are used for pedigrees. Usually a pedigree includes three generations, because ancestors further back have little impact on performance. A pedigree should include performance information about the animal's ancestors.

In some situations, a pedigree can be useful in making decisions about selection. This information is very useful when the animal to be selected has not yet reached its full level of performance. For example, producers may find it difficult to decide whether to keep a dairy heifer as a replacement before she begins to produce milk. By reviewing the pedigree, the heifer's future performance can be estimated, and an educated decision can be made. Also, pedigree information can be helpful when examining long-term factors such as longevity or abnormalities that may be revealed when the animal is older. Finally, a pedigree can help when evaluating traits that may be expressed in only one gender, such as milk production.

Performance data - A third basis of selection is performance data, which may include production records for the animal, performance tests, and progeny tests. Production records for an animal and related animals, which might include data such as weaning weight, yearling weight, and growth rate, can indicate whether an animal should be selected for further production or culled. Performance testing carried out by central test stations involves evaluating differences in performance under uniform conditions.

Information obtained through performance testing will vary for different species of livestock but might include items such as gain over a specified period and efficiency of feed conversion. Progeny testing measures the performance of the offspring of an animal against the performance of the progeny of other animals.

## Selection Factors for Production

Fewer factors are used when selecting animals for production. One of the most important is the conformation of the animal. The skeletal structure, muscling, and fat deposition all affect the level of production for an animal. Animals with good conformation will most likely produce more of the valuable products for a particular species, such as milk, eggs, and higher priced cuts of meat. Animals with good conformation also tend to be healthier and more productive.

Other factors that may be used when selecting animals for production include health, size or weight, and sex. Only healthy animals should be chosen because unhealthy livestock will not be productive. The size or weight of the animals may have an effect on the quantity and quality of the product produced. The sex of the animal may also affect whether the animal is selected for production or kept for breeding.

## Summary

Livestock and poultry producers can greatly improve a herd or flock by selecting animals that display desirable traits. Important factors to consider in selecting breeding animals are conformation, pedigree, and performance data. Important factors for selecting animals for production include conformation, health, size or weight, and sex.

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## *Lesson 3: Selecting Beef Cattle*

In beef programs, farm managers want to select the best quality animals. An animal could appear sound in all aspects yet pass on undesirable traits, such as poor milking ability and calving problems, to offspring. Therefore, when selecting beef animals for breeding purposes, producers base selection on both visual evaluation of general health and body conformation and performance data. When selecting animals for production, however, they focus on the visual evaluation of the animal.

### Selecting Beef Animals for Breeding

A beef animal used for breeding purposes must possess the traits that are in demand in the marketplace. Some of these traits may be more heritable than others, yet each trait is important because improvement through selection is a process that may require several generations of breeding. As mentioned above, selection of beef cattle for breeding involves looking at both performance data and traits that can be evaluated visually. When examining traits using visual appraisal of the animal, the selection criteria evaluated usually include the following: conformation, size and scale, sex character, breed character, and temperament.

#### *Conformation*

The appearance of a live animal is judged by a conformation score. Conformation refers to the form, type, and shape of the animal. To determine a conformation score, an evaluation of skeletal structure, muscling, and fat is necessary. Criteria vary from breed to breed, and further information can be obtained from specific breed associations.

Beef cattle should be structurally correct, and examining the structure of a beef animal's body is important when selecting cattle for breeding. The ideal beef animal should appear to have a relatively long neck, which is a good indicator of growth. The animal's body should be long, wide, and deep. The top and rump should be level and wide. Body capacity is important to the animal's health and production and is indicated by wide-sprung ribs, a wide heart girth, and a deep chest floor that provides adequate space for proper development of the heart and lungs. Producers should avoid animals that have a shallow body, with a narrow heart girth and very compact ribs. When viewed from the rear, the round should be wide and show good depth, with the widest part halfway between the hock and the tail head. The shoulder should be well balanced and gradually slope down toward the front legs.

To be productive for years, a beef animal needs to be able to move with ease to cover plenty of pasture to graze and to mate. Thus, the structure of the feet and legs should be checked to make sure they are sound and strong. All joints should have strong definition and show no signs of swelling. Legs should be set squarely at each corner of the body. The pasterns should be strong. The toes should be equal in size; if toes are not even, they will wear abnormally and eventually lead to lameness. Hooves should be big and round, with a deep and strong heel. When viewing the animal from the front, the legs should be set wide with the hooves pointing straight forward, even when the animal is walking. When observing the animal from the rear, the legs should be equally wide at the pasterns and the hocks. The rear legs should turn outward subtly from the pasterns down. The feet and legs of beef animals should show no signs of structural incorrectness. Common problems in feet and leg structure include being sickle-hocked, calf-kneed, post-legged, buck-kneed, splay-footed, pigeon-toed, cow-hocked, and bowlegged. Any of these problems could lead to lameness and should therefore be avoided.

The animal should not have any excess fat and should be checked for fat deposition, especially in the rear flank, foreflank, underline, and brisket. Muscling should be smooth, balanced, and heavy throughout the body, especially the forearm. The animal should not have too much muscling, to the point that movement is restricted, or too little muscling. Higher priced cuts should be fully developed; these parts include the round, rump, loin, and ribs.

A number of conformation scoring systems are used in the United States. A common method of muscle conformation evaluation used in the beef industry involves a range of seven specific scores. The scale is as follows.

- Exceptionally thin (1)
- Very light muscled (2)
- Light muscled (3)
- Average muscling (4)

- Heavy muscled (5)
- Very heavy muscled (6)
- Double muscled (7)

Although a lightly muscled beef animal is not expected to produce a very valuable carcass, an animal that has too much muscling is undesirable as well. In general, many producers strive for beef animals that are classified at or near 5 or 6, but these standards vary from breed to breed.

A simplified method of grouping beef animals according to their body condition or amount of fat cover has been developed. Producers estimate the amount of fat and give the animal a body condition score (BCS) that places it into a group with similar animals. The scores range from 1 to 9, with a score of 1 indicating an extremely thin animal and a score of 9 an extremely fat one. Table 3.1 gives a description of the nine body condition scores for beef cattle.

### *Size and Scale*

Size is another important factor in selection. The selection of large-framed cattle tends to result in progeny that mature later. However, such offspring usually grow faster and are lean. They produce more meat than small-framed cattle and are more efficient in converting feed. At the same time, cattle that are too large-framed have calving difficulties, tend to mature very late, and have heavy mature weights that are not very economical because they require more feed to reach. Thus, many producers select medium-framed females and large-framed bulls. By selecting medium-framed cows, farm managers control feed and maintenance costs. Large-framed bulls are selected to pass on increased growth to the offspring.

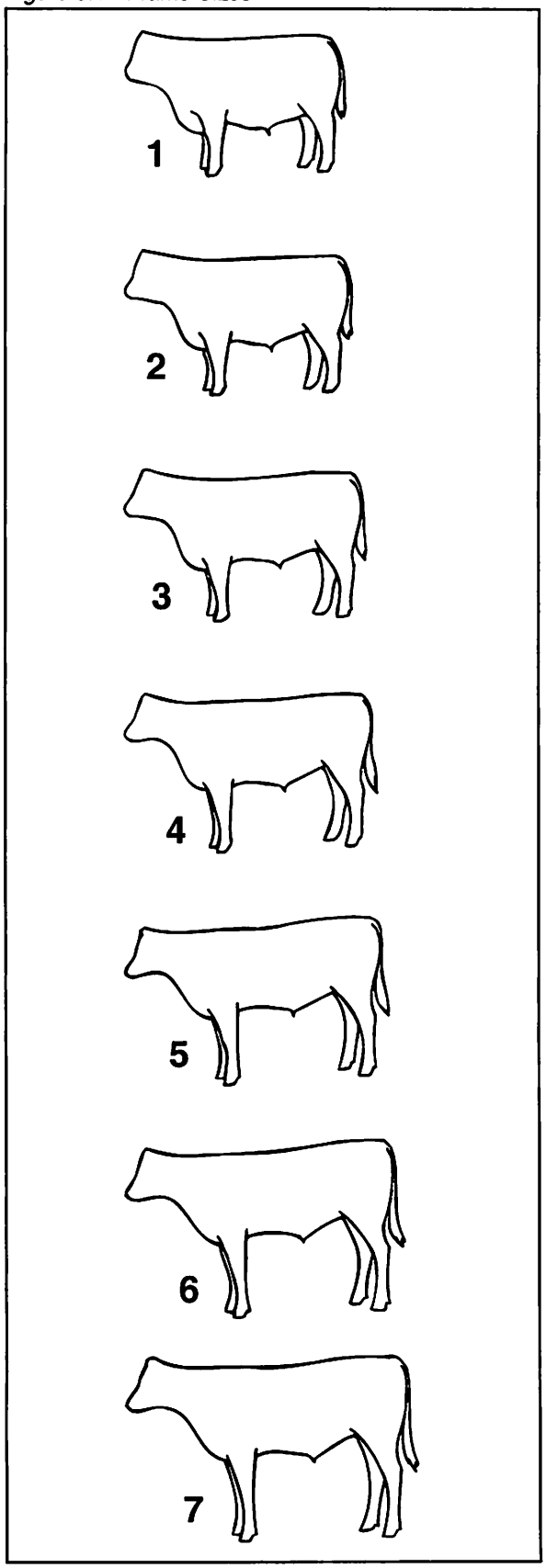
Animals are classified according to frame size. Frame size refers to the size of the animal's skeleton in relation to its age. Seven body type scores developed by the University of Wisconsin indicate frame size in beef cattle. See Figure 3.1 for an illustration of the seven frame sizes. In general, English breeds should have a frame score between 1 and 5. Exotic breeds fall between 3 and 7.

The Beef Improvement Federation (BIF) has developed the most accurate means of measuring frame size in beef cattle. This measurement must

*Table 3.1 - Body Condition Scoring*

| Score | Description |
|---|---|
| 1 | Emaciated - Extremely thin, with no visible fat cover along the spine and over the ribs; bone structure of the shoulder, ribs, back, hooks, and pins is easily visible |
| 2 | Very thin - Somewhat thin; less prominent tail head and ribs, with some visible muscle tissue in hindquarters |
| 3 | Thin - Ribs visible but not as sharp; fat is present at the tail head and along the spine, but backbone is still highly visible |
| 4 | Borderline - Foreribs no longer visible; some fat cover over hip bones |
| 5 | Moderate - Good appearance, with fat cover present over all the ribs; areas around the tail head have visible fat cover |
| 6 | Good - A great deal of spongy fat present on the ribs and around the tail head; hindquarters plump and full |
| 7 | Very good - Obvious fat cover; fleshy, spongy fat cover is present over the ribs and tail head, with some fat around the crotch/vulva |
| 8 | Fat - Fleshy with large deposits of fat at the ribs and tail head; fat cover thick and spongy with bone structure starting to disappear |
| 9 | Extremely fat - Blocky looking, with bone structure no longer visible and not easily felt; mobility may be impaired by fat |

*Figure 3.1 - Frame Sizes*




be made from the same point on every member of When the animal reaches 205 days of age, a measurement is taken from the hip to the ground while the animal is standing straight on a level surface. The hip height measurement correlates with the above frame types and aids in estimating the future size of the animal. The desirable frame size depends on the breed of cattle.

*Sex Character*

Selecting animals for sound reproductive traits is crucial in improving the overall herd as well as the economic gain of a beef production system. Such traits are difficult to appraise visually, so performance testing has gained popularity as a means of evaluation. Even so, certain traits should be examined when visually evaluating a beef animal for breeding purposes.

Certain characteristics should be present in cows and heifers. Females should appear feminine. They should have a graceful, angular look. Cows and heifers should have a relatively long and smooth neck and show some refinement in the head. Farm managers often select female beef cattle that have a slight slope from the hooks to the pins, because animals with this characteristic tend to have fewer problems when calving. Females should be wide at the pin bones because animals that are narrow are prone to calving problems. When visually evaluating younger females, producers must be sure heifers have proper udder development and a sound vulva.

Bulls should also have some identifiable traits. Bulls should be masculine and rugged in the head and neck areas. Animals older than one year of age should have strong muscling in the arm and forearm. If a bull shows these characteristics before he is a year old, he may mature too early, which can lead to excess fat deposits.

An important visual indicator of fertility in bulls is the soundness and size of the scrotum. Bulls should have properly developed testicles contained in a scrotal sac that hangs to about hock level. A measurement of the scrotal circumference is an indicator of the potential production of semen. Acceptable size for the scrotum varies between breeds. In general, yearling bulls should have a scrotal circumference between 25 and 40 centimeters. Scrotal circumference is measured by placing a scrotal measuring tape around the scrotal sac at the widest point and pulling it taut but not tight for the reading. If a bull is fat, it will

most likely deposit fat in the scrotum, so the measurement will not be reliable.

*Breed Character*

Breed character is more important to purebred breeders who may weigh pedigree more heavily in the selection process than performance and visual appraisal. Still, breeders should strive to select the beef animal that best suits the criteria of the breed.

Breed character refers to the distinguishing characteristics of specific breeds. These characteristics may include such traits as hair color, head shape, overall body shape, whether the animal is polled or horned, etc. Visually determining the purity of the breed in animals is difficult. Many breed associations perform blood tests to determine breed purity. If the animal has met all the standards that are required for registration in a breed registry, evidence of breed purity is considered adequate.

*Temperament*

The temperament, or disposition, of the animals used for breeding affects production. Animals with a bad temperament are more difficult to handle and require more management. Gentle females are better mothers and raise better calves. Bulls that have a bad disposition can be extremely dangerous to other animals and to humans. Signs of a bad temperament in beef cattle include nervousness, carrying the head very high, charging and bucking, and frequent urination.

*Performance Data*

In addition to the characteristics evaluated during visual appraisal, performance data is essential in selecting the best possible animals for breeding purposes. Performance data consists of the records for animals documenting their reproduction and production. One of the advantages of using performance data for selection is that farm managers are required to collect records to determine which animals should be culled and which are the best to use for breeding purposes. In a sense, managers must maintain their record keeping practices because they need good records to use in selection.

The cow is responsible for 50 percent of the calf's genetic makeup. Visual evaluation of the heifer or cow is not enough for selection. The cow's weaning weight and feed conversion records, as well as an evaluation of the calf crop produced, should be considered when deciding which animals should be included in the breeding herd.

The use of sire summaries has greatly improved the selection of genetically superior sires. Sire summaries are developed by the different breed associations, which update and distribute the summaries on an annual basis. The summaries evaluate traits that are considered economically important to producers. Birth weight, yearling weight, and weaning weight are evaluated in all sire summaries. Other traits evaluated vary from breed to breed. Many sire summaries evaluate the female progeny of the sire in the form of a maternal milk EPD. This figure represents the ability to produce milk. The majority of the bulls evaluated in the sire summaries are used in artificial insemination programs. Thus, a producer who uses artificial insemination for breeding can select semen from a bull that is genetically superior in the traits the producer is trying to improve in the herd. If a producer uses a natural mating system, he or she can purchase the progeny of a particular bull described in a sire summary.

Progeny tests, which measure the production of a breeding bull by the performance of his progeny, are used to create a sire summary. Sire summaries use the term expected progeny difference (EPD) to indicate the ability of a sire to pass on traits. EPDs are specific to a particular breed. An EPD is a number that may either be expressed as a positive or negative figure using the unit of measurement for the particular trait being evaluated (pounds for weight, for example). The number indicates the expected amount of difference from the average bull's offspring that the offspring of a bull will show for a particular trait. An example of a sire summary is provided in Figure 3.2. An EPD for yearling weight of +80.4 (Bull C) shows that the offspring of that sire is expected to weigh 80.4 pounds more than the average bull's offspring at 365 days of age. The progeny of Bull A is expected to produce calves that would weigh 2.7 pounds less than the average bull's progeny. The value labeled ACC is an evaluation of the accuracy for the data reported on an EPD. The greater the number of calves sired by a bull is, the greater the accuracy because more values are available to add the bull's statistics.

*Figure 3.2 - Sire Summary*

| Report | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Birth Weight | | Weaning Weight | | Yearling Weight | | Maternal Milk | |
| | EPD | ACC | EPD | ACC | EPD | ACC | EPD | ACC |
| Bull A | -1.6 | 0.81 | -2.7 | 0.79 | -3.2 | 0.72 | +10.0 | 0.80 |
| Bull B | +2.4 | 0.90 | +39.1 | 0.91 | +70.0 | 0.83 | +16.0 | 0.76 |
| Bull C | +8.3 | 0.97 | +53.8 | 0.97 | +80.4 | 0.89 | -5.0 | 0.66 |
| ACC = accuracy | | | | | | | | |

By evaluating the information in a sire summary, a producer can make direct comparisons among the listed bulls. For example, compare the weaning weight data of Bull B and Bull C in Figure 3.2. The offspring of Bull B is expected to weigh +39.1 pounds at weaning. Also, the offspring of Bull C are expected to weigh 53.8 pounds more than the offspring of the average bull of that breed. From this information, the offspring of Bull C should weigh 14.7 pounds (53.8 - 39.1) more on average at weaning than Bull B's offspring. Note in the figure that the accuracy of weaning weight EPD values for Bull A, B, and C varies greatly.

## Selecting Beef Animals for Production

When selecting feeder cattle for production, some of the same characteristics are evaluated as when selecting breeding animals. However, the animals are evaluated somewhat differently. The following criteria are important: sex, frame size, age and weight, grade, and body condition.

Sex - Three classes of feeder cattle are offered for purchase: steers, heifers, and young bulls (bullocks). When comparing steers and heifers, differences in performance depend on the system of feeding. If the animals are fed to the same degree of finish or fatness, heifers tend to reach the desired weight about 80 percent faster than steers of the same frame size because heifers mature faster. Thus, heifers require fewer days of feed to reach the point of slaughter. However, little difference is found in performance levels between steers and heifers when fed to the same degree of finish. If the animals are fed for the same amount of time, steers will gain faster and more efficiently because they are more efficient in gain during the last phases of the finishing period.

Young bulls are not recommended for finishing. Bullocks gain faster than steers and heifers, they require less feed, and have a higher cutability, but they also require more management because they tend to be temperamental. To ensure the meat is tender, they need to be marketed at 18 months of age. However, because they tend to mature late, they usually do not have a sufficient degree of marbling by 18 months to be graded as choice.

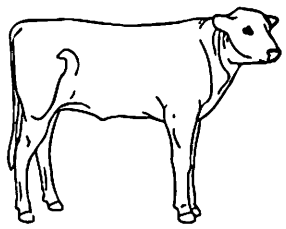
Frame size - In general, large-framed feeder cattle gain more rapidly and more efficiently than small-framed cattle. However; larger-framed cattle need to reach larger weights and thus require more feed. The producer should be able to recognize the different frame sizes of cattle and feed them accordingly. The Wisconsin frame size standards (Figure 3.1) are used to classify the animals by frame size.

Grade - The USDA has developed a standard set of feeder cattle grades that were last updated in 1979. The grades are based on thriftiness, frame size, and muscling. Thriftiness is defined as the ability of feeder cattle to gain weight normally and maintain health. Frame size is graded as large, medium, or small. Muscling refers to thickness and development in relation to frame size and is classified as 1, 2, or 3. In general, an animal with a thicker, muscular system has a higher ratio of muscle to bone, which leads to a better yield grade. Figure 3.3 shows the U.S.D.A. feeder steer grades.

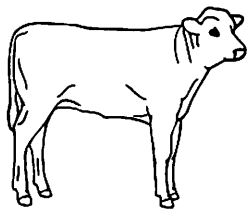
Body condition - Feeder cattle should have excellent body condition. As with breeding animals, feeder cattle are assigned a body condition score (BCS) ranging from 1 to 9. A thin and thrifty beef animal has a better potential of producing a higher price per hundredweight than fat animals.

*Figure 3.3 - U.S.D.A. Feeder Steer Grades*

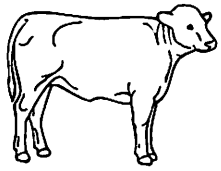
**FRAME SIZES**



**Large Frame**
- **Tall and long for age**
- **At a half-inch of fat, steers will be 1200 lbs. or more heifers will be 1000 lbs. or more**



**Medium Frame**
- **Slightly tall and slightly long for age**
- **At a half-inch of fat, steers will be 1000-1200 lbs. heifers will be 850-1000 lbs.**



**Small Frame**
- **Small frame and shorter-bodied for age**
- **At a half-inch of fat, steers will be less than 1000 lbs. heifers will be less than 850 lbs.**

**MUSCLING SCORES**

**No. 1**
- **Slightly thick throughout**
- **Moderate width between legs**
- **High proportion of beef breeding**

**No. 2**
- **Narrow throughout**
- **Legs set close together**
- **Back and loin have sunken appearance**

**No. 3**
- **Less thickness than No. 2**
- **Legs closer together than No. 2**

## Records

Accurate record keeping is a must for proper management and can be a very useful tool for selecting quality beef cattle for breeding or production. Birth date, birth weight, weaning weight, yearling weight, fat thickness, and hip height can be used to evaluate animals. Scrotal circumference at 365 days of age should be recorded for breeding bulls. Health records can also be useful when selecting animals. This simple information can be used in performance equations providing farm managers with a wealth of information for estimating the productivity of breeding animals.

## Summary

When evaluating beef animals for breeding, traits that can be visually evaluated and performance data both form the basis for proper selection. Structural correctness, sex character, size and scale, conformation, breed character, and temperament can all be appraised visually. The general types of performance data used in selection includes progeny, performance, and production testing. Selection indexes and EPDs are useful methods of analyzing records to determine breeding potential. To evaluate feeder cattle for production, sex, age and weight, frame size, body condition, and grade are all important. Accurate record keeping is important for selection in all cattle production systems.

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## *Lesson 4: Selecting Dairy Cattle*

Although dairy cattle and beef cattle are the same animal species, selection criteria differ. Because dairy cattle are mostly used for the purpose of milk production rather than for beef, both male and female dairy animals have been bred for efficient milk production. The result is that the appearance and the genetics of dairy cattle differ greatly from those of beef cattle.

Over the past 50 years, overall production within the dairy industry has increased dramatically, while the number of dairy animals has decreased. Fewer cows are producing more milk. This increase in efficiency is mainly attributed to the use of genetically superior animals and the phasing out of undesirable traits through proper selection.

### Selecting Dairy Cows for Production and Breeding

In dairy production systems, all dairy cows are used for breeding, since the production of offspring stimulates lactation. Thus, the selection criteria for breeding and production animals does not vary as it does for beef cattle. The selection of dairy cows is based on four factors that ensure high productivity throughout the life of the animal. They are dairy type or physical appearance, performance data, pedigree, and health and vigor.

#### *Dairy Type*

In the United States, five breeds of dairy cattle are most commonly used for dairy production. These breeds are Holstein, Ayrshire, Guernsey, Brown Swiss, and Jersey. All have different attributes that make them desirable for different situations. Such attributes may include the ability to thrive in a certain climate, longevity, ease in calving, and high milk production. Thus, the use of a specific breed may depend on factors such as the geographic location of a production facility or the size of the facility. Each of these dairy breeds has a breed association. These breed associations have worked together to develop a Dairy Cow Unified Score Card (Figure 4.1) to evaluate the general appearance of cows as it relates to milk production potential according to the standards of each association. The card presents the traits of the ideal dairy type.

The score card breaks down the characteristics of the general appearance of an ideal dairy cow into five categories with varying point values: frame (15 points), dairy character (20 points), body capacity (10 points), feet and legs (15 points), and udder (40 points). These five headings are then further divided into more specific traits.

Frame - Important characteristics of a dairy animal's skeletal structure, except for the feet and legs, are evaluated in this category. The first priority is an acceptable rump. Pin bones should be slightly lower than the hips and the rump should be wide and long. The tail head should be located evenly between the pin bones and set moderately high. The next priority is the frame stature. Stature refers to the height of the animal, including the leg bones. Height, measured at the withers and hips, should be well proportioned; a cow with a long structure is desirable. Evaluation of the front end comes next. Legs should be set straight and square with adequate width between them. The crops should be well developed and the neck and withers should gracefully join to create a feminine appearance. The last two elements of structure evaluated in this category are the back and the breed characteristics. The back should be straight, with a healthy and adequate loin. Breed characteristics refer to traits that distinguish a particular breed, such as the shape of the head and neck and the overall style and balance.

Dairy character - In this category, the traits that are a physical indication of high milk production are appraised. An animal with good dairy character tends to be very efficient in converting feed to milk. An evaluation of dairy character focuses on the ribs, thighs, withers, neck, and skin. The ribs should have adequate space between bones that are flat and wide. The bones should be set at an angle that causes them to slant to the rear. Thighs should be long and lean with plenty of space between them. The neck should be long and should blend into the shoulders gracefully. Sharp withers are desirable, and the chine should be pronounced. Skin should be pliable. Cows with poor dairy character usually are not smooth and have too much excess fat.

Body capacity - A dairy cow needs good body capacity to be able to take in the amount of feed needed for high milk production. The animal also needs adequate space within the body cavity for proper development of the heart and lungs. The characteristics evaluated under this heading include the barrel and chest. It involves a three-

*Figure 4.1 - Dairy Cow Unified Score Card (Courtesy of The Purebred Dairy Cattle Association)*

# DAIRY COW UNIFIED SCORE CARD

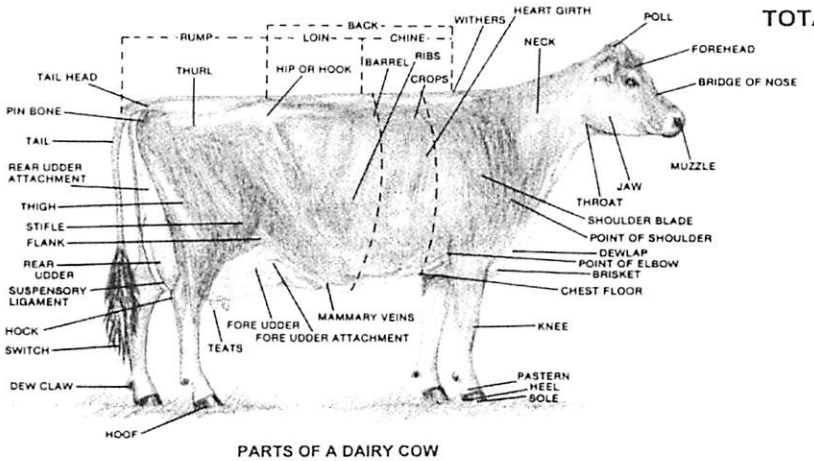


*Breed characteristics should be considered in the application of this score card*

## MAJOR TRAIT DESCRIPTIONS

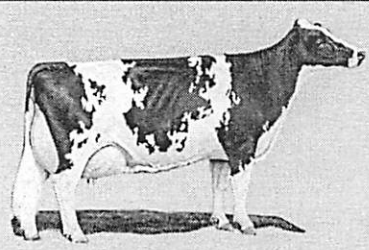
There are five major classification traits on which a classifier bases a cow's score. Each trait is broken down into body parts to be looked at and ranked.

| | Perfect Score |
|---|---|
| **1) Frame - 15%**<br>The skeletal parts of the cow, with the exception of feet and legs, are evaluated. Listed in priority order, the descriptions of the traits to be considered are as follows:<br>**Rump** - long and wide throughout with pin bones slightly lower than hip bones. Thurls need to be wide apart and centrally placed between hip bones and pin bones. The tailhead is set slightly above and neatly between pin bones, and the tail is free from coarseness. The vulva is nearly vertical. **Stature** - height, including length in the leg bones. A long bone pattern throughout the body structure is desirable. Height at the withers and hips should be relatively proportionate. **Front End** - adequate constitution with front legs straight, wide apart and squarely placed. Shoulder blades and elbows need to be firmly set against the chest wall. The crops should have adequate fullness. **Back** - straight and strong; the loin - broad, strong, and nearly level. **Breed Characteristics** - overall style and balance. Head should be feminine, clean-cut, slightly dished with broad muzzle, large open nostrils and a strong jaw is desirable.<br>Rump, Stature, and Front End receive primary consideration when evaluating Frame. | 15 |
| **2) Dairy Character - 20%**<br>The physical evidence of milking ability is evaluated. Major consideration is given to general openness and angularity while maintaining strength, flatness of bone and freedom from coarseness. Consideration is given to stage of lactation. Listed in priority order, the descriptions of the traits to be considered are as follows:<br>**Ribs** - wide apart. Rib bones are wide, flat, deep, and slanted toward the rear. **Thighs** - lean, incurving to flat, and wide apart from the rear. **Withers** - sharp with the chine prominent. **Neck** - long, lean, and blending smoothly into shoulders. A clean-cut throat, dewlap, and brisket are desirable. **Skin** - thin, loose, and pliable. | 20 |
| **3) Body Capacity - 10%**<br>The volumetric measurement of the capacity of the cow (length x depth x width) is evaluated with age taken into consideration. Listed in priority order the descriptions of the traits to be considered are as follows:<br>**Barrel** - long, deep, and wide. Depth and spring of rib increase toward the rear with a deep flank. **Chest** - deep and wide floor with well-sprung fore ribs blending into the shoulders.<br>The Barrel receives primary consideration when evaluating Body Capacity. | 10 |
| **4) Feet and Legs - 15%**<br>Feet and rear legs are evaluated. Evidence of mobility is given major consideration. Listed in priority order, the descriptions of the traits to be considered are as follows:<br>**Feet** - steep angle and deep heel with short, well-rounded closed toes. **Rear Legs**: **Rear View** - straight, wide apart with feet squarely placed. **Side View** - a moderate set (angle) to the hock. **Hocks** - cleanly molded, free from coarseness and puffiness with adequate flexibility. **Pasterns** - short and strong with some flexibility.<br>Slightly more emphasis placed on Feet than on Rear Legs when evaluating this breakdown. | 15 |
| **5) Udder - 40%**<br>The udder traits are the most heavily weighted. Major consideration is given to the traits that contribute to high milk yield and a long productive life. Listed in priority order, the descriptions of the traits to be considered are as follows:<br>**Udder Depth** - moderate depth relative to the hock with adequate capacity and clearance. Consideration is given to lactation number and age.<br>**Teat Placement** - squarely placed under each quarter, plumb and properly spaced from side and rear views.<br>**Rear Udder** - wide and high, firmly attached with uniform width from top to bottom and slightly rounded to udder floor.<br>**Udder Cleft** - evidence of a strong suspensory ligament indicated by adequately defined halving.<br>**Fore Udder** - firmly attached with moderate length and ample capacity.<br>**Teats** - cylindrical shape and uniform size with medium length and diameter.<br>**Udder Balance and Texture** - should exhibit an udder floor that is level as viewed from the side. Quarters should be evenly balanced, soft, pliable and well collapsed after milking. | 40 |
| **TOTAL** | 100 |

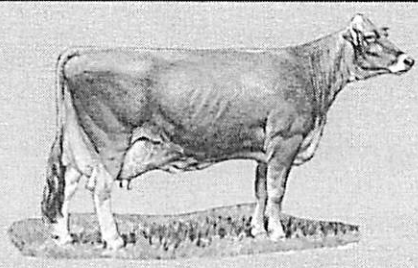



PARTS OF A DAIRY COW

*Figure 4.1 - Dairy Cow Unified Score Card (cont.)*

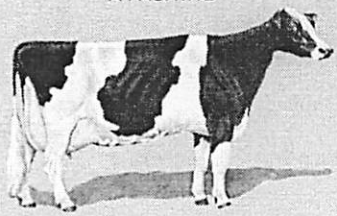


AYRSHIRE

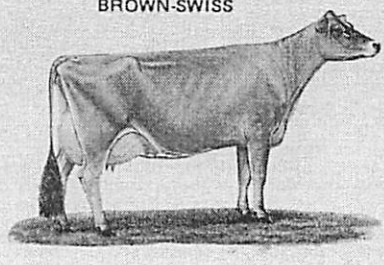


BROWN-SWISS

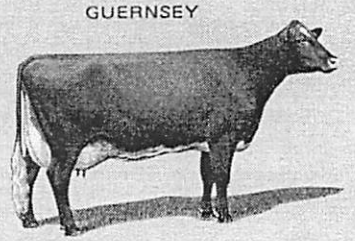
GUERNSEY



HOLSTEIN-FRIESIAN



JERSEY



MILKING SHORTHORN

## BREED CHARACTERISTICS

*Except for differences in color, size and head character, all breeds are judged on the same standards as outlined in the Unified Score Card. If any animal is registered by one of the dairy breed associations, no discrimination against color or color pattern is to be made.*

### AYRSHIRE

Strong and robust, showing constitution and vigor, symmetry, style and balance throughout, and characterized by strongly attached, evenly balanced, well-shaped udder.

HEAD-clean cut, proportionate to body; broad muzzle with large, open nostrils, strong jaw; large, bright eyes; forehead, broad and moderately dished; bridge of nose straight; ears medium size and alertly carried.

COLOR-light to deep cherry red, mahogany, brown, or a combination of any of these colors with white, or white alone, distinctive red and white markings preferred.

SIZE-a mature cow in milk should weigh at least 1200 lbs.

### HOLSTEIN

Rugged, feminine qualities in an alert cow possessing Holstein size and vigor.

HEAD-clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw; large, bright eyes; forehead, broad and moderately dished; bridge of nose straight; ears medium size and alertly carried.

COLOR-black and white or red and white markings clearly defined.

SIZE-a mature cow in milk should weigh a minimum of 1500 lbs.

### MILKING SHORTHORN

Strong and vigorous, but not coarse.

HEAD-clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw; large, bright eyes; forehead, broad and moderatly dished; bridge of nose straight; ears, medium size and alertly carried.

COLOR-red or white or any combination. (No black markings allowed)

SIZE-a mature cow should weigh 1400 lbs.

### BROWN SWISS

Strong and vigorous, but not coarse. Size and ruggedness with quality desired. Extreme refinement undesirable.

HEAD-clean cut, proportionate to body; broad muzzle with large, open nostrils; strong jaw; large, bright eyes; forehead, broad and slightly dished; bridge of nose straight; ears medium size and alertly carried.

COLOR-solid brown varying from very light to dark. Muzzle is black encircled by a mealy colored ring, and the tongue, switch and hooves are black

SIZE-a mature cow in milk should weigh 1500 lbs.

### GUERNSEY

Size and strength, with quality and character desired.

HEAD-clean cut, proportionate to body; broad muzzle with large, open nostrils; Strong jaw; large, bright eyes; forehead, broad and slightly dished; bridge of nose straight; ears medium size and alertly carried.

COLOR-a shade of fawn with white markings throughout clearly defined. When other points are equal, clear (buff) muzzle will be favored over a smoky or black muzzle.

SIZE-a mature cow in milk should weigh at least 1150 lbs.

### JERSEY

Sharpness with strength indicating productive efficiency.

HEAD-proportionate to stature showing refinement and well chiseled bone structure. Face slightly dished with dark eyes that are well set.

COLOR-some shade of fawn with or without white markings. Muzzle is black encircled by a light colored ring, and the tongue and switch may be either white or black.

SIZE-a mature cow in milk should weigh about 900 lbs.

## FACTORS TO BE EVALUATED

*The degree of discrimination assigned to each defect is related to its function and heredity. The evaluation of the defect shall be determined by the breeder, the classifier or the judge, based on the guide for discrimination and disqualifications given below.*

**HORNS**
*No discrimination for horns.*

**EYES**
1. Blindness in one eye: *Slight discrimination.*
2. Cross or bulging eyes: *Slight discrimination.*
3. Evidence of blindness: *Slight to serious discrimination.*
4. Total blindness: *Disqualification.*

**WRY FACE**
*Slight to serious discrimination.*

**CROPPED EARS**
*Slight discrimination.*

**PARROT JAW**
*Slight to serious discrimination.*

**SHOULDERS**
Winged: *Slight to serious discrimination.*

**TAIL SETTING**
Wry tail or other abnormal tail settings: *Slight to serious discrimination.*

**CAPPED HIP**
*No discrimination unless effects mobility.*

**LEGS AND FEET**
1. Lameness - apparently permanent and interfering with normal function: *Disqualification.* Lameness - apparently temporary and not affecting normal function: *Slight discrimination.*
2. Evidence of crampy hind legs: *Serious discrimination.*
3. Evidence of fluid in hocks: *Slight discrimination.*
4. Weak pastern : *Slight to serious discrimination.*
5. Toe out: *Slight discrimination.*

**UDDER**
1. Lack of defined having: *Slight to serious discrimination.*
2. Udder definately broken away in attachment: *Serious discrimination.*
3. A weak udder attachment: *Slight to serious discrimination.*
4. Blind quarter: *Disqualification.*
5. One or more light quarters, hard spots in udder, obstruction in teat (spider): *Slight to serious discrimination.*
6. Side leak: *Slight discrimination.*
7. Abnormal milk (bloody, clotted, watery): *Possible discrimination.*

**LACK OF SIZE**
*Slight to serious discrimination.*

**EVIDENCE OF SHARP PRACTICE**
(Refer to PDCA Code of Ethics)
1. Animals showing signs of having been tampered with to conceal faults in conformation and to misrepresent the animal's soundness: *Disqualification.*
2. Uncalved heifers showing evidence of having been milked: *Slight to serious discrimination.*

**TEMPORARY OR MINOR INJURIES**
Blemishes or injuries of a temporary character not affecting animal's usefullness: *Slight to serious discrimination.*

**OVERCONDITIONED**
*Slight to serious discrimination.*

**FREEMARTIN HEIFERS**
*Disqualification.*

dimensional measurement, a combination of the length, width, and depth of the barrel and chest. They both should be deep and wide. The barrel should also be long.

Feet and legs - The feet, rear legs, hocks, and pasterns are evaluated under this heading. Rear legs are observed from the side and rear to determine if they show any evidence of poor structure, such as splayed feet or bowlegs. The pasterns should be strong, and the hocks should show no signs of swelling.

Udder - Soundness of the udder of a dairy cow is weighed more heavily than any other characteristic on the Unified Dairy Cow Score Card. Depth, teat placement, udder cleft, fore udder, teats, and udder balance and texture are all evaluated as traits that contribute to high productivity.

When visually evaluating the udders of a dairy cow, the fore udder, rear udder, and then all four quarters are looked at to assess the udder as a whole. The fore udder should have good capacity and should blend smoothly into the underline of the cow. The bottom of the fore udder should hang at the same level as the rear udder. The suspensory ligament should be strong and create a slight division in the floor of the udder. The rear udder should have pronounced division by a strong suspensory ligament. The four quarters should be rounded and balanced.

Udder tissue should be soft, elastic, and flexible. Teats should be 1.5 to 2.5 inches in length and of even size. The teats should hang straight down when the udder is full. These characteristics of the udder tissue and teats are important to the dairy industry because they make a milking machine easier to use.

Large udders and mammary veins are desirable. Large udders are associated with higher milk production, although very large udders are more prone to injury. The floor of the udder should be slightly above the point of the hock. Other measures of udder capacity are the width and height of the udder at the point of attachment. Mammary veins circulate blood to and from the udder. The larger the mammary veins, the better the amount of circulation to the udder.

The conformation of the udder will change according to the stage of lactation and age of a dairy cow. These factors must be taken into account when evaluating udder soundness. See Figure 4.2 for an illustration of an ideal udder.

### *Performance Data*

Production records are used within the dairy industry to evaluate the production of a dairy cow and estimate the production potential of her progeny. Many farm managers utilize tests provided by the National Cooperative Dairy Herd Improvement Program (NCDHIP). This is an industry-wide program for record keeping and production testing. To qualify for official testing by the Dairy Herd Improvement Association (DHIA), farmers are obligated to keep accurate identification records and follow the regulations of the NCDHIP. The results of the testing may be published and used by the USDA to evaluate sires.

The NCDHIP sponsors the DHIA testing plan. In the program, an official tester from the DHIA visits the dairy production system one day per month. The tester takes samples of milk from each cow and examines feed and production records. The milk produced by each cow in the herd is weighed as well. This information is then sent to a data

*Figure 4.2 - Ideal Udder*

processing center for analysis, and a summary of the results is then sent to the producer. A herd summary is supplied, as well as information on individual cows, such as daily milk weights, percent butterfat, milk protein, somatic cell count, reproductive potential, value of the milk produced, amount of concentrates fed, and 305-day ME (mature equivalent) milk yields. A sample sheet showing information on different cows is provided in Figure 4.3. The DHIA program allows producers to compare individual cows within the herd. Based on these comparisons, the producer can determine which are the most and least efficient cows in the herd.

Dairy producers may also use unofficial owner-sampler testing programs that are less expensive. The program is similar to the DHIA tests, but the herd owner takes the samples and records the milk weights. A tester then evaluates the samples and supplies the results to the producer.

*Pedigree*

When selecting dairy cows for production and breeding, farm managers must carefully evaluate the pedigree of the animal. A pedigree provides the production records of an individual cow or heifer, which includes information on her individual production potential as well as the production potential of her offspring. A pedigree also provides the production records of her ancestors. Most pedigrees provide information on three generations, but producers may purchase more detailed records of an animal's ancestry. Approximately 50 percent of the genetic makeup of an animal is inherited directly from the sire and dam, so emphasis should be placed on the performance of the parents. The rest of the ancestors contribute the remaining 50 percent of the genetic makeup of the animal.

*Health and Vigor*

Any cows selected for production and breeding should come from healthy herds. The overall health of a herd can generally be evaluated by examining the number of cows in production, the calving records of cows in the past year, and the amount of milk being produced. A healthy herd is fertile and has high milk production. They have the stamina and strength to live a long and productive life. If the herd is not fertile or is producing less milk, nutritional deficiencies, health problems, or management problems may be at fault.

All available veterinary records of cows considered for selection should be checked before making a purchase. Cows should test negative for tuberculosis, leptospirosis, and brucellosis, since these diseases are serious causes of health problems in dairy herds. If testing was performed more than thirty days prior to purchase, the animals must be retested. Animals with problems such as mastitis, sterility, and udder problems should not be selected.

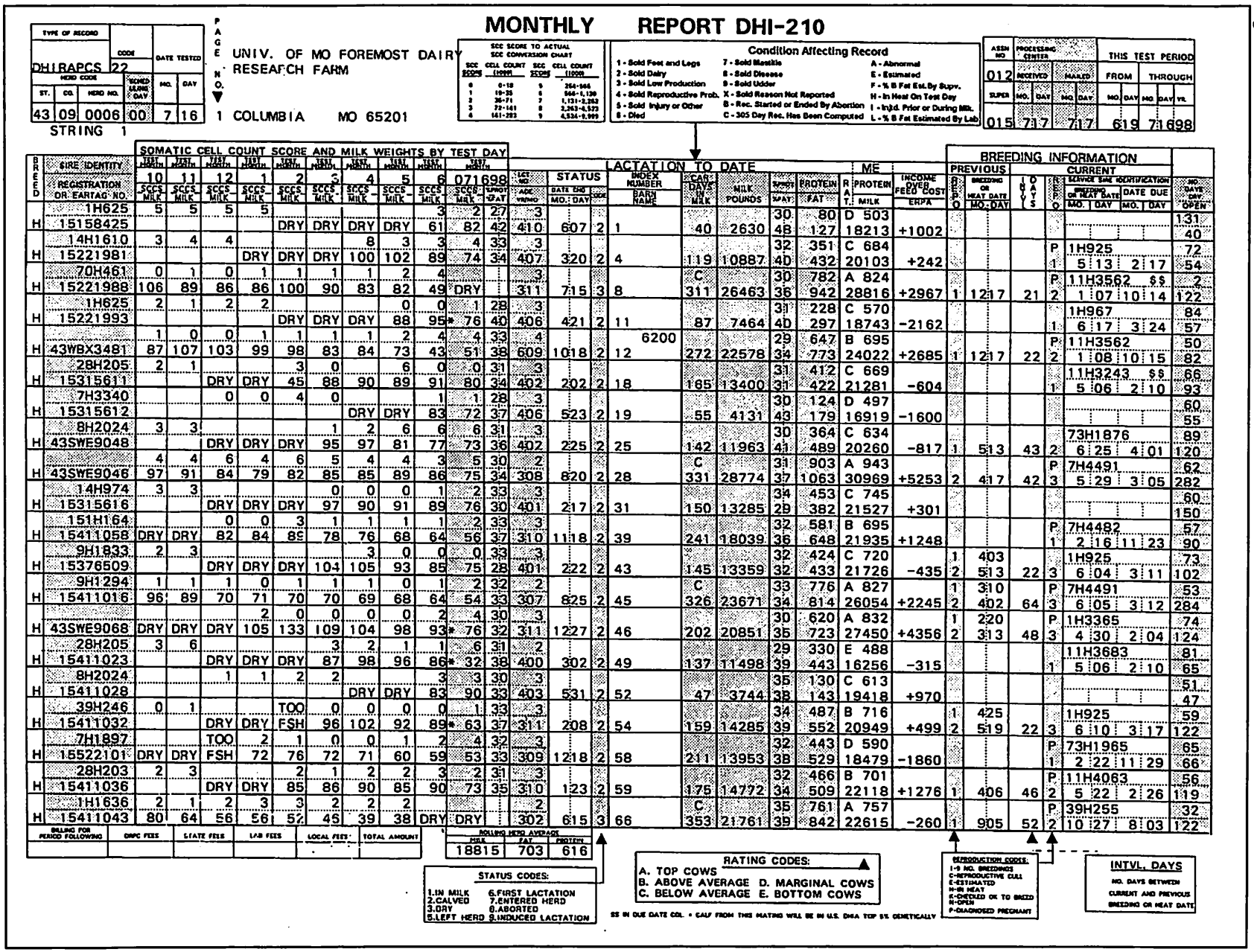
## Selecting Dairy Sires for Breeding

In general, dairy cows are used for both breeding and production. In contrast, dairy bulls are used only for breeding. Male dairy calves that are not kept for breeding purposes are usually culled because they offer little opportunity for economic gain and are expensive to maintain.

Bulls have the ability to pass on traits for high milk production. When considering a bull as a sire, examining the pedigree of the animal is important. The pedigree of a sire provides information about the milk production of the bull's ancestors.

Progeny testing evaluates the production of the offspring of the bull being considered. Indexes can be used to predict a bull's potential for passing on traits that will improve milk production to its offspring. Sire indexes are based on comparing the performance of the daughters of a sire with other animals. Many certified sires have progeny in up to 50 to 100 herds, so a sire index computed by the USDA is very reliable. The USDA publishes the Predicted Transmitting Ability (PTA) of certified sires biannually. The values contained in indexes indicate the bull's ability to pass on economically important traits, such as pounds of milk produced, protein, milk fat, and body conformation. The values represent the expected amount of difference from the bull's average offspring for a particular trait.

Another method of selection is the Net Merit index. It is an economic index that involves using the PTA's for milk, fat, protein, somatic cell score, and productive life. The index starts with the milk-fat-protein economic index, which is calculated based on a milk price of $12.30 per hundredweight of milk with 3.5 percent fat and 3.2 percent protein. The costs associated with feed and somatic cell



# MONTHLY REPORT DHI-210

TYPE OF RECORD: DHIRAPCS — CODE: 22 — DATE TESTED: MO. 7, DAY 16 — HERD CODE: ST. 43, CO. 09, HERD NO. 0006 — NUMBER MILKING TODAY: 00 — PAGE NO. ▼ 1

UNIV. OF MO FOREMOST DAIRY
RESEARCH FARM
1 COLUMBIA MO 65201

STRING 1

SCC SCORE TO ACTUAL SCC CONVERSION CHART

| SCC SCORE | CELL COUNT (1000) | SCC SCORE | CELL COUNT (1000) |
|---|---|---|---|
| 0 | 0-12 | 5 | 264-566 |
| 1 | 13-25 | 6 | 566-1,130 |
| 2 | 26-71 | 7 | 1,131-2,263 |
| 3 | 72-141 | 8 | 2,263-4,525 |
| 4 | 141-283 | 9 | 4,526-9,999 |

Condition Affecting Record

1 - Sold Feet and Legs; 2 - Sold Dairy; 3 - Sold Low Production; 4 - Sold Reproductive Prob.; 5 - Sold Injury or Other; 6 - Died; 7 - Sold Mastitis; 8 - Sold Disease; 9 - Sold Udder; X - Sold Reason Not Reported; B - Rec. Started or Ended By Abortion; C - 305 Day Rec. Has Been Computed; A - Abnormal; E - Estimated; F - % B Fat Est. By Supv.; H - In Heat On Test Day; I - Inj'd. Prior or During Mlk.; L - % B Fat Estimated By Lab.

| ASSN NO | PROCESSING CENTER | | THIS TEST PERIOD | | | | |
|---|---|---|---|---|---|---|---|
| 012 | RECEIVED | MAILED | FROM | | THROUGH | | |
| SUPER | MO. DAY | MO. DAY | MO. DAY | | MO. DAY | YR. | |
| 015 | 7 17 | 7 17 | 6 19 | 7 | 16 | 98 | |

SOMATIC CELL COUNT SCORE AND MILK WEIGHTS BY TEST DAY

| BREED | SIRE IDENTITY / REGISTRATION OR EARTAG NO. | TEST MONTH 10 SCCS | 10 MILK | TEST MONTH 11 SCCS | 11 MILK | TEST MONTH 12 SCCS | 12 MILK | TEST MONTH 1 SCCS | 1 MILK | TEST MONTH 2 SCCS | 2 MILK | TEST MONTH 3 SCCS | 3 MILK | TEST MONTH 4 SCCS | 4 MILK | TEST MONTH 5 SCCS | 5 MILK | TEST MONTH 6 SCCS | 6 MILK | TEST MONTH 07 16 98 SCCS | 07 16 98 MILK | SPOT %FAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1H625 | 5 | | 5 | | 5 | | 5 | | | | | | | | | | 3 | | 2 | | 27 |
| H | 15158425 | | | | | | | | | DRY | | DRY | | DRY | | DRY | | 61 | | 82 | | 42 |
| | 14H1610 | 3 | | 4 | | 4 | | | | | | | | 8 | | 3 | | 3 | | 4 | | 33 |
| H | 15221981 | | | | | | | DRY | | DRY | | DRY | | 100 | | 102 | | 89 | | 74 | | 34 |
| | 70H461 | 0 | | 1 | | 0 | | 1 | | 1 | | 1 | | 1 | | 2 | | 4 | | | | |
| H | 15221988 | 106 | | 89 | | 86 | | 86 | | 100 | | 90 | | 83 | | 82 | | 49 | | DRY | | |
| | 1H625 | 2 | | 1 | | 2 | | 2 | | | | | | | | | | 0 | | 0 | | 28 |
| H | 15221993 | | | | | | | | | DRY | | DRY | | DRY | | 88 | | 95 | | * 76 | | 40 |
| | | 1 | | 0 | | 0 | | 1 | | 1 | | 1 | | 2 | | 4 | | 4 | | 4 | | 33 |
| H | 43WBX3481 | 87 | | 107 | | 103 | | 99 | | 98 | | 83 | | 84 | | 73 | | 43 | | 51 | | 38 |
| | 28H205 | 2 | | 1 | | | | | | 3 | | 0 | | | | 6 | | 0 | | 0 | | 31 |
| H | 15315611 | | | | | DRY | | DRY | | 45 | | 88 | | 90 | | 89 | | 91 | | 80 | | 34 |
| | 7H3340 | | | | | 0 | | 0 | | 4 | | 0 | | | | | | 1 | | 1 | | 28 |
| H | 15315612 | | | | | | | | | | | | | DRY | | DRY | | 83 | | 72 | | 37 |
| | 8H2024 | 3 | | 3 | | | | | | | | 1 | | 2 | | 6 | | 6 | | 6 | | 31 |
| H | 43SWE9048 | | | | | DRY | | DRY | | DRY | | 95 | | 97 | | 81 | | 77 | | 73 | | 36 |
| | | 4 | | 4 | | 6 | | 4 | | 6 | | 5 | | 4 | | 4 | | 3 | | 5 | | 30 |
| H | 43SWE9046 | 97 | | 91 | | 84 | | 79 | | 82 | | 85 | | 85 | | 89 | | 86 | | 75 | | 34 |
| | 14H974 | 3 | | 3 | | | | | | | | 0 | | 0 | | 0 | | 1 | | 2 | | 33 |
| H | 15315616 | | | | | DRY | | DRY | | DRY | | 97 | | 90 | | 91 | | 89 | | 76 | | 30 |
| | 151H164 | | | | | 0 | | 0 | | 3 | | 1 | | 1 | | 1 | | 1 | | 2 | | 33 |
| H | 15411058 | DRY | | DRY | | 82 | | 84 | | 89 | | 78 | | 76 | | 68 | | 64 | | 56 | | 37 |
| | 9H1833 | 2 | | 3 | | | | | | | | 3 | | 0 | | 0 | | 0 | | 0 | | 33 |
| H | 15376509 | | | | | DRY | | DRY | | DRY | | 104 | | 105 | | 93 | | 85 | | 75 | | 28 |
| | 9H1294 | 1 | | 1 | | 1 | | 0 | | 1 | | 1 | | 1 | | 0 | | 1 | | 2 | | 32 |
| H | 15411016 | 96 | | 89 | | 70 | | 71 | | 70 | | 70 | | 69 | | 68 | | 64 | | 54 | | 33 |
| | | | | | | | | 2 | | 0 | | 0 | | 0 | | 0 | | 2 | | 4 | | 30 |
| H | 43SWE9068 | DRY | | DRY | | DRY | | 105 | | 133 | | 109 | | 104 | | 98 | | 93 | | * 76 | | 32 |
| | 28H205 | 3 | | 6 | | | | | | | | 3 | | 2 | | 1 | | 1 | | 6 | | 31 |
| H | 15411023 | | | | | DRY | | DRY | | DRY | | 87 | | 98 | | 96 | | 86 | | * 32 | | 38 |
| | 8H2024 | | | | | 1 | | 1 | | 2 | | 2 | | | | | | 3 | | 3 | | 30 |
| H | 15411028 | | | | | | | | | | | | | DRY | | DRY | | 83 | | 90 | | 33 |
| | 39H246 | 0 | | 1 | | | | | | TOO | | 0 | | 0 | | 0 | | 0 | | 1 | | 33 |
| H | 15411032 | | | | | DRY | | DRY | | FSH | | 96 | | 102 | | 92 | | 89 | | * 63 | | 37 |
| | 7H1897 | | | | | TOO | | 2 | | 1 | | 0 | | 0 | | 1 | | 2 | | 4 | | 32 |
| H | 15522101 | DRY | | DRY | | FSH | | 72 | | 76 | | 72 | | 71 | | 60 | | 59 | | 53 | | 33 |
| | 28H203 | 2 | | 3 | | | | | | 2 | | 1 | | 2 | | 2 | | 3 | | 2 | | 31 |
| H | 15411036 | | | | | DRY | | DRY | | 85 | | 86 | | 90 | | 85 | | 90 | | 73 | | 35 |
| | 1H1636 | 2 | | 1 | | 2 | | 3 | | 3 | | 2 | | 2 | | 2 | | | | | | |
| H | 15411043 | 80 | | 64 | | 56 | | 56 | | 52 | | 45 | | 39 | | 38 | | DRY | | DRY | | |

| BREED | LACT NO | STATUS DATE END MO. | STATUS DAY | STATUS CODE | INDEX NUMBER / BARN NAME | CAL DAYS IN MILK | MILK POUNDS | %FAT | PROTEIN %FAT | RAT | PROTEIN MILK | INCOME OVER FEED COST ERPA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 30 | 80 | D | 503 | |
| H | 1 | 6 | 07 | 2 | | 40 | 2630 | | 48 | 127 | 18213 | +1002 |
| | | | | | | | | | 32 | 351 | C | 684 | |
| H | 4 | 3 | 20 | 2 | | 119 | 10887 | | 40 | 432 | 20103 | +242 |
| | | | | | | C | | | 30 | 782 | A | 824 | |
| H | 8 | 3 | 15 | 2 | | 311 | 26463 | | 36 | 942 | 28816 | +2967 |
| | | | | | | | | | 31 | 228 | C | 570 | |
| H | 11 | 4 | 01 | 2 | | 87 | 7464 | | 40 | 297 | 18743 | -2162 |
| | | | | | 6200 | | | | 29 | 647 | B | 695 | |
| H | 12 | 4 | 01 | 2 | | 272 | 22578 | | 34 | 773 | 24022 | +2685 |
| | | | | | | | | | 31 | 412 | C | 669 | |
| H | 18 | 4 | 02 | 2 | | 165 | 13400 | | 31 | 422 | 21281 | -604 |
| | | | | | | | | | 30 | 124 | D | 497 | |
| H | 19 | 4 | 06 | 2 | | 55 | 4131 | | 43 | 179 | 16919 | -1600 |
| | | | | | | | | | 30 | 364 | C | 634 | |
| H | 25 | 4 | 02 | 2 | | 142 | 11963 | | 41 | 489 | 20260 | -817 |
| | | | | | | C | | | 31 | 903 | A | 943 | |
| H | 28 | 4 | 08 | 2 | | 331 | 28774 | | 37 | 1063 | 30969 | +5253 |
| | | | | | | | | | 34 | 453 | C | 745 | |
| H | 31 | 4 | 01 | 2 | | 150 | 13285 | | 29 | 382 | 21527 | +301 |
| | | | | | | | | | 32 | 581 | B | 695 | |
| H | 39 | 3 | 31 | 2 | | 241 | 18039 | | 36 | 648 | 21935 | +1248 |
| | | | | | | | | | 32 | 424 | C | 720 | |
| H | 43 | 3 | 31 | 2 | | 145 | 13359 | | 32 | 433 | 21726 | -435 |
| | | | | | | C | | | 33 | 776 | A | 827 | |
| H | 45 | 3 | 25 | 2 | | 326 | 23671 | | 34 | 814 | 26054 | +2245 |
| | | | | | | | | | 30 | 620 | A | 832 | |
| H | 46 | 3 | 31 | 2 | | 202 | 20851 | | 35 | 723 | 27450 | +4356 |
| | | | | | | | | | 29 | 330 | E | 488 | |
| H | 49 | 3 | 02 | 2 | | 137 | 11498 | | 39 | 443 | 16256 | -315 |
| | | | | | | | | | 35 | 130 | C | 613 | |
| H | 52 | 3 | 31 | 2 | | 47 | 3744 | | 38 | 143 | 19418 | +970 |
| | | | | | | | | | 34 | 487 | B | 716 | |
| H | 54 | 3 | 11 | 2 | | 159 | 14285 | | 39 | 552 | 20949 | +499 |
| | | | | | | | | | 32 | 443 | D | 590 | |
| H | 58 | 3 | 09 | 2 | | 211 | 13953 | | 38 | 529 | 18479 | -1860 |
| | | | | | | | | | 32 | 466 | B | 701 | |
| H | 59 | 3 | 10 | 2 | | 175 | 14772 | | 34 | 509 | 22118 | +1276 |
| | | | | | | C | | | 35 | 761 | A | 757 | |
| H | 66 | 3 | 15 | 2 | | 353 | 21761 | | 39 | 842 | 22615 | -260 |

BREEDING INFORMATION

| BREED | PREVIOUS BREEDING OR HEAT DATE MO. DAY | CURRENT BREEDING OR HEAT DATE MO. DAY | INVTS | SERVICE SIRE IDENTIFICATION | BREED | NO. DAYS DRY OPEN |
|---|---|---|---|---|---|---|
| | | | | | | 131 |
| H | | | | | | 40 |
| | | | | 1H925 | P | 72 |
| H | | | | 5 13 2 17 | 1 | 54 |
| | | | | 11H3562 $$ | P | 2 |
| H | 12 17 | 21 | | 1 07 10 14 | 2 | 122 |
| | | | | 1H967 | | 84 |
| H | | | | 6 17 3 24 | 1 | 57 |
| | | | | 11H3562 | P | 50 |
| H | 12 17 | 22 | | 1 08 10 15 | 2 | 82 |
| | | | | 11H3243 $$ | | 66 |
| H | | | | 5 06 2 10 | 1 | 93 |
| | | | | | | 60 |
| H | | | | | | 55 |
| | | | | 73H1876 | | 89 |
| H | 5 13 | 43 | 2 | 6 25 4 01 | 2 | 120 |
| | | | | 7H4491 | P | 62 |
| H | 4 17 | 42 | 3 | 5 29 3 05 | 3 | 282 |
| | | | | | | 60 |
| H | | | | | | 150 |
| | | | | 7H4482 | P | 57 |
| H | | | | 2 16 11 23 | 1 | 90 |
| | | | | 1H925 | | 73 |
| H | 5 13 | 22 | 3 | 6 04 3 11 | 3 | 102 |
| | | | | 7H4491 | P | 53 |
| H | 3 10 | 64 | 3 | 6 05 3 12 | 3 | 284 |
| | | | | 1H3365 | P | 74 |
| H | 2 20 | 48 | 3 | 4 30 2 04 | 3 | 124 |
| | | | | 11H3683 | | 81 |
| H | | | | 5 06 2 10 | 1 | 65 |
| | | | | | | 51 |
| H | | | | | | 47 |
| | | | | 1H925 | | 59 |
| H | 4 25 | 22 | 3 | 6 10 3 17 | 3 | 122 |
| | | | | 73H1965 | P | 65 |
| H | | | | 2 22 11 29 | 1 | 66 |
| | | | | 11H4063 | P | 56 |
| H | 4 06 | 46 | 2 | 5 22 2 26 | 2 | 119 |
| | | | | 39H255 | P | 32 |
| H | 9 05 | 52 | 2 | 10 27 8 03 | 2 | 122 |

| BILLING FOR PERIOD FOLLOWING | DHPC FEES | STATE FEES | LAB FEES | LOCAL FEES | TOTAL AMOUNT |
|---|---|---|---|---|---|
| | | | | | |

ROLLING HERD AVERAGE: MILK 18815 — FAT 703 — PROTEIN 616

STATUS CODES:
1.IN MILK; 2.CALVED; 3.DRY; 5.LEFT HERD; 6.FIRST LACTATION; 7.ENTERED HERD; 8.ABORTED; 9.INDUCED LACTATION

RATING CODES:
A. TOP COWS
B. ABOVE AVERAGE D. MARGINAL COWS
C. BELOW AVERAGE E. BOTTOM COWS

REPRODUCTION CODES:
I-0 NO. BREEDINGS; C-REPRODUCTIVE CULL; E-ESTIMATED; H-IN HEAT; R-RECEIVED OK TO BREED; N-OPEN; P-DIAGNOSED PREGNANT

INTVL. DAYS: NO. DAYS BETWEEN CURRENT AND PREVIOUS BREEDING OR HEAT DATE

$$ IN DUE DATE COL. = CALF FROM THIS MATING WILL BE IN U.S. DHIA TOP 5% GENETICALLY

Figure 4.3 - DHIA Record

counts are subtracted, and the value of productive life is included. The index gives a weighting of 10 for yield, 4 for productive life, and -1 for somatic cell score. The Net Merit index reflects the net contribution that these traits make to income and is expressed as a dollar value.

## Record Keeping

Several different types of records are useful in selecting dairy animals and should be kept by producers. Health records indicate the health history of the animal. Production records from the DHIA or owner-sampler records should be kept, as well as information on freshening, breeding, and drying dates. These dates indicate the number of days the cow is producing milk.

## Summary

Selection of dairy cattle for breeding and production is vital to ensuring high herd productivity. One of the main tools for selection of dairy cows is the Dairy Cow Unified Score Card. This scoring system categorizes the general appearance of a cow under five headings: frame, dairy character, body capacity, feet and legs, and udder. In this system, the udder section is considered the most important part of a dairy cow. Dairy cows are also selected on the basis of pedigree, production records, and health. Because dairy sires also pass on milk production traits to their offspring, bulls are selected mainly on the basis of pedigrees and progeny tests. The use of sire and total performance indexes help to predict the potential production value of a sire.

## Credits

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## *Lesson 5: Selecting Swine*

In the swine industry, managers must make important selection decisions for both breeding and production. They must be able to choose the best possible boars and gilts or sows to phase out undesirable traits within the herd and develop the traits that are in demand in the marketplace. A producer must be able recognize the undesirable traits that could be improved within the herd and desirable or undesirable traits in animals being considered as replacement animals.

### Selecting Swine for Breeding

When evaluating new breeding stock, selection is based on the following criteria: conformation, reproductive soundness, and performance tests. In addition, litter size and rate of gain should be considered when selecting sows and gilts.

#### *Conformation*

Conformation refers to the general appearance of the animal's form and shape. The animal should exhibit the traits that will enable it to lead a long and productive life under the stress of a high-intensity breeding program.

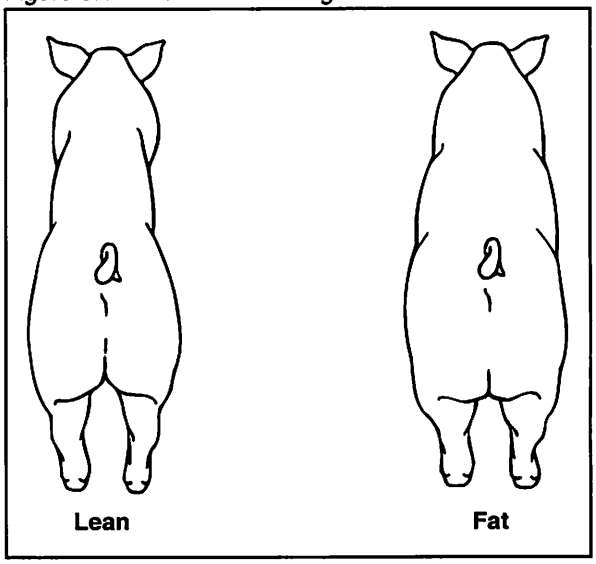
Proper skeletal correctness is especially important since commercial producers generally raise their animals on concrete floors, which tend to accelerate the progression of skeletal problems. Animals that display skeletal correctness should have a flat and even top with a balanced and level rump. A rump or a back that is too high is very undesirable. Animals should have shoulders that slope gradually toward the front feet, with front legs that blend well at the shoulder. Good feet and legs are important for standing on hard concrete floors. Long, sloping pasterns that enable the animal to walk with long and graceful strides are desirable. When they are viewed from the front, hogs should have straight legs. When viewed from the rear, the hog should stand squarely on the hind legs, which should toe out a bit below the pastern. Toes should be even. If a hog has uneven toes, they will not wear normally, which leads to lameness. Animals should not have unsound legs, such as buck knees, pigeon toes, splayed feet, or cow hocks.

Hogs selected for breeding should have long, large-framed bodies. Small-framed hogs are not as efficient as large-framed hogs, which also tend to be more lean. They have the potential to be marketed at 240 to 260 pounds without slowing down the growth rate or depositing excess body fat.

Good body capacity is also important. The volume of the body capacity of breeding swine should be adequate for proper development of the lungs and heart. The length, width, and depth of the animal's body should support a high rate of breeding and feed intake.

When examining muscling, hogs should be evaluated for the expression, or definition, of muscle instead of thickness alone, which may be the result of fat rather than muscling. Observing the animal from the rear is best. Animals should be wide through the back and loin, with a deep rump. The ham should be thick, deep, and smooth; it should always be the widest part of the body, as shown in Figure 5.1. A narrow ham is an indicator of poor muscling. A good hog has a wide chest and shoulders, with a back that is thinner than the width across both the shoulder and ham. The loin eye area, which is measured at the tenth rib, reveals the amount of muscling. In general, a meaty hog has a loin eye area of more than 6 square inches at 240 pounds. This area is usually measured using ultrasound.

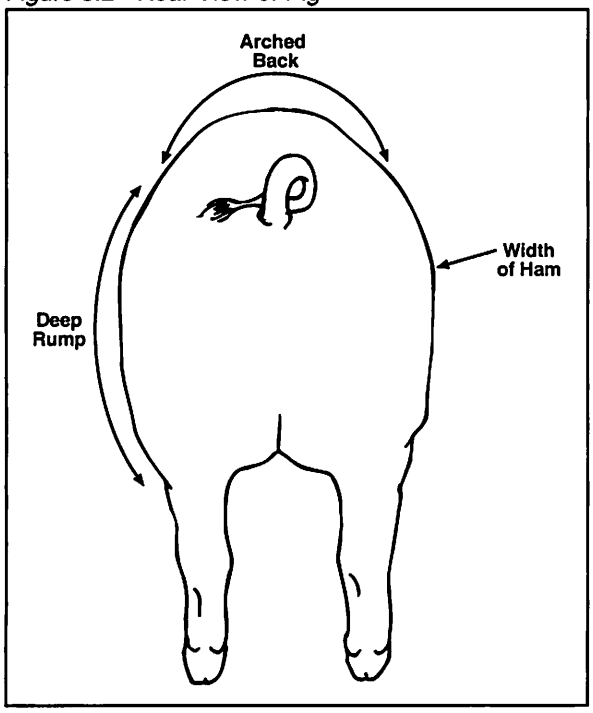
*Figure 5.1 - Lean and Fat Hogs*




In addition to being heavily muscled, breeding animals must be lean. Breeding stock should be leaner than average. When viewed from the top, a lean hog has an hourglass shape, illustrated in

Figure 5.1. Also, lean hogs will be trim through the lower body. When observing the animal from the rear, the top of the back should be arched (see Figure 5.2) rather than square, which indicates fat deposits. Producers should use ultrasound to examine backfat thickness, which is the best indicator of leanness. Adjusted backfat scans at 240 pounds should be between .6 and 1.1 inches.

*Figure 5.2 - Rear View of Pig*




### *Reproductive Soundness*

Boars selected for breeding should show strong reproductive potential. The testicles should be well-developed and equal in size. Boars should have an aggressive disposition. They should have a strong desire to mate.

Sows and gilts used for breeding should exhibit a well-developed reproductive system. A strong indicator of reproductive potential is the vulva. Gilts with a small vulva should not be used for breeding, because a small vulva is a symptom of defects in the internal reproductive system.

Checking the underline of the animals is important when selecting replacements. Both male and female breeding hogs should have at least six well-developed and sound teats per side. Good teats are important in both boars and sows since these traits are highly heritable. They should not have teats that have inverted nipples or uneven spacing. Even spacing allows for larger udder sections with more mammary tissue, which enables the sow to produce more milk.

### *Health*

Only healthy animals should be chosen as breeding replacements. Before purchasing replacement breeding stock, herd managers should check the animal's health records to be sure that it has tested negative for brucellosis, leptospirosis, and pseudorabies. Animals that have watery or infected eyes, are bloated, or are having trouble breathing should be avoided. If possible, producers should obtain herd health records from the breeder.

### *Gain*

Fast-gaining gilts should be used for breeding replacements. When buying gilts, producers should be sure to evaluate records showing gain and feed efficiency. Producers should note the age of the animal when it reaches 230 pounds; fewer days are more desirable. Gilts should reach 230 pounds in less than 175 days.

### *Litter Size*

If a sow is capable of farrowing and raising a large litter, she has good mothering ability, a very desirable trait. Replacement gilts should be chosen from large litters. Also, sows that show little mothering ability, such as poor milking ability, should be culled from the herd.

### *Performance Data*

A number of swine performance testing stations exist in the United States. These stations test hogs and calculate production information such as age at 230 pounds, backfat depth, adjusted average daily gain, feed efficiency, carcass quality of litter mates, and loin eye areas. Such data is quite useful for producers, although other options for performance testing exist.

The USDA, Purdue University, and eight purebred swine associations have worked together to develop a Swine Testing and Genetic Evaluation System (STAGES). This program was developed to evaluate the Expected Breeding Value (EBV) of both boars and sows. STAGES ranks individual breeding swine, along with their sires and dams,

among the rest of the registered animals within a specific breed. The program combines data about backfat thickness, feed efficiency, sow productivity, growth, and carcass merit to determine the genetic superiority of swine. These figures are reported in the form of Expected Progeny Differences, or EPDs. EPDs look at the expected performance of the offspring of an animal in comparison to an average animal's offspring. An EPD with a positive value indicates an animal that is superior in the trait examined, while a negative number indicates an animal that performs below average for that trait. STAGES also provides information about pedigrees.

Purebred swine producers may also choose to enter their animals in performance testing systems set up by breed associations. Producers may enter their herd in a Production Registry established by the breed association for their registered purebreds. The registry will accept a litter for registration if it meets certain requirements, including having a group of eight or more litter mates that meet the standards for rate of gain for that breed. Breed associations have also developed a Certified Litter program that incorporates the Production Registry standards along with standards for carcass evaluation. Recognition may be given to animals that perform above average, since they are considered high quality breeding animals.

Producers who are evaluating animals for breeding stock should look at sow productivity. Sow productivity is a very important trait that has low heritability. Generally, productivity in sows is evaluated by looking at data about litter size, number of pigs weaned per litter, 21-day litter weight, and number of litters per sow per year.

A Sow Productivity Index (SPI) that compares a sow to other farrowing sows in a herd is a helpful tool in selection; it uses a formula to combine values for number born alive and 21-day litter weight into a single value. A ratio is then established by dividing the individual sow's index value by the average index for the herd and multiplying it by 100. With the average for the group set at 100, any animal assigned a number above 100 is considered above average for those traits, while one with a number below 100 is considered below average. Sows with above average SPI numbers should produce daughters that have larger and heavier litters.

In addition to the Sow Productivity Index, maternal and paternal indexes can be used in selection programs. The Terminal Sire Index (TSI) uses data on leanness and growth, looking at EPDs for the number of days to reach 230 pounds and backfat at 230 pounds. This index is used to select terminal sires. The Maternal Line Index (MLI) looks at EPDs for 21-day litter weight, number born alive, days to 230, and backfat at 230 pounds. This index can be used to select replacement gilts.

## Selecting Swine for Production

Selecting feeder pigs is somewhat less complicated than selecting breeding stock. Factors that influence the selection of feeder pigs include health, size and conformation, and uniformity.

Health - Only healthy pigs are even considered for selection. Feeder pigs that have been wormed and castrated and have docked tails should be chosen. No visible indications of external parasites should be present.

Size - Feeder pigs should weigh between 35 and 80 pounds when they are selected. They should be an appropriate size for their age.

Conformation - Meaty feeder pigs are capable of producing the carcass quality that is in demand by consumers. Feeder pigs should be extremely lean and show muscle expression at 50 pounds to maintain their leanness until they reach market weight. Large-framed animals are desirable because they mature later and are leaner at higher weights. A short, fat feeder pig will be overfinished at market weight. Animals with problems with their legs and feet should be avoided.

Uniformity - A group of feeder pigs should be relatively uniform in size, age, and condition. A uniform group will feed well with less competition between animals. A uniform herd is convenient for the producer as they tend to reach market weight at the same time.

## Records

Keeping accurate records is an integral part of sound management practices. Because keeping track of hogs as they move from stage to stage in a production system can be difficult, the use of complete records can save swine managers time

by providing information for each animal that can be used to aid in selection. A variety of records can help farm managers keep up with the system.

Among the records that are important for selection for breeding and production are those dealing with animal health. Since producers wish to select only healthy animals, complete veterinary records are necessary. Information that is of particular interest for selection includes vaccination dates, parasite treatments, past illnesses and their treatments, and general observations of swine health.

Another type of record needed for selection of breeding animals is reproductive records. The traits used in the Sow Productivity Index, the date of birth, number of pigs per litter, and 21-day litter weights, should be recorded. In addition, records should include information about farrowing problems, number of pigs weaned per litter, and number of litters born per sow per year.

Production records that can be used later for selection of breeding stock are also required. Information about growth rates is valuable, particularly the number of days to 230 pounds. Records about backfat thickness and loin-eye area at 230 pounds are also useful in selection of breeding stock. Data about feed efficiency, or the amount of feed required for gain, should also be included in records.

## Summary

Making good choices is vital when selecting swine animals for both breeding and production. When selecting male and female swine for breeding, important criteria include health, reproductive soundness, conformation, and performance tests, as well as rate of gain and litter size for sows and gilts. Important performance testing programs include STAGES, or the Swine Testing and Genetic Evaluation System, and sow productivity indexes. Feeder pigs are selected according to health, type and size, and uniformity. Keeping accurate records is important to swine production systems, since they can be valuable tools in selection. Common types of records that can be utilized include health, reproductive, and production records.

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## *Lesson 6: Selecting Sheep*

Sheep are different from swine in that they produce two primary products, meat and wool, although meat is the most valuable product. Some breeds have been bred specifically for one of these two products, while others are considered to be dual purpose breeds. In any case, the selection criteria for sheep includes the same elements as for swine: adequate breeding performance and conformation as well as producing a desirable end product such as a carcass or wool.

### Selecting Sheep for Breeding

When selecting sheep for breeding, farm managers usually look for traits that need to be improved within their meat producing or wool producing flock. Although differences exist in the selection criteria for meat- producing animals and fleece-producing animals, a farm manager should base his or her selection on conformation, size and scale, sex character, reproductive efficiency, growth, fleece characteristics, and performance data.

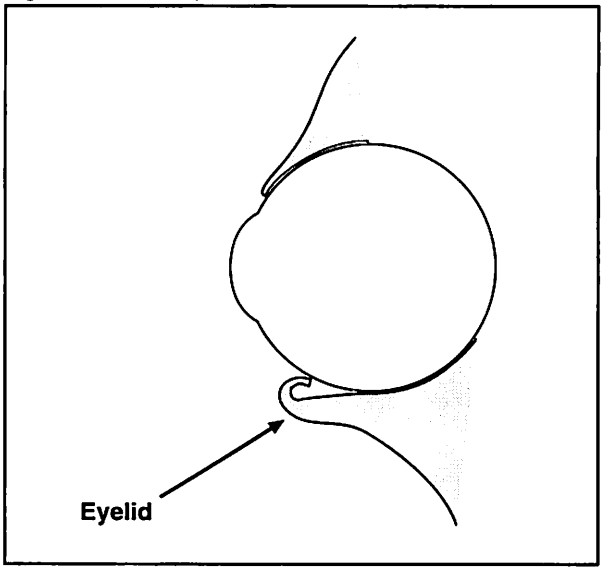
#### *Conformation*

Evaluating conformation involves looking at body capacity, fat, muscling, and structural correctness. A sheep that has good capacity has wide, deep ribs. The animal stands wide, with legs set at each corner of the body. The chest is deep and allows plenty of room for proper development of the lungs and heart. In selection, a common error is to mistake excess fat for good capacity in sheep. When visually evaluating sheep, handling the animals to check for fat deposits is important. A thick breast, middle, flank, or twist or fullness behind the shoulders or heart girth are indicators of excess fat. The top of the animal should also be muscular and lean, not square and boxy, which indicates excess fat deposits. Handling the animals is especially important in sheep selection because many muscling traits can be hidden underneath wool. Ideally, a lamb should have very little fat and heavy muscling. The majority of its weight should be located in its legs and loin, because they are the highest priced cuts. Heavy muscling in the rump and loin is also desirable.

Structural correctness is important for the animal's overall health and productivity. A sheep that is structurally correct has a long and smooth shoulder. Its rump is balanced, and the animal stands squarely on all four legs. The feet and legs should be strong with a good amount of space between them. Weight should be evenly distributed on all four feet. The pasterns should be relatively straight. A sheep should be able to walk gracefully with long strides, enabling it to thrive in the changing conditions of the range. Sheep that have problems with its front legs, such as being buck-kneed, pigeon-toed, or calf-kneed or having weak pasterns or splayed feet, should be avoided. Incorrect skeletal structure in the hind legs includes being post-legged or sickle-hocked and having weak pasterns. When evaluating a sheep from the rear, the animal should not be cow-hocked or bowlegged or exhibit any other type of unsound leg structure.

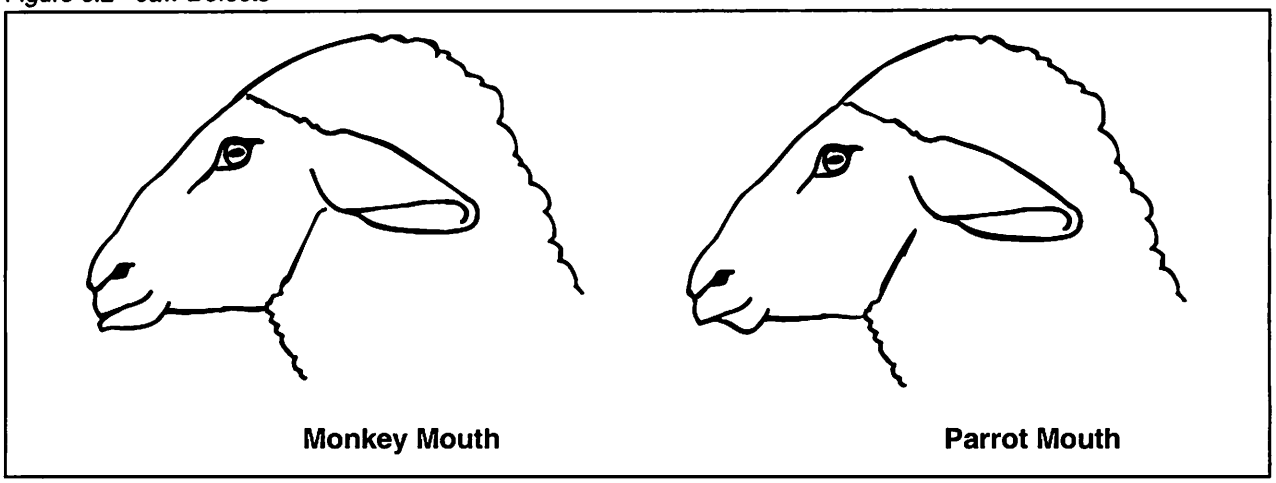
Sheep should have a head and neck that are well-formed. Ideally, a sheep should have a long neck and a wide forehead. The space between the eyes should be relatively wide, and the eyes should be free of defects. Sheep with eye problems like entropion, or inverted, eyelids (as shown in Figure 6.1), or ectropion eyelids, which refers to loose, saggy eyelids, should be avoided. The face should be open rather than wooly. Wool should not grow right around the eyes, which can be a problem with wool breeds.

*Figure 6.1 - Entropion*




A sheep's mouth must be sound for it to forage in the pasture. Jaws should meet and be correctly centered, with the teeth in the lower jaw meeting the dental pad in the upper jaw. Defects like

*Figure 6.2 - Jaw Defects*




parrot mouth, which is a short lower jaw that causes the upper dental pad to protrude, or monkey mouth, an undershot jaw causing the lower teeth to protrude, should be avoided; both of these problems are illustrated in Figure 6.2. A scratched mouth is another undesirable jaw defect. With this problem, the position of the jaws is correct, but the teeth miss the dental pad. Jaw defects are highly heritable and make it difficult for the animal to forage for food, which can result in nutrition problems and stress.

### *Size and Scale*

Producers often select large-framed rams to breed with medium-sized ewes. This system is more economical as the animals will usually produce lambs of a desirable size, yet the producer can avoid having to feed many large-framed ewes in the herd. Standards for size and scale are different for each breed of sheep. For purebred varieties, rams are usually long bodied, long legged, and late maturing. Purebred breeders keep these selection criteria in mind when choosing the best animal available.

### *Sex Character*

Ewes should look feminine. They should be more refined and have sleek and graceful lines in the neck and head. The udders and teats should be sound. In spite of the economic advantages of using medium-sized ewes for breeding, large-framed ewes do tend to have less complications during parturition. They also have better milking ability, are more hearty, and produce heavier fleeces. Finally, purebred ewes should clearly demonstrate the traits unique to that breed.

Rams should appear masculine and more rugged than ewes. The neck and face should be broader and stronger. Rams should also show superiority in growth and muscle development. They should have proper testicular development and adequate scrotal circumference, a highly heritable trait. As with cattle, scrotal circumference measurement standards vary between the different breeds. In general, a ram at puberty (5 to 7 months of age) should have a scrotal circumference of at least 12 to 13 inches. When selecting rams, animals that have a higher than average scrotal circumference measurement at puberty should be chosen.

### *Reproductive Efficiency*

Reproductive efficiency is an important trait to consider when selecting sheep. Although the heritability of multiple births in sheep is relatively low, producers customarily select replacement animals from a set of triplets or twins, because improvement of reproductive efficiency is possible. Also, ewe lambs that reach puberty in the first year tend to be more fertile and usually have higher lamb production throughout their lives. The mothering ability of the ewe can be evaluated by looking at the weaning weight of lambs at 60 days of age, which is the best indicator of the milking ability of the dam.

### *Growth*

Growth rates indicate how quickly an animal will gain for production purposes. Birth, weaning, and yearling weights can all be used to estimate growth rate. Birth weight is an excellent clue to future growth rates of a lamb. In general, the heavier the birth weight, the more rapidly the lamb

will grow. However, with heavier lambs, a higher risk of lambing complications exists, so a lamb that is too heavy is not necessarily desirable. Desirable birth weights vary with different breeds as well as the type of birth, either single or multiple.

Common times to wean a lamb are at 60, 90, or 120 days. The weaning weight at any of these three ages is an excellent clue to the future growth potential of a ewe lamb. If weaning at the age of 60 days, weaning weights should not be used to select ram lambs, because they will not have expressed their potential growth at this age. Weaning lambs at 90 days is most common in the industry. Weaning at this age allows for selection of both genders.

*Fleece Characteristics*

The fleece is a secondary product of mutton breeds and the primary product of wool breeds. Ideally, the fleece should be tight, dense, and long. The fleece grade indicates the fiber's diameter, which should be uniform throughout the entire fleece. Selection of wool breeds is based on an evaluation of the uniformity, length, and fineness or diameter of the fiber. Wool quality and amount of fiber produced differ greatly between different breeds. In general, a wool breed sheep should produce about 12 pounds annually, while a meat breed animal should produce about 6 to 8 pounds per year.

*Performance Data*

The National Uniform Sheep Selection Program has developed a ewe index that aids in evaluating a ewe's reproductive efficiency, milking ability, and wool production. This index is only intended for use of comparing ewes from the same flock. The values for the ewe index are calculated and then a ratio comparing an individual ewe's index to the average flock index is used to decide which animals produce poorly in comparison with the rest of the flock. Such information helps determine which animals to cull from the flock.

The National Extension Sheep Committee has developed a lamb index for the purposes of making comparisons within a flock. Emphasis is placed on multiple births, growth rate, and wool production. By incorporating the lamb index along with adjusted weaning weight into selection criteria for replacements, overall accuracy is improved.

The National Sheep Improvement Program (NSIP) is a program that provides estimates of the genetic potential or value of breeding sheep. Presently, NSIP provides two programs, one for purebred flocks and one for commercial flocks. Producers receive information on the genetic value of their sheep based on pedigree information and data from their performance records. Information provided by NSIP includes values for fleece, growth, and reproductive traits in the form of a Flock Estimated Progeny Difference (FEPD).

FEPDs provide an estimate of the genetic value of every ewe, ram, or lamb in a flock for the traits selected by the producer. Unlike beef cattle EPDs, which compare animals within an entire certified breed, an FEPD can only be used to compare animals within the same flock. It is expected that as the database grows, NSIP will eventually be capable of providing comparisons between flocks.

Like EPDs, FEPDs involve the comparison of the performance of the offspring of an individual with the performance of the offspring of an average animal, which has an FEPD of zero. Positive FEPD values indicate above average performance, while negative values are a sign of below average performance. The values assigned are based on the performance of the individual animal and all its relatives. Traits that are measured in FEPDs include number of lambs born, total litter weight at 60 days of age, and individual weights at various ages. NSIP also provides values for wool producers. Traits evaluated are clean or grease fleece weight, staple (wool fiber) length, and fiber diameter.

**Selecting Sheep for Production**

Lambs may be finished in a feedlot or on good pasture before being marketed. When selecting sheep for meat production, farm managers base selection on the health, conformation, weight, and sex of the lamb.

Health - Before feeder lambs are selected, they should be examined carefully to make sure that they are healthy. Lambs should be alert. They should have no obvious signs of illness, such as coughing, weakness, or dull wool. They should also be free of signs of parasites.

Conformation - When selecting feeder lambs, lean animals with proper skeletal structure are preferred. The lambs should not have any

problems with their jaws or legs and feet, because these problems slow down growth and development. Ideally, a lamb is heavily muscled and is neither too fat nor too thin; lambs that are too thin may not produce satisfactorily. The majority of its weight should be held in the leg and loin area, which are the highest priced cuts. The lamb should be well muscled in the rump and loin, which should be deep and wide. The chest should be wide to allow adequate muscling to develop. The ribs should be wide and the forearms thick and smooth. The top should be muscular and lean, not square and boxy, a sign of excess fat.

Weight - In the sheep industry, three weight standards describe feeder lambs: light weights (60 to 75 pounds), medium weights (75 to 85 pounds), and heavy weights (85+ pounds). Feeder lambs are sold for finishing when they weigh between 65 and 90 pounds at 5 to 8 months of age. After being fed for 60 to 90 days, they are marketed at 100 to 140 pounds. Producers want to buy feeder lambs that have a higher weight because production will likely be more efficient as long as the weight is from muscle and not excess fat.

Sex - In general, wethers, or castrated rams, are preferred by farm managers because they tend to gain faster and yield a carcass with higher cutability than ewe lambs. Ram lambs have an even faster rate of gain and demonstrate carcass traits superior to wethers, but they are commonly docked in price at lamb markets. Although ram lambs may require more management, achieving better financial returns than with wethers and ewe lambs is possible. Returns are dependent on the marketing of the ram lamb. If the producer can market the meat so that it will not be discounted in price, an operation raising ram lambs can be successful and economically efficient.

**Records**

If they are available, health records can be used as an aid in selection for both breeding and production. Medical records should describe vaccinations, treatments for parasites, and veterinary care for health problems.

Breeding and production records are important when selecting animals for breeding. A producer should be sure to keep information for each animal. The data on an individual animal that may be needed for selection purposes includes its birth weight, the type of birth, its weaning weight, and its yearling weight. Other records necessary to indicate the reproductive efficiency of a ewe are the number of lambs born, number weaned, and lambing difficulties. Wool production records for fleece weight and staple length may also be valuable.

**Summary**

When evaluating sheep for breeding, the basis of selection include conformation, size and scale, sex character, reproductive efficiency, growth, performance data, and breed and fleece characteristics for wool production. Feeder lambs are selected according to the health, conformation, weight, and sex of the animal. Accurate health, breeding, and production records can help determine which animals should be selected.

**Credits**

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## *Lesson 7: Selecting Horses*

Horses are available for a variety of uses because horses have been selected and bred for different tasks in the past. Five different general uses of horses exist: pleasure, breeding, show, sport, and work. A horse used for one of these tasks will not necessarily be successful at performing the others. Therefore, the first step in selecting a quality horse is to specify the intended use of the animal. Its use will play a major role in determining what animal will be chosen. For example, a horse from a draft breed would not be used for racing, but it would be useful for pulling a heavy wagon.

### Selecting Horses for Performance

Once the use of the horse has been determined, the best possible animal for that use must be selected. The selection of horses for performance is generally based on temperament, conformation, size, health, and age.

*Temperament*

Because horses often have to work closely with other animals and with humans, a good temperament is very desirable. A bad disposition outweighs all other factors, even if a horse excels in the other selection criteria. A horse with a good temperament is cooperative and passive; it shows a desire to get a job done. Such an animal can be a pleasure to work with and can become a companion. A horse with a bad temper is mean, moody, stubborn, and aggressive. Bad-tempered animals make getting a job done much more stressful and time-consuming. Also, a bad-tempered horse is dangerous to humans and other livestock.

A horse expresses its temperament through body language. A passive and cooperative horse points its ears forward. It is calm and receptive to training and handling. If a horse has a bad disposition, it lays its ears back, has wide eyes, and throws its head back. Such a horse is liable to kick or bite and is a hazard to others.

The sex of an animal can affect temperament. Stallions tend to be more difficult to handle than geldings or mares. Mares have a less feisty disposition than stallions but are prone to sporadic mood changes due to hormone fluctuations. In general, geldings show more calm behavior.

*Conformation*

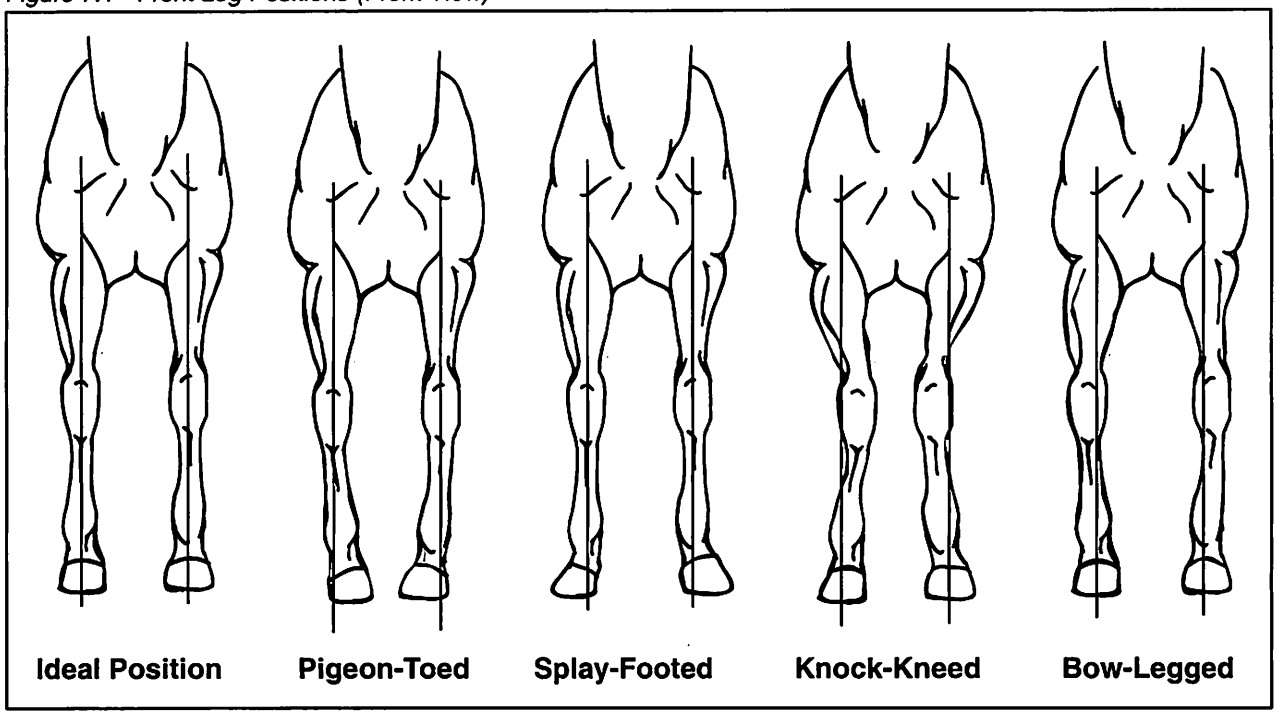
When evaluating the conformation of a horse, two terms, blemish and unsoundness, describe undesirable traits. A blemish refers to any abnormality that has no effect on performance. For example, a blemish may be a scar left over from a saddle sore, which may detract from the beauty of the animal but not from its performance. Unsoundness refers to an abnormality that affects the horse's performance. Unsoundness may be inherited, such as poor leg structure. Improper management can also result in unsoundness, such as an injury or nutritional deficiency that has led to improper bone structure.

When selecting a horse, evaluating the entire body is important. The chest of a horse should not be too wide or too narrow, which will affect the placement of its legs. Body capacity in the chest should be adequate for proper development of the heart, lungs, and digestive system, especially given the longevity of horses. Ribs should be well sprung and long. The ribs of a horse should not be visible; however, they should be easily felt during handling. The back should be short and straight with enough muscle to support a rider. A horse should be well muscled, especially in the hindquarters, to power movement.

A sound head and neck are important to the balance, stability, and agility of a horse. The neck should be long, lean, and smooth with well-developed muscles. It should have a graceful, arch-like form. The point where the neck meets the shoulder should be prominent. The head should be refined and proportional to the rest of the body and must be held high. The shape of the head should resemble a long triangle when viewed from the front. The lips and teeth should meet evenly; the teeth should not be overshot or undershot. The nostrils should be large. If they are too small, the horse will have trouble breathing when it is engaged in heavy exercise. The horse's eyes should be prominent. Horses with sight problems, such as blindness or moon blindness (occasional blindness), should not be selected. These horses are easily spooked and temperamental and perform poorly. A sign of sight problems is cocking the head in one direction, indicating a problem in one eye. The ears should be small and active.

A horse's shoulders affect the way the animal moves. The shoulders should have depth and be

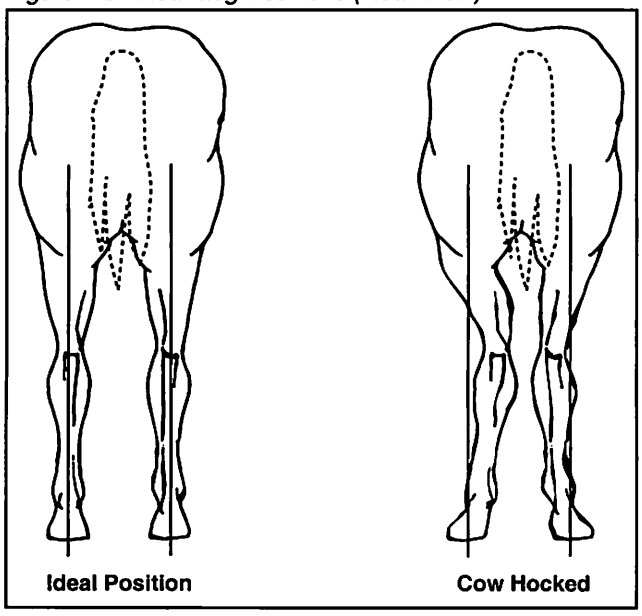
*Figure 7.1 - Front Leg Positions (Front View)*




set at a long, downward-sloping angle toward the front feet. This angle facilitates strides and absorbs shock from everyday movement and exercise. If the shoulders are not set correctly, the animal will have a shorter stride and display less shock absorption, making the horse difficult and uncomfortable to ride.

The feet and legs of a horse are very important because they affect the way the horse moves, and a horse's usefulness depends on how well it moves. To evaluate the legs and feet from a front or rear view, imagine that parallel lines have been drawn from the points of the shoulder or buttocks to the ground. The line should divide the front leg and the hind leg from the hock down evenly. When viewing the feet and leg structure of a horse from the front, the horse should have straight front legs and feet from the forearm to the hoof. Animals should not be splay-footed, pigeon-toed, bowlegged, or knock-kneed. Figure 7.1 shows proper and improper leg position. Horses that stand with the front legs too far apart or too close together should not be chosen. The width and narrowness of the base of the horse should also be considered while evaluating the hind legs from a rear view. The horse should be examined for other unsound leg structures from the rear, such as being bowlegged or cow-hocked (Figure 7.2).

*Figure 7.2 - Rear Leg Positions (Rear View)*




A horse's legs should also be evaluated from the side. From the side, a line drawn from the point of the shoulder should pass through the elbow and the center of the foot; the line for the rear legs should begin at the point of the buttocks and parallel the cannon. Front legs should not be camped out or under, calf-kneed, or buck-kneed, as shown in Figure 7.3. The rear legs should not be camped out or under, post-legged, or sickle-hocked (Figure 7.4). The hind feet should toe-out

*Figure 7.3 - Front Leg Positions (Side View)*

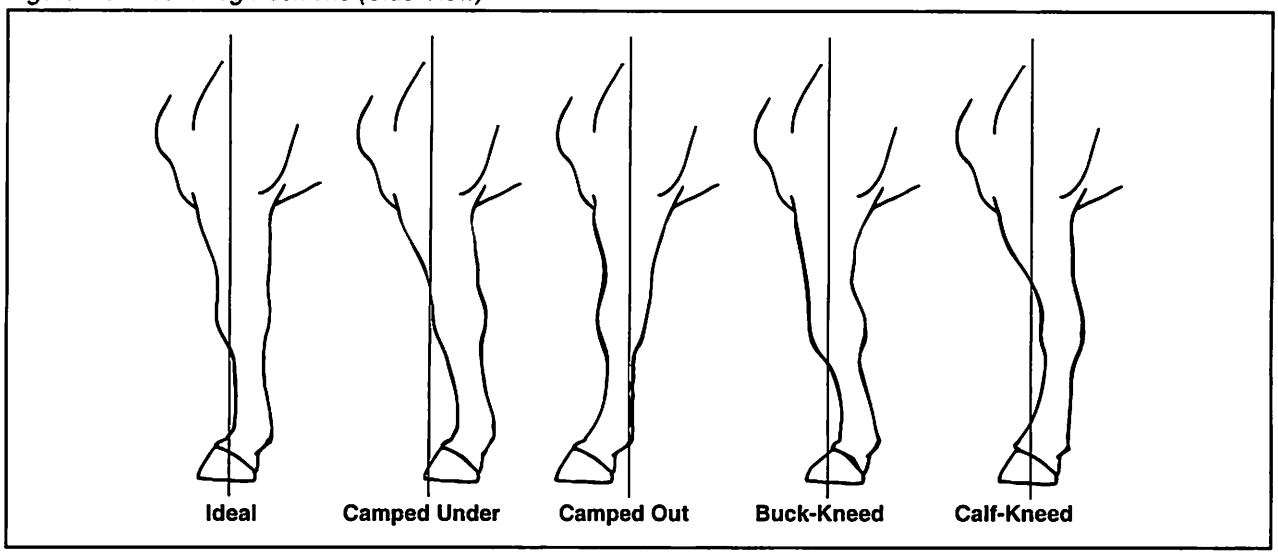
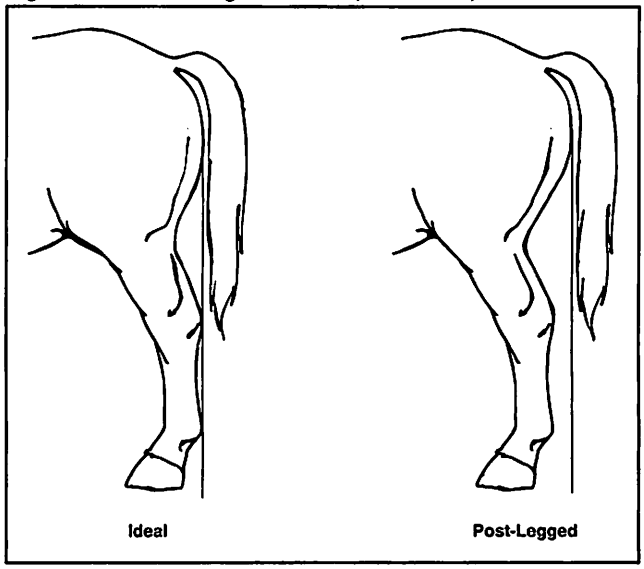


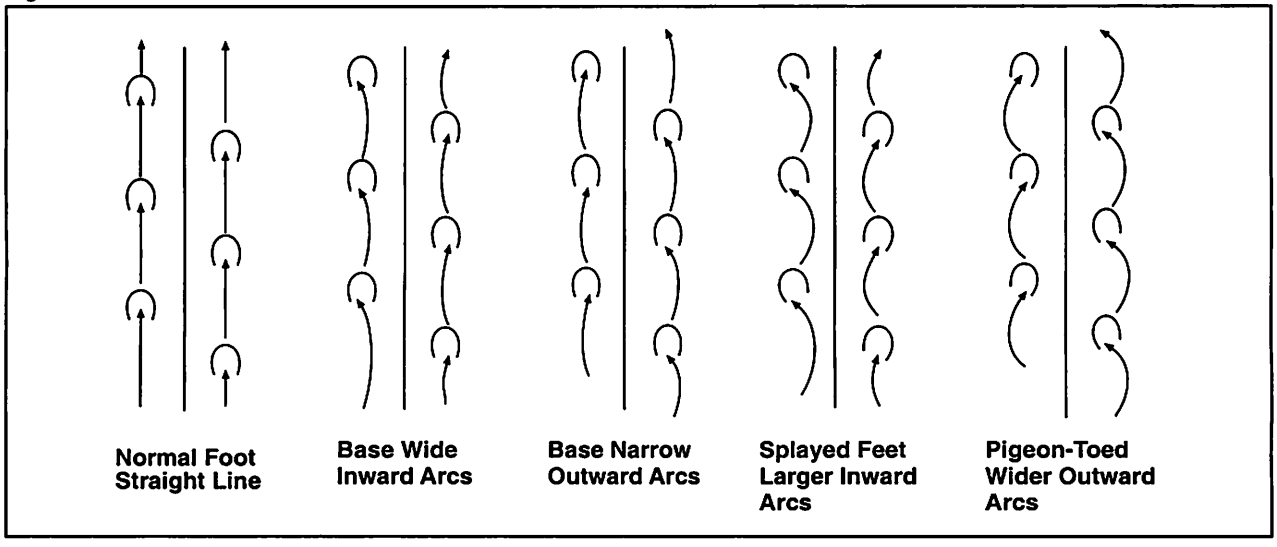

*Figure 7.4 - Rear Leg Positions (Side View)*




slightly. The pastern and the hoof of the front leg should form a 45-degree angle with the ground, while the rear leg should have a 50-degree angle. The heel should not be too high or too low.

A horse should have a proper gait, or leg action. Horses should ideally walk with their legs moving only in a forward motion, but such a perfect gait is rare. Figure 7.5 shows the ideal gait and abnormalities that cause the horse's feet to move inward or outward. Above all, a horse must move safely. For example, if the feet tend to wing inward and interfere, striking the cannon or fetlock of the other foot, the animal may trip itself. The opposite movement, winging outward, referred to as paddling, is much safer.

*Figure 7.5 - Gaits*



*Size*

A horse should be big enough to perform the tasks it is expected to do, including the task of carrying a rider. The prospective rider must choose a horse that is big enough to carry him or her comfortably. In general, the bigger the horse, the more expensive it will be.

*Health*

A sound horse can provide optimum performance for years, but only if it is healthy. A healthy horse is alert, shows a good appetite, and has a shiny, smooth coat. Symptoms of health problems include a dull, rough coat, listlessness, or a bloated belly. The buyer should request to see all veterinary records, including deworming schedules and vaccinations. He or she may want a veterinarian to perform a pre-purchase health evaluation to ensure that the animal is healthy.

*Age*

Horses are in their prime between of five and eight years of age. Horses in their prime are mentally mature, physically mature, experienced, and usually trained. They generally cost more, but require less investment in time and training. In general, the more experienced an animal is, the more expensive it will be. Young foals therefore usually have a lower cost. However, a greater risk of unsoundness and injury exists when purchasing foals, and they also require an investment in training. Older horses can be less expensive and are generally good for training novice riders. The age of a horse can be estimated by looking at its teeth.

## Selecting Horses for Breeding

A herd manager should always be aware of undesirable traits in the horse herd or in individual horses within the herd. Horses should be selected to improve on these traits. Breeding genetically superior animals will provide the best results. A well-trained horse will not pass on its training to its offspring. A common mistake is breeding animals because they are well-liked instead of for their genetic superiority. Breeding horses are selected according to their conformation, temperament, reproductive soundness, performance data, and pedigree.

Conformation - The conformation of a breeding animal should be the same as that described for performance in the preceding section. An unsound horse should never be used for breeding regardless of how desirable some of its qualities may be. Using a stallion that is only average in the desired trait is better than using one that excels in that trait but is unsound. Following this guideline will prevent other undesirable traits from being passed on to the horse's progeny, reducing the progress made through selection.

Temperament - Horses used for breeding should have a good disposition. A horse with a bad temper is dangerous to his or her mate and could harm very expensive, genetically superior sires or dams.

Reproductive soundness - Mares and stallions selected for breeding should be fertile. Stallions should appear masculine and have fully developed testicles. To ensure fertility, breeders tend to perform fertility tests on stallions twice, once before mating and again afterwards. Mares should appear feminine. Having a veterinarian perform a breeding soundness examination on mares before the breeding season begins is advisable. If the horse is twelve years old or older, an examination is imperative.

Performance data - All breed associations in the United States provide breeding and production records for registered stallions and mares. These records can be used to select animals based on their past breeding performance and the merit shown by their offspring. Show and race horses usually also have performance records that indicate their merit in those areas.

Pedigree - Pedigree information is most important for horses that will be used for show or racing. Pedigrees are most useful when an animal is young and untrained, because its individual worth is more difficult to determine at that stage. When selecting animals that are very similar, a good pedigree may be a deciding factor in choosing between them.

## Records

A number of records can be useful for the purposes of selection. Breeding and production records are helpful when selecting horses for breeding. Records kept for mares should include the birth date, the number of times she has been

bred, the number of times she has been settled, the number of live foals she has produced, and the performance records of her foals. Breeding and production records kept for stallions should include the name, breed, registration number, owner's name, and date of service for each mare bred; number of mares bred; number of mares settled; number of live foals produced; and performance records for the foals. Health records detailing deworming schedules and vaccinations should also be kept for selection of horses for both performance and breeding.

## Summary

When selecting a horse, specifying the expected task of the animal is important. Tasks may include breeding, sport, show, work, or pleasure, and horses are selected based on conformation for the expected task. Selecting a horse with a bad disposition is a bad idea, no matter what the animal will be used for. An unruly horse can harm humans and other livestock; they also require much more time and management. Other factors to consider when selecting a horse are size, health, and age. Reproductive soundness is a consideration when selecting horses for breeding. Breeding, production, and performance records and pedigree information can help evaluate a horse's suitability for breeding, so keeping good records is a necessity. Health records are useful when selecting a horse for either performance or breeding.

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## *Lesson 8: Selecting Poultry*

Selecting poultry involves some of the same factors involved in selecting other species. Both conformation and performance data may be used in selecting birds for various purposes. This lesson focuses on the factors affecting the selection of chickens and turkeys.

### Selecting Poultry for Breeding

Unlike producers of other species of livestock, producers of eggs and broilers do not breed their own animals. Instead, they rely on commercial breeders to select poultry for breeding and develop genetically superior birds.

#### *Layer Hens and Roosters*

Hens and roosters should be chosen carefully for breeding to produce offspring that will be productive laying hens. Selection of layer hens and roosters for breeding is based on conformation, health and vigor, pedigree, and performance data.

Conformation - A layer hen should be small-bodied in comparison to broiler chickens to consume less feed while producing a large number of eggs. However, the hen must have the proper body capacity for production. The body should be rectangular in shape. The heart girth should be deep and broad. The back should be wide, long, and flat. The keel bone should be long. A strong head with a relatively long, flat skull is ideal. The face should be smooth and clean. Feet and toes should be broad, strong, and straight with no abnormalities. The skin should be elastic and soft, and the feathers should be smooth and well-kept.

In general, the criteria for selecting genetically superior males for breeding layer hens is the same as that for layer hens with only a few differences. Males should have sturdy and straight legs. The breast bone should be straight and the plumage should be well kept. A sound male breeder should have good body capacity and posture. The back should be wide and straight with the tail feathers held higher than the back.

Health and vigor - Layer hens and roosters should be healthy and vigorous. They must have adequate stamina to produce eggs. Signs of an unhealthy bird are listless behavior and a coarsely textured or discolored comb. Vent feathers may be damp and dirty, and plumage may be unkempt. A healthy bird is alert, active, and vocal. It has bright round eyes and a smooth, waxy, and bright red comb. It has dry and well-groomed feathers.

Pedigree - The pedigree of the hen or rooster reveals the productivity of its ancestors. The information on a pedigree may be especially helpful if performance data is not available. Also, it can be the determining factor when selecting between two birds that are otherwise similar. In evaluating the pedigree of a bird, the data for the more recent ancestors should outweigh that of more distant relatives.

Performance data - One way to evaluate performance involves looking at the performance of the bird and its sisters and brothers. Many producers tend to select families of birds for breeding purposes. Keeping a valuable family bloodline for breeding is more efficient because the producer does not have to go through the process of individually selecting each bird. When measuring the performance of an individual bird and its siblings, accurate records of production are needed. These records should demonstrate desirable laying and egg characteristics.

Progeny testing is also used to evaluate performance. This testing, which measures the actual performance of the offspring, is a long and expensive process but worthwhile as it is an excellent method of determining superior breeding stock. Accurate record keeping is crucial to the validity of progeny testing.

#### *Broiler Breeders*

The selection criteria used for broiler breeders includes conformation, body weight, and health and vigor. Performance data is also used to determine the genetic superiority of the breeding flock.

Conformation - The bird's conformation should be a smooth and graceful combination of a crescent-shaped back, broad breast, and upright head. Legs should be strong and straight. Poor conformation of a broiler is indicated by a wedge-shaped body, crooked breast, or crooked back.

A bird with good conformation does not have excess fat, although a healthy layer of subcutaneous fat is desirable. A bird with too little

fat has thin skin over the abdominal area, at the point where the skin over the thigh is connected to the breast, and under areas with heavy feathering. Measuring the amount of fat on a broiler involves gently pinching the skin of the abdomen. If it is hard, adequate fat is deposited; if it is soft, the bird does not have enough fat.

The amount of fleshing, or the commercially important muscles that make up the shape of the bird, is important to the quality of the bird. Broilers should have thick breasts that are rounded in shape and wide through the keel bone. The back and legs should be strong and meaty. Signs of poor fleshing include a breast with pointy triangular shape or a thin back and legs.

A quality broiler has close-fitting, well-groomed feathers. It should not have bare spots that leave the skin vulnerable to picking and sunburns. Also, broilers should not have too many pinfeathers. These feathers are difficult to remove during processing.

Body weight - Body weight is an important factor in selecting broiler breeders. Body weight of offspring is closely related to the weight of the broiler's parents at seven weeks of age. Birds should be evaluated at seven weeks, and only larger birds should be selected for breeding.

Health and vigor - Only healthy birds should be used for breeding broilers. Unhealthy birds are not likely to produce sound offspring.

Performance data - An important performance measure for the selection of broiler breeders is growth rate. Rapid growth reduces the amount of time to market and produces savings in feed consumption. Broiler breeding stock should therefore display good growth rate.

*Turkey Breeding Stock*

Selection of breeding turkeys is very similar to selection of broiler breeder stock, focusing on conformation, body weight, health and vigor, and performance data. Conformation is even more important in turkey breeding stock than in broilers because turkey carcasses may be marketed whole and because birds are marketed at higher weights.

## Selection of Poultry for Production

*Layers*

Often pullets used for replacement layers will be supplied to a producer as part of a contract with an integrated operation. If producers select their own pullets, they should be obtained from a reputable hatchery. Commercial pullets should be well-developed physically and ready to begin producing eggs around 22 weeks of age. As described in the preceding section, layers should have good body capacity with a wide, long body and long keel bone. Feet and toes should be broad, strong, and straight with no abnormalities. The sexual maturity of a pullet is determined by observing the head and comb. The head should be well-developed, and the comb should be large, firm, and bright red.

Some producers keep layers for a longer time, allowing them to stop producing eggs for a period while they shed and renew their feathers. At this time, some hens may be culled while others are kept for further production. Factors to consider when selecting layer hens include conformation and pigmentation. Production records showing the rate of lay, or the number of eggs produced in a given period, should also be analyzed; hens should lay at least 220 eggs per year.

Conformation - Certain characteristics of the hen's body indicate high egg production. The abdomen of a productive layer hen is large, pliable, and soft. The pubic bones should be flexible and spread apart. An adequate width is about three fingers width apart.

Pigmentation - As a hen puts energy into laying eggs, she loses pigmentation in specific body parts. By observing the pigmentation patterns of a hen, a producer can determine if she is producing well or not. A productive hen has bleached pigmentation on her beak, eye rings, earlobes, and shanks; a non-productive hen has yellow pigmentation. A healthy productive hen also normally has a bleached vent that is smooth, elastic, and moist. A yellow vent that is small and dehydrated is a strong indication that the hen is not productive.

*Broiler Chicks*

In the poultry industry, broiler producers operating under a contract do not select individual birds themselves. The chicks are supplied by large

commercial hatcheries that are often part of the integrated poultry operation. They are responsible for breeding and supplying high-quality chicks for production. A thrifty, meaty, disease-free bird is ideal.

Breeders provide producers with either straight-run chicks or sexed chicks. Straight-run chicks are random in gender, while sexed chicks are divided according to gender. Raising sexed birds has some benefits. Female chicks sell for a better price when they are marketed. They tend to produce a more rounded carcass with more flesh in the breast, back, thighs, and legs.

### *Turkey Poults*

As with the selection of broiler chicks, breeding companies are responsible for supplying high quality, genetically superior turkey poults to producers. Thus, producers should only accept poults from reputable hatcheries. The companies provide straight-run or sexed poults.

### Records

Certain records are useful when selecting birds for breeding. Information about laying and egg characteristics is useful when selecting layers for breeding, while growth rate, amount fed, and mortality records can help in the selection of broiler breeders. If layer hens are to be kept for further egg production after molting, egg production records can indicate which birds may be selected or culled.

## Summary

In the poultry industry, birds used for breeding are evaluated by looking at some of the same factors as is the case with other types of livestock, including conformation, health and vigor, and performance data, although the breeding is carried out by commercial breeders rather than by individual producers. Selecting animals for production is generally not the responsibility of the producer, who obtains the birds from a hatchery.

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## *Lesson 1: Breeding Systems*

After farm managers have selected quality animals to use for breeding, they must choose a breeding system that suits their needs and facilities. Each of the breeding systems has advantages and disadvantages. Also, some systems require different types of resources to be used efficiently and profitably.

### Breeding Systems

A breeding system is a system that determines the offspring's breed and its relationship to its parents and other offspring. Choosing a breeding system can maximize offspring crop and genetic superiority or result in inferior offspring, depending on whether the best option is selected. The selection of a breeding system is an important decision. Two basic systems of breeding, straightbreeding and crossbreeding, are used.

#### *Straightbreeding*

Straightbreeding involves mating animals of the same breed. This type of breeding is often utilized to produce purebred animals for commercial producers, who use them to improve their stock. Some methods of straightbreeding include purebred breeding, inbreeding, outcrossing, and grading up.

Purebred breeding - Purebred breeding is the mating of purebred animals of the same breed. Such animals are recognized by a breed association and have a pedigree proving their ancestry. Through records, the genetic history of the animal can be traced all the way back to the animals originally accepted by the breed association. The term purebred can be misleading. Purebred animals are not necessarily superior, although they tend to be better than grade animals, or animals not eligible for registry.

Purebred breeding is a business. Its main purpose is to raise foundation stock for other breeding systems, primarily crossbreeding systems that produce market animals. Many breeders also enjoy raising purebred animals for show. Financial returns can be varied in this specialized business; success depends on the species and breed being produced. This type of mating system requires a larger investment, as purebred breeding animals are more expensive than unregistered stock. However, a demand for purebred animals exists for quality animals.

Inbreeding - Inbreeding involves mating animals that are closely related to each other, more closely related than the average of the population. They must have related ancestry within the last four or five generations. This system is often used in purebred breeding systems, more so than on commercial farms. Inbreeding works to improve the genetic purity, or homozygosity, of purebred animals. After several years of mating animals that possess the same genes, the resulting offspring have increased purity for these genes. The purpose of inbreeding is to form families or groups of genetically superior animals, produce breeding stock, and develop lines for crossbreeding systems. This system has resulted in a number of excellent herds.

Two general types of inbreeding systems exist: intensive inbreeding and linebreeding. Intensive inbreeding, also called closebreeding, involves mating animals that are very closely related and whose ancestors have been inbred for a number of generations. The animals share more than one ancestor. Mating sire to daughter, son to dam, or brother to sister are all examples of intensive inbreeding. Linebreeding is mating animals that are somehow related to each other but never closer than half-brother or half-sister. Other examples of linebreeding include the mating of cousins and grandparent to grandchild. The mating of these animals is used to maintain a close genetic relationship to an outstanding ancestor.

### Advantages and Disadvantages

Using inbreeding in a breeding program has some benefits, but it also can create problems. The main advantage of inbreeding is that it increases genetic uniformity, improving the efficiency of selection by concentrating genetic material of superior animals that can pass on these traits. A disadvantage of inbreeding is that it causes decreases in vigor, fertility, survival rate, and growth rate. Also, the expression of undesirable genes occurs at a greater rate because all the traits are grouped together at a high frequency. Both improvement and regression are less intense in linebreeding than in intensive inbreeding. As undesirable genes become more obvious, culling any animals that have undesirable traits is necessary, but it is also expensive. The great expense limits the use of inbreeding systems. The

average animal breeder does not commonly use this system. Instead, universities and large breeders may use an inbreeding system as they experiment to improve the breed.

The key to a successful inbreeding program is proper care, management, and selection. Proper care and management are important since inbreeding reduces fertility and vigor in animals. Selecting animals for the traits that will contribute directly to the improvement of the herd is vital.

Outcrossing - Outcrossing is another type of straightbreeding; it is the most widely used breeding system for most livestock species. In this system, breeders mate animals that are from the same breed but not closely related to introduce new traits into the herd or flock. To add a desired trait, outcrossing is sometimes implemented in breeding programs that primarily use inbreeding.

Outcrossing has both advantages and disadvantages. One advantage is that desirable traits can be introduced into the herd or flock. Another benefit of outcrossing is that the risk of maximizing undesirable traits is not as high as with inbreeding, which creates homozygous gene pairs. The effect is an increase in homozygosity over time, but as unrelated animals are bred, the gene pairs are mostly heterozygous. A disadvantage of outcrossing is that undesirable traits are still carried by the animals used for breeding, although they may not be expressed since they are disguised by the desirable traits.

Grading up - Grading up, or upgrading, involves mating purebred sires to grade females. Grade animals are relatively pure but do not meet all the requirements for registration with a breed association. The purpose of grading up is to improve quality, develop uniformity, and increase the performance of offspring. This system is best used for cattle and horses. Grading up is not very efficient with swine, sheep, and poultry because of the large number of purebred breeders raising these species, which decreases costs for purebred animals. Buying purebred stock is simply more efficient.

In grading up, improvement is dependent on generation interval and the quality of the sire. The shorter the interval between generations, the more rapid the genetic improvement. The purebred sire should be tested for production, and the results should be above the average of the commercial herd. If the results of production testing are lower than the herd averages, the herd would not grade "up" but rather grade "down."

The chief advantage of grading up is that it results in offspring that genetically resemble the purebred sire. The first crossing produces the most genetic improvement because half of the offspring's genes are from the sire. The second generation of offspring is 75 percent purebred, and the third is 87.5 percent. Noticeable improvement in the herd usually occurs by the fourth generation when the herd carries 94 percent of the characteristics of the purebred sire. After this point, improvement occurs much more slowly. Another advantage of grading up is that using grade females is cheaper than purchasing purebred females.

### *Crossbreeding*

Crossbreeding is mating animals from different breeds. Animals used for breeding should be selected for genetic superiority to improve the herd. The characteristics of the breeding animals should also be complementary. For example, many breeders choose to cross Angus cattle, which have a high carcass grade, with Charolais, for higher cutability traits. The traits are improved since the dominant genes tend to keep the recessive genes that are undesirable from being expressed. Crossbreeding is a good way to reduce weaknesses in a herd by crossing animals that show lower performance in one trait with those that perform strongly in that trait. Different types of crossbreeding include two-breed crossing, three-breed crossing, backcrossing, and rotational breeding.

Two-breed cross - The two-breed cross utilizes purebred sires to mate with high grade or purebred dams of another breed. An example of this type of cross is a "black baldie," which is the progeny of an Angus bull and a Hereford cow. This system has been reported to produce an average 8 to 10 percent increase in pounds of calf weaned per cow bred in cattle systems as well as a 2 to 3 percent increase in the rate of gain in the feedlot.

Like all crossbreeding systems, a two-breed cross has two major advantages over straightbreeding. One benefit is that crossbreeding systems result in increased vigor, heavier offspring, and increased fertility due to hybrid vigor. Another name for an animal produced by mixing breeds is a hybrid. Crossbreeding results in hybrid vigor, or heterosis. This phenomenon causes crossbred progeny to out-produce the average of the parents'

production. In a crossbreeding system, traits that are highly heritable show little improvement in hybrid vigor. However, those traits that have low heritability show a better response. The greater the genetic difference between the two breeds crossed, the greater the hybrid vigor. Another advantage of crossbreeding is that it results in animals that combine desirable traits not found in any one breed. Strengths of different breeds are therefore combined in one animal.

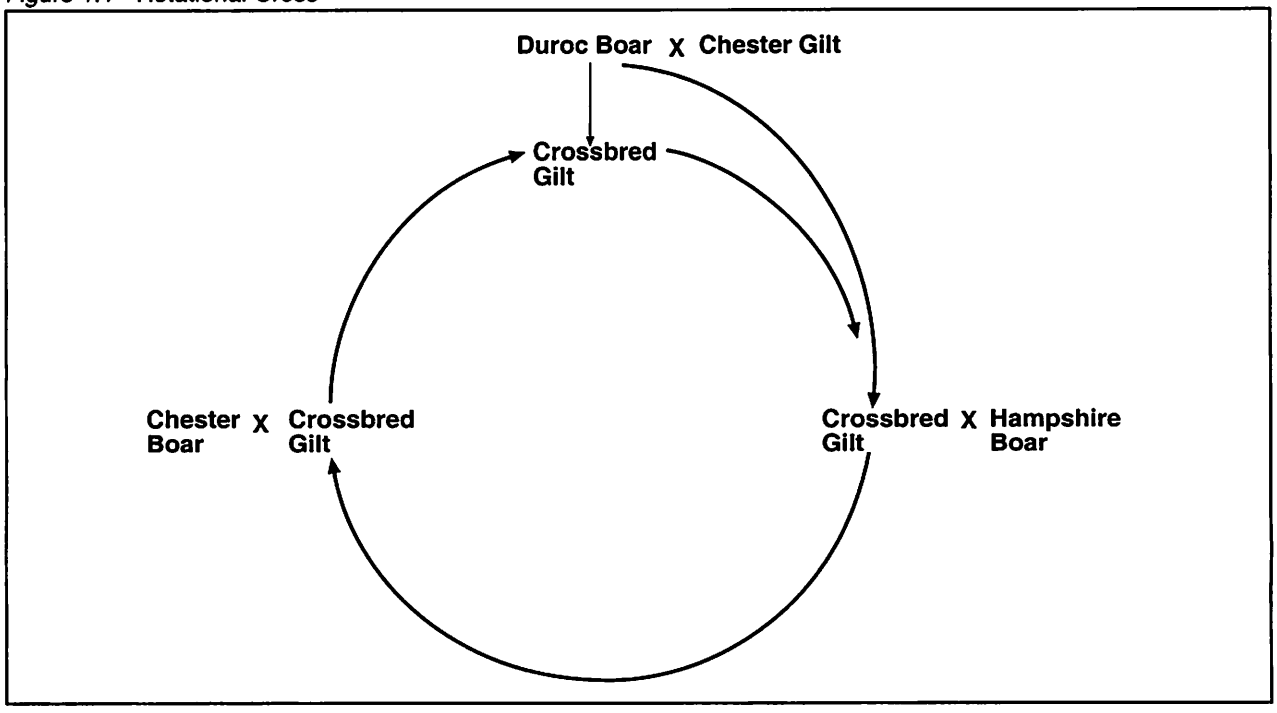
Two-breed crosses also have some disadvantages. One disadvantage of this system is that the sire and dam are purebred; therefore, the hybrid vigor is only present in the progeny. Another problem is that to continue breeding over time, the purebred or high-grade dams will need to be replaced, which becomes expensive. Other systems that use crossbred dams may be more efficient for breeders.

Three-breed cross - A three breed cross involves mating a crossbred female to a male of a different breed. For example, the black baldie described in the previous section could be mated to a Simmental bull to form a three-breed cross. The advantages of this system are improved hybrid vigor due to the use of a crossbred dam and the potential for the introduction of a greater diversity of desirable traits into one animal.

Backcrossing (crisscrossing) - The two-breed backcross or crisscross method of crossbreeding first involves mating sires of one breed with dams of another breed. Breeders then mate the crossbred females to males of the same breed as the sire or dam, alternating between them so that a female sired by a male from one breed will be mated to a male from the other breed. A maximum heterosis of 67 percent is attained with this type of crossbreeding. An advantage of this system is that crossbred females are utilized, improving hybrid vigor. Also, the animals combine desirable traits not found in any one breed. Other benefits are that this system is easily managed and produces its own replacement females.

Rotational breeding - A rotational cross involves using sires of different breeds for succeeding generations of females, ending with a male of the same breed as the female used in the first cross. This series is then repeated. A three-breed rotational cross is commonly used in swine breeding systems (Figure 1.1). It involves rotating the use of purebred sires of three different breeds for mating with crossbred dams. The crossbred females of each new generation are kept to breed with the next purebred sire in the series. The rotation is completed when all three of the purebred sires have been used. Advantages of rotational crossing include improved heterosis due to the use of crossbred females. As in all types of crossbreeding, the animals produced combine traits that are desirable for production not found in

*Figure 1.1 - Rotational Cross*



any one breed. Also, commercial producers can select their own replacements, so production-tested sires are the only outside purchase. A disadvantage of this system is that after the first few generations, breeders must either maintain sires or purchase semen from sires of all of the purebred breeds.

## Effect of Resources

Choosing a breeding system is a very important decision for livestock breeders. The decision is based upon the species being bred, as well as whether the system suits their needs and resources. The resources available to breeders make a marked difference in the choice of a breeding system. Some resources to consider when choosing a breeding system for any species of livestock include the size of the herd or flock, number of pastures, availability of feed, availability of breeding stock, and financial resources. All of these resources can be reasons to choose or avoid a particular breeding system. Also, the effects of the resources all interact to influence the choice of a breeding system. For example, in a three-breed rotational crossbreeding system for swine, eventually three genetically superior boars of differing breeds are required. However, not all swine operations have the financial resources or the space to work with three different breeds of boars. In another example, breeders that raise cattle may choose to grade up, if they can afford the costs associated with using a purebred sire to mate with the females. Whatever their situation, managers should make wise decisions based on the resources available and on profitability. They must plan well, realistically evaluating their resources and what can be done with them.

## Summary

Two main types of breeding systems exist: straightbreeding and crossbreeding. Methods of straightbreeding include purebred breeding, inbreeding, outcrossing, and grading up. Methods of crossbreeding include two-breed crossing, three-breed crossing, backcrossing, and rotational breeding. These breeding systems have advantages and disadvantages. In order for breeders to decide which breeding system is best for the herd or flock, they must carefully consider their resources. Resources that affect the choice of breeding system may include the size of the herd, number of pastures, availability of feed, availability of breeding stock, facilities, and environmental or climatic conditions. The manager must consider which breeding system is the most efficient use of available resources and will be the most profitable.

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## *Lesson 2: Mating Systems*

In addition to selecting a breeding system, livestock and poultry breeders must also decide which type of mating system would best suit the needs of their herd or flock. Two general types of mating systems, artificial insemination and natural mating, are used in commercial agriculture. Both general mating systems have advantages and disadvantages. Factors that may influence the choice of a mating system include the climate, location and type of market, size of the operation, personal preferences of the breeder, the economic and production goals of the breeder, and available resources such as financing, equipment, or labor.

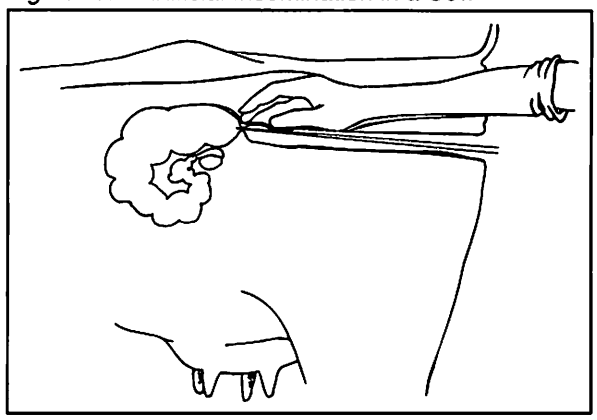
### Mating Systems

As its name suggests, artificial insemination (AI) is not a natural process. Instead, it involves collecting semen from the sire and placing it in the reproductive tract of the dam. The sire and dam never make physical contact. In fact, managers can avoid having a sire at the production facility if they choose to purchase semen from an outside source.

Artificial insemination can be used for cattle, swine, sheep, horses, and poultry (particularly turkeys), although the process differs depending on the species. First, the semen is collected with an artificial vagina, electro-ejaculator, or by hand. The semen is frozen and stored if it is not used right away; sometimes chemicals are added to increase the longevity of the sperm. When females are observed to be ready for mating (in mammals, when they are in estrus, or heat), the semen is thawed (if it was frozen) and placed into an inseminating instrument. A technician deposits the semen directly into the female's reproductive tract with a pipette, as shown in Figure 2.1.

Artificial insemination has many advantages for producers. AI increases uniformity, the genetic development of large numbers of animals that are part of a genetically superior family line. The more numerous the family line, the better the basis is for a constructive breeding program and the more efficient selection will be. Another advantage of insemination is that it increases the use of genetically superior sires, because the frozen semen can be shipped to breeders. AI works well with estrus synchronization programs in which animals are brought into heat at the same time.

*Figure 2.1 - Artificial Insemination in a Cow*



An added benefit is that AI makes it possible to prove the genetic superiority of sires by increasing the number of their offspring, thus making progeny testing more accurate. Using artificial insemination also eliminates the need to keep a sire on the premises. Instead, managers need only purchase semen, and the semen of one bull can breed more cows using an AI system. Insemination also benefits breeders because it reduces the chance of breeding injuries; in addition, it helps to control disease by eliminating sexual contact between sires and dams. Finally, AI tends to improve production records because breeders must use them to keep track of which animals have been inseminated. AI increases profits for some breeders by eliminating labor and other costs associated with keeping a sire.

While artificial insemination obviously has its advantages, disadvantages exist as well. One problem with AI is that skilled technicians that have been specially trained to inseminate animals are necessary to improve conception rates. Because of the need for training, an AI system requires a large investment to begin and operate. Another disadvantage is that artificial insemination can accentuate the damage to a herd caused by a poor sire because its semen will be used for servicing a large number of females, thus creating many genetically inferior offspring. AI may also increase the spread of disease if the equipment is not sanitary. A final problem is that AI can easily be abused through such practices as the distribution of poor semen and label switching.

Artificial insemination is an effective tool for many breeders. However, such technology is not the key to high conception rates for all breeding programs because detecting proper insemination

a large herd needs to use more sires. Pasture space is limited in this operation, so buying a dairy bull is not an option, but the producer is able to afford the initial investment of beginning an artificial insemination program. AI is thus the best mating system for this particular producer.

**Summary**

Two general types of mating systems are used by producers: artificial insemination (AI) and natural mating. Artificial insemination involves collecting semen from a sire and placing it in the female's reproductive tract. No physical contact occurs between the animals, and many breeders who use AI do not keep a sire on site. In contrast, natural mating involves physical contact between the sire and the dam with or without the intervention or assistance of humans. General types of natural mating include hand mating, corral mating, stud mating, pasture mating, flock mating, and pen mating. All mating systems have advantages and disadvantages. Breeders must evaluate their resources wisely to decide which of these systems is the most efficient and the most profitable for the operation.

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times is easier in some animal species than others, and timing is critical for success with AI.

Many breeders prefer to use natural mating systems. Natural mating involves physical contact between the male and female with or without human intervention and assistance. Many different types of natural mating systems are used, such as hand mating, pasture mating, corral mating, stud mating, flock mating, and pen mating. Some of these systems are used with particular species. All of these mating systems have advantages and disadvantages.

Hand mating - Hand mating is a good way for purebred breeders to use a natural mating system but still control mating. In this system, males are kept separate from females before the female comes into heat. When the female enters the estrus phase of her reproductive cycle, she is brought to the male for servicing. An advantage of hand mating is that mating is controlled. This control also allows breeders to keep more accurate records than with other types of natural mating, since they know the exact animals and breeding dates involved. However, this system requires more labor than some other natural mating systems. Managers must be sure that the female is observed at least twice a day during the breeding season to see if she is in heat. When it is confirmed that she is in standing heat (ready to mate), labor is needed to bring her to the sire.

Corral mating - Horse breeders utilize corral mating. This mating system is not very different from hand mating; the difference in terms stems from the distinctive use of a corral in the horse industry. The selected sire and dam are placed together in a corral for servicing. The only handling involved is transporting the sire and dam to the corral and then transporting them back to their separate pens.

Stud mating - The poultry industry uses stud mating systems. The males are held alone in a pen or coop, and the female is brought to the male for servicing. This system requires more labor as different females are brought back and forth to the male. However, maximum breeding value is usually achieved by the male because more matings take place, which is efficient for the breeder.

Pasture mating - In a pasture mating system, males and females are kept together in the same pasture during the breeding season or, in some cases, throughout the entire year. If a manager wants the offspring to be born around the same date and have a relatively uniform size, the males should be limited to sharing a pasture only during the breeding season. Advantages of pasture mating are that it can be used for many livestock species and that it is not labor intensive, because less handling is involved. One difficulty with this system is keeping accurate records, especially if more than one sire is used. To improve the accuracy of siring records, different sires can be kept in separate pastures.

Flock mating - The flock mating system is used by poultry breeders. It involves placing several males with an entire flock of females for natural servicing. In general, one male can run with fifteen to twenty females to achieve high conception rates. An advantage of this system is that it requires minimal labor.

Pen mating - Pen mating is also used by poultry breeders. Instead of placing an entire flock with several males, one male is placed in a pen with fewer females, usually eight to twenty hens. An advantage of this system is that record keeping is easier because the exact parents of every chick are known. Evaluating the males for production also becomes easier. A disadvantage is that the fertility rates are lower than those in a flock mating system because the female cannot chose her mate. Also, no competition takes place between males for mating, which can drastically reduce fertility rates.

## Resources Effect on Selection of Mating System

The mating system used should be matched to the resources available to the breeding system. Producers should carefully evaluate which resources are limiting factors that may prevent the use of a particular mating system. They should plan to use the mating system that is the most efficient and profitable for the operation as a whole.

Resources that a livestock or poultry breeder should consider when selecting a mating system are the availability of labor, number of females and males in the herd or flock, facilities available, and financial resources. The effects of all of these resources interact, so that specific mating systems are more likely to be beneficial in a particular situation. For example, a dairy producer who has

## *Lesson 3: Breeding Beef and Dairy Cattle*

Breeding is an important aspect of both beef and dairy cattle production. For beef cattle, breeding produces the offspring that producers profit from by marketing, while for dairy operations, breeding and reproduction are necessary for milk production. Reproductive efficiency is therefore vital for profitability in both systems. The ability to detect when an animal is in heat is useful, and several methods can be used to detect estrus, including visual evaluation. In addition to recognizing heat in cattle, producers should be aware of factors that will affect conception rates in their herds to be sure to maximize production. They should also use some method of pregnancy detection to confirm whether their cows have conceived.

### Methods of Heat Detection for Cattle

Both dairy and beef producers can use several methods to detect heat in cattle. In the dairy and beef industries, producers commonly utilize teaser bulls with chin ball markers or heat-mount detectors. They are aids to those who work with the animals to help detect heat before this phase of the estrous cycle has passed and the opportunity for servicing is temporarily lost. These methods are by no means a replacement for detecting heat visually, however. For successful estrus detection, producers must be familiar with the physical signs that indicate that a cow is ready for servicing.

#### *Physical Signs*

A female of any livestock species is in standing heat and ready for servicing only when she allows other animals to mount her; this test is the only true indicator of standing heat in a cow. Although other physical signs are helpful in detecting heat, they do not confirm if the cow is truly in heat. Therefore, while the signs of estrus are important, producers should never allow servicing if standing heat is not confirmed. If she is not ready for service, an angry reaction by the cow can be dangerous to the handlers, the sire, and the cow herself.

Several other visual signs of estrus can be used for heat detection. The nervous system of cows and heifers is altered by estrus. The result is a tendency to bawl loudly and be very excitable and restless. Cattle in heat commonly try to mount other cows and heifers as well as allowing other females to mount them. A good sign that the cow or heifer is in heat is if the hair over the tailhead is roughed up, because it is a result of her being ridden by other females. Many cows and heifers will have a swaybacked appearance as they flatten themselves out in the loin area and raise the tailhead high. The vulva will appear swollen. Mucus with a very thin consistency, often forming long threads, will flow from the vulva. Cows and heifers in heat frequently have wet mucus on the buttocks, over the pins, and under the tail.

About two to three days after the cow or heifer is in heat, she will excrete bloody mucus from her vulva, a sign that the animal has passed out of heat. This discharge, which may be found smeared on the buttocks, tail, or on the ground behind the animal, gives no indication whether the animal has been fertilized during mating.

#### *Teaser Bulls*

Teaser bulls have been used as heat detectors for a number of years, sometimes with a marking system such as the chin ball marker or heat-mount detector. The teaser bull, commonly referred to as a gomer, is used to signal heat in females after some process is used to make the bull incapable of impregnating a cow. When cows are in heat, they will allow gomer bulls to mount them.

Vasectomized bulls are often used as teaser bulls. A veterinarian performs the vasectomy on the bull. In the surgery, a piece of the vas deferens is removed from the spermatic cord, preventing sperm transport. An advantage to this method is that the sexual organs are left intact and are still able to function normally, although the sperm cannot travel to the urethra. A disadvantage is that the bull is still able to copulate, creating a risk of the spread of venereal disease.

Another surgical procedure used to prevent a teaser bull from fertilizing a cow is displacing the penis and sheath. In this case, a veterinarian surgically redirects the penis and sheath from the normal position to the folds in the flank. The bull has a normal erection but is prevented from copulating. A disadvantage of this method is that the bull may get frustrated, lose his sex drive, and will not be helpful in identifying cows and heifers in standing heat.

Chin ball marker - As a method of determining which females are in heat, the chin ball marker is an excellent aid to the breeder. This device is similar in construction to a ballpoint pen. It is attached with a halter to the chin of a teaser bull. As the bull mounts the cow, he rests his head on the rump or back or over the shoulders of the cow, and the chin ball marker smears ink on these areas. After this method is used to detect standing heat, the manager must be sure that the cows are serviced by the preferred mating technique. This system of heat detection is commonly used in large pastures and with large herds. One gomer bull should work eighty cows. If the herd is larger, or if the pasture is very large, using two gomer bulls is advisable. The chin ball marker will need to be refilled after 15 to 20 cows or heifers have been marked.

Heat-mount detector - The heat-mount detector is a very useful method of heat detection known to identify up to 95 percent of heat periods. This system is similar to the chin ball system in that a teaser bull is used to identify the cows in heat. The detector is made of a small plastic capsule attached to a fabric base. The capsule is filled with red dye, and the entire detector is attached to the teaser bull with a harness. The capsule is located on the brisket of the bull. If enough pressure is placed on the capsule, the dye will slowly be released. If the cow is in standing heat and allows the teaser bull to mount her, the result is a mark by the dye. If she does not allow him to mount her, even if he attempts to do so, enough pressure will not be exerted on the capsule to leave a mark.

Electronic activity indicator - This device is the latest development in heat detection. It is frequently used for dairy cattle. A transmitter is attached to the cow using a neck chain. The activity level of the cow is transmitted daily to a computer in the dairy barn. During estrus, the female becomes more active. The increase in activity level indicated by the computer lets the producer know when estrus begins.

## Management Factors Affecting Estrus Detection

As indicated above, proper heat detection can make or break a breeding program. Along with recognizing the physical signs of heat, different management techniques can also contribute to successful detection of heat. Keeping accurate records of the dates dams were bred, the dates that unsettled dams came back into heat, and calving dates will help a breeder determine the specific time frame in which a cow or heifer will enter another heat period.

Cows and heifers generally come into heat every 21 to 22 days, so breeding dams should be observed from 17 to 25 days after the last heat period. With this time frame, the animals, even those kept in the pasture, are closely observed for signs of heat at least twice a day. If possible, observing the animals three times a day for periods of at least twenty minutes is desirable. A clear and concise identification system, such as branding, tattooing, or ear-tagging, should be used to avoid mixing up breeding animals and to be sure that records are valid.

The goal of both beef and dairy herd programs is to achieve a 100 percent calf crop annually. Many breeders achieve these percentages because they incorporate proper estrus detection and management into their breeding programs.

## Factors Affecting Conception Rates

High conception rates are important in ensuring a good calf crop. Environmental, physiological, and managerial factors all affect conception rates in cattle.

High temperatures tend to lower conception rates. Cows and heifers need adequate shade and water to avoid overheating.

Age is another important factor that affects conception rates. Females used for breeding should not be bred too young, because they are still growing themselves and should not be forced to nurture a growing fetus simultaneously. Breeding heifers to calve at two years of age will increase the lifetime production of the animal from 1 to 1.3 calves per year, if they are able to be bred again in the second season. Heifers bred at this age will have time to recuperate and will come into heat after the first calving in time to be bred again with the rest of the herd. Young heifers require more feed or good pasture and should be kept separate from mature cows. These practices will help increase development so they may be ready to breed earlier.

The quality of the bull can affect the rate of conception for the herd. Breeding bulls are ready to perform by 18 to 24 months of age. A mature

bull can service between 25 to 50 cows in a pasture mating system. He should be capable of servicing 40 to 50 cows in a hand mating system. In a range system, one bull is generally used for every 25 cows. A young bull should be able to service ten to twelve cows in a hand mating system and eight to ten in a pasture mating system. Bulls should undergo a breeding soundness evaluation prior to the breeding season. General health, foot and leg condition, and abnormalities of the reproductive organs should be evaluated. A fertility test should also be performed to analyze the quality of the semen. If an unusual percentage of cows are not settled after being mated twice by the same bull, the bull is most likely infertile. Producers must check the quality of the semen to be sure.

The post-calving period directly affects the conception rates of the next breeding season. If annual calving is desired, cows must calve a minimum of 45 days prior to the next breeding season. The cows' bodies need this time to recuperate from giving birth as well as to prepare to nourish future offspring. The highest conception rates in cattle occur when they are bred 60 to 90 days after calving. The number of days after calving before a cow comes into heat again is influenced by age. In general, older cows come into heat in less time than younger cows and heifers.

Good herd health and nutrition are imperative for high conception rates. Before breeding, producers should cull all animals that are diseased or unsound for breeding. Nutrition is directly related to high conception rates. If a female is too fat or thin, conception rates are lower. If a cow is gaining weight just before and during the breeding season, she is more likely to conceive. Flushing involves giving breeding females more feed starting two to three weeks prior to breeding to cause weight gains. The results of flushing are more eggs being shed, females coming into heat more rapidly, and higher conception rates. Either grain feeding or turning the breeding females onto lush pasture will accomplish flushing.

Finally, choosing the best time to breed a cow in heat can greatly affect conception rates. A cow should be bred within a 24-hour period after standing heat is first observed. Because the cow's ovary only releases the egg after standing heat, breeding late in the heat period or slightly after heat is best. Conception rates tend to be higher if the cow or heifer is bred between 9 and 24 hours after standing heat is observed. It is generally recommended that cows be bred 12 hours after standing heat is noted.

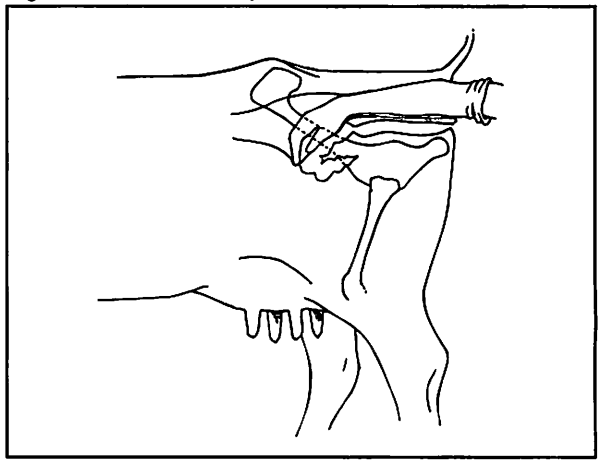
To help improve conception rates, many beef and dairy cattle producers use the practice of estrus synchronization, which involves using synthetic hormones to cause a group of females to come into heat at the same time. In 1979, a commercial product known as Lutalyse was approved by the Food and Drug Administration. Lutalyse is a commonly used injectable substance that works like naturally-produced prostaglandin, which triggers estrus. The recommended procedure is to administer two injections eleven days apart, between days five and eighteen of the 21-day estrous cycle. Other products used to synchronize estrus include orally administered synthetic hormone and injectable gonadotropin release hormone (GNRH).

## Detecting Pregnancy

One of the most simple and common ways to detect pregnancy in cattle is to test the cow or heifer for heat 17 to 25 days after the last heat period. If the animal is not responding to a teaser bull and shows no physical signs of heat, she may very well be settled. To determine if the cow or heifer is settled or not, many breeders palpate their breeding females. This method of detecting a pregnancy is very accurate.

Rectal palpation is very popular among breeders. The only equipment required to perform a rectal palpation is protective covering for the hand and arm of the handler, a holding chute to restrain the animal, and lubricant to facilitate entry into the rectum. Rectal palpation, as shown in Figure 3.1,

*Figure 3.1 - Rectal Palpation*



requires that a skilled technician or well-trained laborer insert his or her hand into the rectum, locating the reproductive tract through the wall of the rectum. He or she determines if the animal is settled or not by feeling the cow's reproductive organs. Cows are usually palpated around 45 days after the end of the breeding season.

When a technician begins palpating the cow, she or he holds the cow's tail for balance. The fingers of the gloved and lubricated free hand are held close together to form a wedge shape. Upon entry into the rectum, the hand position is changed to a fist, which is pushed deeper into the rectum while moving feces aside and straightening the rectal folds. If desired, the feces can be pulled out of the rectum; this practice is more time consuming but will increase the sense of touch and is recommended for beginning palpators.

As soon as the palpator's hand enters the rectum, the pelvic ridge should be located. If the animal is not pregnant, the reproductive tract will be just behind the pelvic ridge. If pregnancy has occurred, the tract may be moving to rest on the floor of the pelvis. The first organ that is felt in palpation is the vagina, which is located directly under the rectum and feels spongy and tubular. The palpator follows the vagina to the cervix at its upper end. The cervix feels harder than the vagina. The next organ is the uterus, located right in front of the cervix. Connected to the uterus are two uterine horns. The palpator feels these two horns and the uterus, from the cervix to the tapering upper ends of the uterine horns. As the palpator locates the ovary on the same side as the enlarged uterine horn, a corpus luteum is felt on the ovary. It will feel hard and project from the ovary. At this stage in a pregnancy, the reproductive tract remains on the floor of the pelvis. By 45 days of pregnancy, the embryo is attached to the wall of the uterus and is referred to as a fetus.

## Summary

The ability to detect heat in animals is important to ensure reproductive efficiency. A female of any livestock species is in standing heat only when she allows other animals to mount her. Other physical signs of heat in cattle include an excitable demeanor, restlessness, bawling, mounting other cows, a swaybacked appearance, a swollen vulva, and mucus discharge from the vulva. Tools cattle breeders use to detect heat in cows include teaser bulls, chin ball markers, and heat-mount detectors. Management factors that affect successful estrus detection include keeping accurate records, closely observing cows expected to be in heat, using a good identification system, and handling animals carefully. Factors that affect conception rates include the environment, age of the sire and dam, nutrition and flushing, health, and knowledge of when to breed. Pregnancy detection is commonly done through palpation of the reproductive tract through the rectum of the cow.

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## *Lesson 4: Breeding Swine*

The goal of swine breeders is to produce two crops of pigs per year. Desirable litter size ranges between eight and fifteen pigs per litter. To ensure productivity, breeders must successfully detect heat in sows and gilts and manage the breeding herd to increase conception rates. Checking for pregnancy is also important to make sure that resources are used efficiently for sows and gilts that are productive.

### Methods of Heat Detection

In the swine industry, determining whether a sow is in heat is a relatively easy process. Sows exhibit several visual signs that they are in heat. Producers also use boars to stimulate the sows to make the signs of heat more apparent. A simple method to determine if the sow is in standing heat and ready to be bred also exists.

Breeders first determine if a sow is in heat by observing the physical signs of heat. Signs of heat in a sow include a swollen vulva, a slight mucus discharge secreted from the vulva, and frequent urination. The sow may also attempt to ride other sows in her pen, have an aggressive disposition, grunt loudly, and refuse to eat.

After sows have exhibited signs of heat, the breeder may walk a boar through the facilities. No contact is made between the sows and the boar; however, sows will more clearly exhibit the visual signs of heat if they can smell and hear a boar.

The sows that are thought to be in heat are then checked by one last method before servicing. The breeder will apply pressure on the lumbar area of the sow's back, which consists of the last few vertebrae or the lower third of the back. The sow interprets the pressure as a boar mounting her. If the sow is in standing heat, she will not move, showing that she accepts service. A sow that shows any reaction other than this mating stance is not considered to be in standing heat.

### Management Factors Affecting Estrus Detection

Important management factors for detecting estrus include accurate record keeping, close observation of the animals, and using the appropriate method to detect standing heat when necessary.

Record keeping and observation are both important in determining when estrus should occur. If accurate records are kept, the breeder should be aware of when to expect the sows to enter their heat period, which generally occurs every 21 days. Sows and gilts should be observed at least once a day. Observing them twice a day tends to improve conception rates.

Many breeders try to synchronize estrus for better scheduling and to reduce the amount of time spent observing animals. Sows will naturally enter heat four to five days after weaning. Therefore, managers may choose to wean a group at the same time to synchronize estrus. Heat can be induced by exposing the sow to the boar.

### Factors Affecting Conception Rates

Conception rates are affected by the way gilts are managed for breeding. Gilts should be bred when they reach seven to eight months of age. At this point in their lives they should weigh between 230 and 250 pounds. They can be bred earlier, but conception rates will be lower. Gilts tend to farrow larger litters if they are bred during their second heat period, because they will have released considerably more ova by the time they reach their second estrous cycle. Entering heat periods early or late may decrease conception rates. Gilts that are raised on dirt or pasture are prone to go into heat earlier than those that are raised on concrete floors. If gilts raised on concrete flooring are moved to outside lots before they reach 175 to 200 pounds, conception rates tend to improve. If a boar is kept in a nearby pasture, lot, or pen, gilts will be able to hear, see, and smell the boar, which stimulates early heat periods. Gilts raised in confinement or in large groups of more than ten animals per pen will go into heat later. Breeding swine 24 hours after the beginning of estrus will help to increase conception rates.

Certain management measures can be used to improve conception in sows as well. Sows are ready for breeding during their first cycle of standing heat after weaning. Breeding at this time will improve conception rates. Conception rates in sows are best if they are bred at least twice (24 hours apart) after they enter standing heat.

Breeders should manage their boars to ensure their productivity as sires. A good practice when buying a boar is to purchase it prior to the breeding season and keep it in isolation from other animals on the grounds of the production facility. It should

be isolated for at least 30 days. During this 30-day period, the boar can be treated for parasites, if necessary, and may be observed for any signs of health problems. After this isolation period, the boar should be kept for another 30 days before it is used for breeding. This way the breeder can be sure that the boar is fully adjusted to its new surroundings and prepared for servicing.

The age, health, and reproductive soundness of boars all affect conception in sows and gilts. A boar should be at least 8 to 9 months old before it is used as a sire, and younger boars of 8 to 10 months of age are capable of hand mating only once per day. Studies show that one boar in every dozen is infertile. Therefore, test mating a young boar to a few gilts to prove its fertility is useful. Breeders should also evaluate the young boar's desire to mate, its ability to mount a female, and its ability to impregnate a female. Mature boars should only be used for servicing females twice a day, or up to 10 to 12 times per week, for conception rates to be adequate. They should be in good health and be proven as effective sires.

Other factors that affect conception rates in swine breeding programs include temperature, nutrition, and health. Hot weather tends to lower conception rates in swine. If the temperature exceeds 85°F., producers should expect lower conception rates and heat stress. Swine exposed to high temperatures should be provided cool shelter and plenty of water. Cold temperatures also tend to decrease conception rates. Swine exposed to temperatures of 60° F. or lower tend to experience stress because they spend too much energy maintaining body heat. To ensure that conception rates are optimized, housing should be adequate for the temperature conditions. Nutrition is another important factor. Swine that are overweight or too thin have lower conception rates. Sows and gilts should be flushed two to three weeks before breeding to ensure higher conception rates. Finally, a good herd health program is essential to high conception rates. To prevent the spread of diseases, the breeding herd should be separated from the rest of the herd.

## Pregnancy Detection

Twenty-one days after breeding, all sows and gilts that were bred should be checked for heat. Many producers expose them to a boar by walking a boar in front of the pens containing the females. The producers observe the females for signs of heat. If heat is detected, females should be bred again. If the females show no interest in the boar, they may have settled. A breeder may want to check these females further for pregnancy to be sure they have conceived.

Many swine breeders choose to use an ultrasonic device for pregnancy checks, because this method is 90 to 95 percent accurate when used correctly. The machine is virtually the same as that used in hospitals for observing the fetus in pregnant women. To check a sow or gilt for pregnancy using ultrasound, a technician places a transducer on the rear flank of the animal, 5 inches behind the navel and to the side of the line formed by the nipples. The machine transmits sound, and the echoes returned are measured. If the animal is not pregnant, the depth will echo back at about 5 centimeters. If the sow is pregnant, the echo will be reflected at 15 to 20 centimeters due to the fluid in the uterus. These measurements are not difficult to recognize and pregnancy can be determined as early as 30 days of gestation. Most breeders check sows and gilts at 35 days because the results are more accurate. If sows are not settled, they should be bred again or sent to slaughter.

### Summary

Heat detection is not difficult in swine. Many breeders first observe the sows and gilts for the physical signs of heat, then walk a boar near them to double-check for heat. Next, to check sows for heat, pressure is applied to the lower one-third of the sow's back to see if it will stand still for breeding. Management factors that affect successful estrus detection include keeping accurate breeding records, closely observing sows for visual signs of heat, and checking sows for standing heat. Conception rates are affected by factors like the timing of breeding, the number of times bred, the number of times the boar is used for breeding, temperature, handling, and nutrition. After 21 days, sows are rechecked for signs of heat, and then pregnancy detection is usually done using ultrasound.

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## *Lesson 5: Breeding Sheep*

The goal of sheep producers is to have a lamb crop of 130 to 200 percent per year. Achieving this goal requires good management. Producers must determine when a ewe is in heat and use good management practices to promote high conception rates.

### Methods of Heat Detection

Ewes show almost no visual signs of heat, so sheep breeders have had to develop reliable methods of heat detection using teaser rams. These rams are either vasectomized or are fitted with heavy aprons to prevent mating.

Teaser rams are also fitted with a marking harness consisting of a colored marking block held on the ram's chest. When the ram is accepted by the ewe and attempts to mount her, the block will mark her rump. The marks indicate which ewes have accepted the ram and are in standing heat.

### Management Factors Affecting Estrus Detection

Most sheep breeds have seasonal heat periods. They only come into heat during certain times of the year, typically late summer and early fall, with estrus being triggered by changes in the temperature and the length of the day. When ewes are expected to come into heat, they should be observed closely for marks indicating that they have been mounted by a teaser ram. Generally, ewes should be observed twice daily.

### Factors Affecting Conception Rates

The age of the ewe plays a major role in conception rates. Ewes can be bred to lamb at one year of age. However, conception rates are lower in ewes that are less than two years old. Mature ewes that are three to seven years old have higher fertility rates and have a high percentage lamb crop.

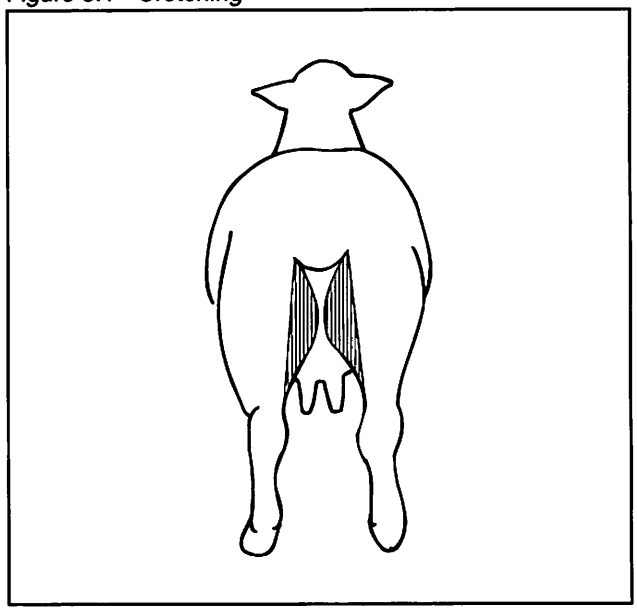
The management of the ram can also affect conception rates. Rams should be at least eight to nine months old before they are used for breeding. The number of ewes a ram can breed in one breeding season depends on its age and the type of breeding system used. In a pasture mating system, a ram lamb can breed about 15 to 25 ewes, a yearling ram can breed about 25 to 35 ewes, and a mature ram can breed about 35 to 45 ewes. A good practice is to keep three mature rams for every 100 breeding ewes when using a pasture mating system. In a hand mating system, a ram lamb can service about 20 to 25 ewes, although the use of a ram lamb is not recommended. A yearling ram can service about 50 to 75 ewes.

Proper nutrition is important because it can play a vital role in conception rates during the breeding season. Ewes should be flushed two weeks prior to the breeding season with good pasture or extra concentrates. Only ewes with proper body condition should be flushed. If the ewe is already overweight, flushing will actually result in lower conception rates. In addition to improving conception rates, flushing is also associated with twinning.

Producers may shear their sheep prior to breeding. "Crotching" ewes before the breeding season also increases conception rates. Crotching involves shearing the ewe's wool around the crotch to make breeding easier for the ram. Crotching is also helpful in preventing the spread of disease. The area around the hindquarters that should be crotched is shown in Figure 5.1. Rams should be sheared six to eight weeks before the breeding season.

The season in which breeding takes place can affect conception rates. For most breeds of sheep, the natural breeding period occurs in the

*Figure 5.1 - Crotching*



late summer and early fall, and lambing takes place in the spring. Some breeds are less restricted to this season than others, but with all breeds, breeding outside the normal breeding season will result in lower conception rates.

Producers can improve conception by breeding ewes at the proper time during estrus. Ewes remain in heat for about 36 hours and tend to ovulate toward the end of the heat cycle. Therefore, if a producer determines that a ewe is in heat in the morning, she should be bred that afternoon. If the producer realizes that the ewe is in heat in the afternoon, breeding should take place the following morning.

Breeding typically takes place in late August and early September, and high temperatures can have a detrimental effect on conception rates. In some cases, hot weather may cause heat sterility in rams because their testicles need to be below normal body temperature to produce healthy sperm. High temperatures can also kill embryos in ewes. If the temperature climbs higher than 90 degrees Fahrenheit, the embryo survival rate decreases during the first eight days after breeding. Rams and ewes need adequate shade and water to avoid overheating. Rams should be shorn, especially in very hot breeding seasons.

## Pregnancy Detection

Many producers rely on the marking block system to indicate which ewes have settled. They may use a light-colored marking block at first; after 14 days, a darker color is used when the teaser ram is run with the ewes again. The ewes that were not settled should return to heat around 17 days after breeding, and the dark markings on their rumps from the teaser ram allows the producer to identify them for rebreeding. Ewes that do not return to heat are likely to be settled.

This method of detecting pregnancy may be more cost efficient than using ultrasound. Ultrasound is commonly used in large commercial lamb operations. These operations may have their own ultrasonic equipment, while smaller farmers can have a veterinarian perform the testing.

Ultrasound can be used to determine whether the ewe is pregnant six to ten weeks after breeding. Ultrasonic pregnancy detectors send ultrasonic pulses into the body cavity of the ewe. When the waves bounce back, they reflect the contours of the reproductive tract. This information can be used to determine whether the ewe is pregnant. It can also indicate whether the ewe is carrying multiple lambs.

## Summary

Unlike many other livestock species, ewes show no visual signs of heat, which forces producers to rely on teaser rams for detecting heat. Management factors that affect successful estrus detection include keeping accurate records and closely observing ewes. Several factors affect conception rates, including the age of the animal chosen for breeding, the preparation of the animals for breeding, and the timing of breeding. Breeders may detect pregnancy in ewes by using teaser rams to detect whether they are settled and by using ultrasound.

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## *Lesson 6: Breeding Horses*

Horse breeding includes all of the risks and challenges that affect breeding sheep and other livestock. However, they are compounded by the large initial investment required as well as difficulty in achieving high conception rates. Good management is necessary for success.

### Methods of Heat Detection

To detect heat in horses, breeders tease mares with a stallion. Unlike some of the other livestock species, the female is brought to the male to check for signs of heat. Two basic methods of teasing mares are used: teasing them in a group or one by one. In either case, some form of restraint must be used to prevent injuries and uncontrolled mating. When teasing just one mare at a time, breeders will employ a teasing rail (see Figure 6.1) to prevent the animals from making contact. A high rail is used to separate a stallion and mare while determining whether the mare is ready to mate; the rail should be high enough to keep the stallion from attempting to breed with the mare. Breeders may also use a teasing mill. This structure does the same job as a teasing rail but allows breeders to expose the stallion to many mares simultaneously. Using a teasing mill can save time for breeders when they have a number of mares to check.

When checking for estrus, visual signs of heat that may be observed in mares include the desire to be near other horses, a little mucus discharge from the vulva, urinating frequently, raising the tail, spreading the hind legs, and allowing the stallion to nip at the mare's flanks and neck. When a mare is in heat, she may also flex and relax her vulva in a winking motion.

### Management Factors Affecting Estrus Detection

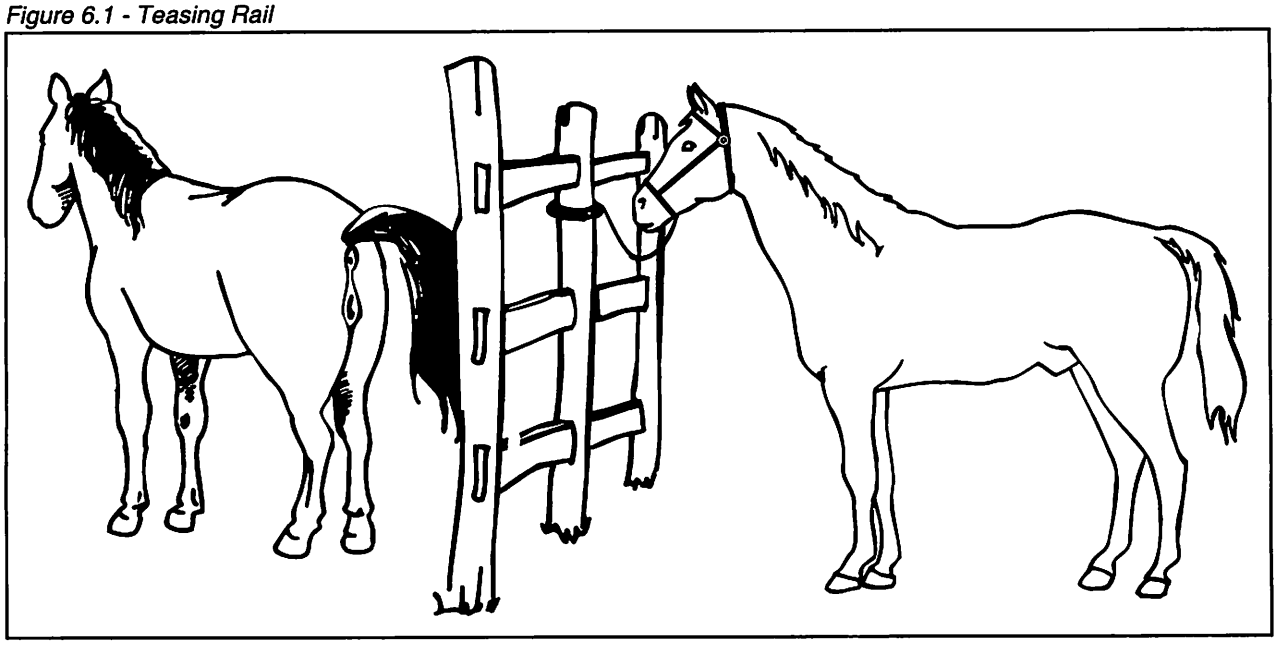
When trying to detect estrus, breeders must know when mares are likely to come into heat. Mares have a seasonal breeding cycle. This cycle begins in the spring when the mare's body senses that the number of daylight hours per day is longer than the period of darkness. A mare's estrous cycle will terminate in the fall as her body senses that daylight hours are decreasing and the hours of darkness are increasing. Because of this cycle, the months of April, May, and June are popular months for breeding.

When a breeder believes that a mare may enter estrus soon, the mare should be brought to a stallion for teasing once a day. If the mare has a violent reaction consisting of bucking and jumping, she is not ready for servicing. If, however, she exhibits the signs of heat, she is likely prepared for breeding.

### Factors Affecting Conception Rates

Generally, horses are considered the most difficult livestock species to settle. The national average for conception rates in mares is only 50 to 60

*Figure 6.1 - Teasing Rail*



percent. Conception rates are affected by many different factors.

Several factors need to be considered when managing mares for breeding. Mares are generally ready to be bred for the first time at the age of three years. They are capable of reproducing until they reach an age of fourteen to sixteen years. Conception rates are improved in mares if they are bred in April, May, or June, as these are the months when they are most likely to experience an estrous cycle. Periods of heat in mares usually last for five to seven days, with ovulation occurring toward the end of the period. Therefore, breeders commonly allow mares to be serviced or artificially inseminated after two days of heat. Mares come into heat between five to eleven days after parturition. They can be bred at this time if their bodies have recuperated from giving birth. Many breeders breed mares during the second heat period after foaling, which occurs 25 to 30 days after parturition. If the stallion is mature, conception rates are improved if a mare in standing heat is bred twice a day over a short period of time. If the breeder prefers to have the mare serviced for a longer period of time, once a day is adequate.

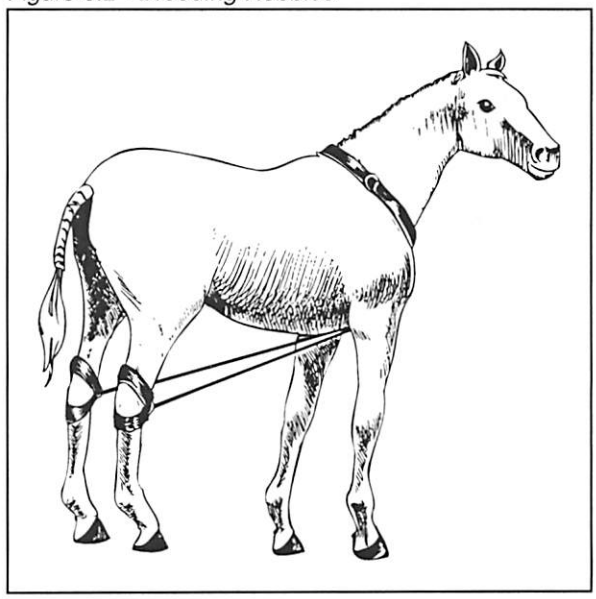
Management factors affecting stallions are also important in ensuring conception rates. Stallions do not have a specific breeding season. Productivity does tend to decrease with decreasing daylight, but viable semen can be collected throughout the year. Young stallions should be used for servicing less frequently; services should not exceed three times per week. In artificial insemination programs, sperm may be collected from both younger and mature stallions at a rate of once every two days. Sperm should be assessed for fertility by checking its motility and numbers.

The health and condition of horses affects conception rates. Prior to breeding, the mare and stallion should be checked for diseases or other health problems to be sure they are sound for breeding. Animals should not be overweight. Being underweight can also have a negative impact on conception rates. Breeders should be sure horses receive proper rations and plenty of exercise to ensure that the animals are in good condition for breeding.

The mating system used can also affect conception in horses. Pasture breeding can be advantageous because this mating system requires less labor. However, conception rates tend to be lower in pasture breeding programs, while hand mating programs yield the best conception rates.

Proper handling is important to high conception rates because stress can affect conception. Before and after breeding, the mare should have time to calm down and relax. She should only be serviced when she shows that she will accept the stallion. In a hand mating situation, using breeding hobbles (see Figure 6.2) is important to prevent the mare from injuring herself, the stallion, and the handlers during servicing.

*Figure 6.2 - Breeding Hobbles*



## Methods of Detecting Pregnancy

The simplest way to detect pregnancy is to check the mare for signs of heat. Mares should be examined for estrus 21 days after breeding. If she shows no signs of heat, she may have settled. However, some mares in heat do not always display visible signs, so other methods of pregnancy detection are necessary to ensure reproductive efficiency.

Most breeders have veterinarians perform rectal palpation on their mares to determine if they have been settled because of the practicality of the process and because it is relatively easy. Palpation should only be performed by a veterinarian because small mistakes, such as a tear in the rectal wall, can kill a horse. Mares are ready to be palpated as early as 35 days after breeding. They need to be restrained to protect

the palpator. Breeding hobbles or a portable restraining pen called a breeding stock are adequate. If the mare has a very jumpy disposition, she may have to be tranquilized. The rectum of a mare is different from that of a cow because the horse's rectum is considerably drier. The palpator must use a lubricant to facilitate entry into the rectum. A torn rectum is extremely serious and usually leads to death.

When a palpator enters the rectum of a cow, the first organ she or he feels for is the cervix, but the landmark organ the palpator looks for in horses is the ovaries. They are located 5 to 10 centimeters behind the upper third of the pelvic arch and are easily recognizable for their tough consistency and oval shape. After the palpator locates an ovary, she or he feels down to the uterine horns. The uterine horns have a funnel-like shape and are connected to the uterus so that the three organs form a "T." The palpator then feels the horns and uterus for signs of pregnancy. If the mare is settled, the amnion, an embryonic membrane, will be recognizable in one of the uterine horns at 35 days. At this point, the amnion will be about the size of a golf ball.

## Summary

Because mares often have difficulty conceiving, managing breeding carefully is necessary. To detect heat in mares, breeders use stallions to tease mares in a group or one by one. Signs of heat in mares include raising the tail, urinating frequently, a desire to be near other horses, a little mucus discharge from the vulva, spreading the hind legs, allowing the stallion to nip at the flanks and neck, and winking of the vulva. Mares have seasonal breeding cycles which are influenced by the number of daylight to darkness hours. Factors that affect conception rates include health and condition, cleanliness, stress, temperatures, the age of the sire and dam, the number of dams per sire, and the timing of breeding. Pregnancy can be detected by observing the horse for signs of heat and by rectal palpation.

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## *Lesson 7: Breeding Poultry*

While most birds go through dramatic mating displays and even fight for courtship, chickens and turkeys are highly domesticated, and breeding is much less complicated by their behavior. As with any livestock species, however, breeders must recognize when their stock are ready to produce offspring and understand the factors that affect productivity, fertility, and hatchability.

### Coming into Production

Unlike other species of livestock, poultry do not experience heat periods. Instead, breeders need to know when birds will come into production, or when they are ready to breed and lay eggs. When breeding chickens, both hens and roosters are ready to breed at 20 to 22 weeks of age. Male and female turkeys are ready to begin breeding at 26 to 30 weeks.

Poultry producers should keep accurate hatching records of breeding birds so that they know when they are ready to come into production. Producers should also be able to recognize signs of sexual maturity. In pullets, for example, sexual maturity is signaled by a well-developed head with a large, firm, bright red comb.

Light causes the release of hormones that increase the growth of ova. It can therefore be used to control the age at which birds reach sexual maturity. Most breeders decrease and then gradually increase the amount of light received during the growing period to control the onset of sexual maturity in pullets so that they will produce eggs of a desirable size.

### Factors Affecting Fertility and Hatchability

Light is the most influential environmental factor affecting reproduction in poultry. Commercial hatcheries can control the production and release of ova in birds by controlling the timing and intensity of light within the poultry house. While laying, chickens should receive 14 to 16 hours of light and turkey hens 14 hours of light a day to stimulate maximum egg production. The amount of light should not be decreased while the birds are laying, because any changes in the environment could decrease egg production. Increasing the number of total hours of light to more than 17 hours will result in thin eggshells and may reduce egg production. Lighting also affects the quantity and quality of semen in male birds.

Proper feeding is also necessary to achieve maximum egg production. During the growing period prior to egg production, the feed intake of breeding birds must be controlled, particularly for broiler breeders and turkeys. If pullets and turkey hens are too heavy at sexual maturity, they will not produce the maximum number of eggs. Broiler breeder hens should also not be allowed to become too fat. Breeding flocks require feed with the proper nutrients, including greater amounts of certain vitamins and minerals, to promote hatchability and embryo development.

The type of mating system used makes a large difference in conception rates. Natural mating may decrease fertility because mating does not occur frequently enough or because the birds are not receptive to mating. Artificial Insemination is therefore common in the poultry industry, particularly with turkeys. Chickens are inseminated when they come into production and then are reinseminated weekly. Repeated inseminations are necessary for fertility because semen dies in the hen's body after about two weeks. Turkeys are often inseminated on two-week intervals to achieve maximum fertility.

The selection of eggs that show desirable physical characteristics related to hatchability is necessary for good hatching rates. Physical characteristics affecting hatchability include shell quality, interior quality, size, and shape. Eggs with strong shells hatch better than thin-shelled eggs. Shell quality is affected by various factors, including the hen's diet, the weather, the length of the laying period, and the age of the hen. Eggs showing interior quality, such as a well-centered yolk, hatch more often than poor quality eggs. Extremely large and small eggs and abnormally shaped eggs do not hatch well.

Proper egg management is essential for increased hatchability. Eggs should be gathered frequently, to help keep eggs clean and to prevent them from chilling or overheating due to the weather. In chicken breeding systems, eggs are normally gathered three to four times daily, although they may be gathered hourly in hot or cold temperatures. When breeding turkeys, eggs are collected at least every two hours. Dirty eggs have lower hatchability rates, so nests should be kept clean. The eggs are immediately decontaminated after gathering using sanitizer to kill any bacteria or

other harmful microorganisms. The eggs can then be stored in a temperature-controlled room at 65 degrees Fahrenheit and a relative humidity of 75 to 80 percent for chicken eggs and 55 to 60 degrees Fahrenheit and 80 percent relative humidity for turkey eggs. Chicken eggs may be held for up to ten days without drastically harming their hatchability, although hatchability does start to decrease after four days. If eggs are held for more than seven days, they should be turned twice a day. Turkey eggs should not be held for more than two weeks.

## Summary

Poultry breeders must know when their birds will come into production. They should therefore keep accurate hatching records and be able to recognize signs of sexual maturity. They may also control the onset of production using appropriate lighting patterns. Factors that affect fertility in breeding birds and hatchability of the eggs include light, feeding, type of mating system, egg selection, and egg management.

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## *Lesson 1: Calving in Beef and Dairy Cattle*

According to the University of Missouri Agricultural Extension guide sheet *Assisting the Beef Cow at Calving Time*, an annual loss of 5 percent of beef calves is due to dystocia, or calving difficulty. Such drastic losses can be avoided by preparing for calving difficulties ahead of time. Management begins with proper selection and breeding. Managers should select breeding stock with little or no record of dystocia. Also, they should take care not to breed heifers calving for the first time with very large bulls.

The goal for both beef and dairy producers is to produce a live and healthy calf that has the potential to be productive. One of the first steps a producer can take to prepare for calving season is to be familiar with the signs of parturition. Producers should also be aware of the proper management techniques for parturition and how to assist with normal and abnormal births. Even though the pregnancy may be healthy, a potential for difficulties always exists during parturition. Sound management techniques will prepare producers to take care of problems as rapidly as possible.

### Signs of Parturition

The first step in preparing for parturition is recognizing the signs of calving. As a cow reaches the last stages of pregnancy, her body will begin to produce milk to prepare for nursing. As a result, a few days before calving the cow's mammary glands in the udders swell up as they fill with milk. Because this change is so pronounced, it is commonly the first sign of parturition in cows. Another sign that the cow will calve soon is the secretion of colostrum, which is the first milk produced by the cow and is rich in antibodies.

The cow's body will change in other ways to indicate parturition. The pelvic ligaments will loosen between the tail head and pin bones, creating a sunken appearance. The vulva will relax and swell. It is also common for white mucus to be secreted from the vulva.

A cow's behavior may also change before parturition. A cow may demonstrate a desire to leave the rest of the herd. Other behavioral signs of parturition include being unusually restless and uneasy.

A few hours before calving, the cow will begin to experience labor pains. When a cow is in labor, she will show her pain by bawling, attempting to push out her calf, and breathing rapidly. The water bag, which is part of the fetal membranes surrounding the calf, will swell as it is extruded and finally collapse in on itself and rupture. The passing of the water bag should be followed by delivery of the calf within one to two hours.

### Management Techniques for Parturition

Sound management includes accurate record keeping and preparing materials that may be needed for the birth. A good manager will keep records that indicate when to expect cows to calve. This allows preparation time for births. Managers should always be prepared for the worst.

The equipment used to assist in parturition should be on hand in an accessible area and ready for use. The items needed include soap, clean towels, clean obstetrical gloves, obstetrical lubricant, and pulling chains. Pulling chains should be cleaned before calving season and between uses. They should be placed in a clean bucket of disinfectant and water before and after their use to kill any bacteria that may harm the cow. Any debris should be removed from the chains after they are used.

During expected calving times, cows should be observed more often than usual. To minimize labor needs, pregnant cows may be kept in a smaller pasture that is located close enough to observe them easily.

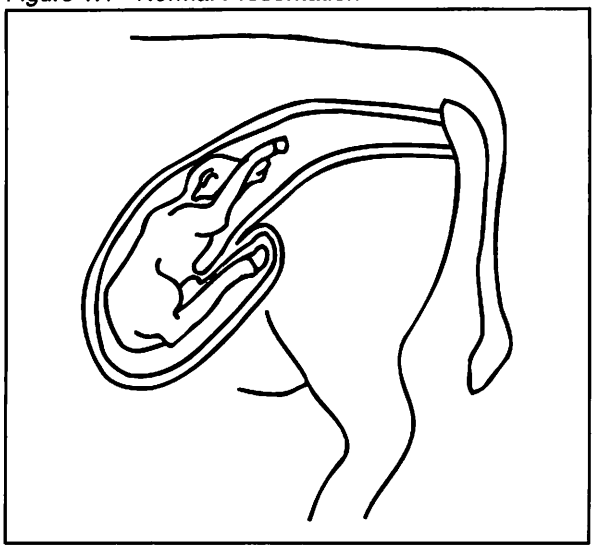
A cow should have a safe and clean place to give birth. If the cow is on pasture, it should be free of excess manure, dangerous equipment, and heavy cover where the cow can isolate itself from the rest of the herd. In confinement, a cow should have a clean and disinfected maternity stall that is 12 by 16 feet in size. The area should provide the animal with plenty of ventilation, light, and fresh bedding.

### Assisting with Normal Births

A cow should give birth within an hour or two after passing the water bag. During gestation, the fetus is on its back in the cow's uterus. About two to six hours before calving the fetus should rotate around to appear in the normal calving position,

shown in Figure 1.1. Note that the forelegs are extended outward with the nose between the legs.

*Figure 1.1 - Normal Presentation*



No assistance is required in the normal delivery of a calf, but certain steps are necessary immediately after a birth. First, the mouth and nostrils are cleared of mucus, and the calf is observed to make sure it is breathing. Sometimes it may need to be "started," or stimulated to breathe. Starting techniques include tickling the nostrils with a piece of hay, slapping the sides of the calf, or suspending the calf in the air by the hind legs and gently shaking it. In extreme cases, artificial respiration may be performed if the calf cannot breathe on its own. Some operations may have a machine for artificial respiration; others may invest in training to do it manually with a hose.

## Assisting with Abnormal Births

If the cow has not delivered after an hour, the producer may choose to call a veterinarian. However, the producer may decide to perform a pelvic examination if he or she is confident enough to do so. During the exam, the amount the cervix has dilated should be checked. The cervix should be open wide enough so that the fetus has no trouble passing through during parturition. Other potential problems that should be checked are whether the calf is too large to exit the cow's body or if the calf and birth canal are dry. The position of the fetus should also be determined; abnormal presentations are shown in Figure 1.2. Experienced cattle producers are capable of giving assistance for some of these conditions, but if the problem proves to be severe, it is better to call a veterinarian. The cow should be restrained by the head before attempting any sort of assistance.

A veterinarian must be called if the calf is too large to exit through the birth canal. In this case, the calf may die and the cow can be severely hurt. If the head and front feet have already exited the cow, the force of the contractions can be deadly. If this problem becomes apparent before the head and front feet have exited the birth canal, the calf can be saved by having the veterinarian perform a caesarian section.

If the calf and the birth canal are dry or if the cervix has not dilated sufficiently, a commercial lubricant and pulling chains can be used to assist with parturition. Many obstetrical lubricants are available on the market and should be purchased before calving. A glove should be worn to spread the lubricant on and inside the cow. Soap should never be used in place of an obstetrical lubricant. The soap will cause swelling and inflammation of the vaginal membranes, which results in a delayed return to heat and decreased conception rates.

After lubricant is applied, clean obstetrical pulling chains should be attached to the calf. Only experienced cattle producers or a veterinarian should use obstetrical pulling chains. The pulling chains should be placed around the pasterns of the forelegs with the loop portion of the chains on top of the hooves, as in Figure 1.3. The placement of the chains is important. If they are positioned incorrectly, the calf's legs can be broken.

After the chains are in place, handles are attached to the chains, and the calf is pulled gently from the cow's body. Alternately pulling gently on each leg, freeing the calf a few inches at a time, is recommended. The shoulders, which are much wider than the head, will be walked out of the pelvic opening one at a time, causing the least amount of stress on the cow.

*Figure 1.3 - Position of Pulling Chains on the Forelegs*

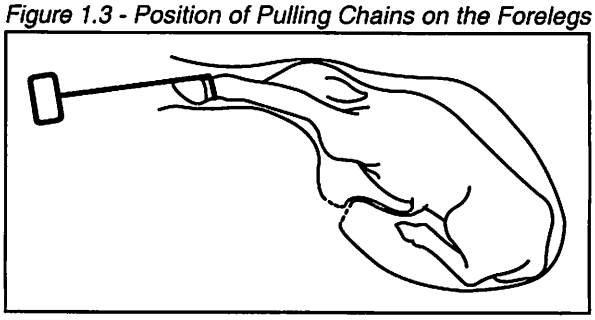
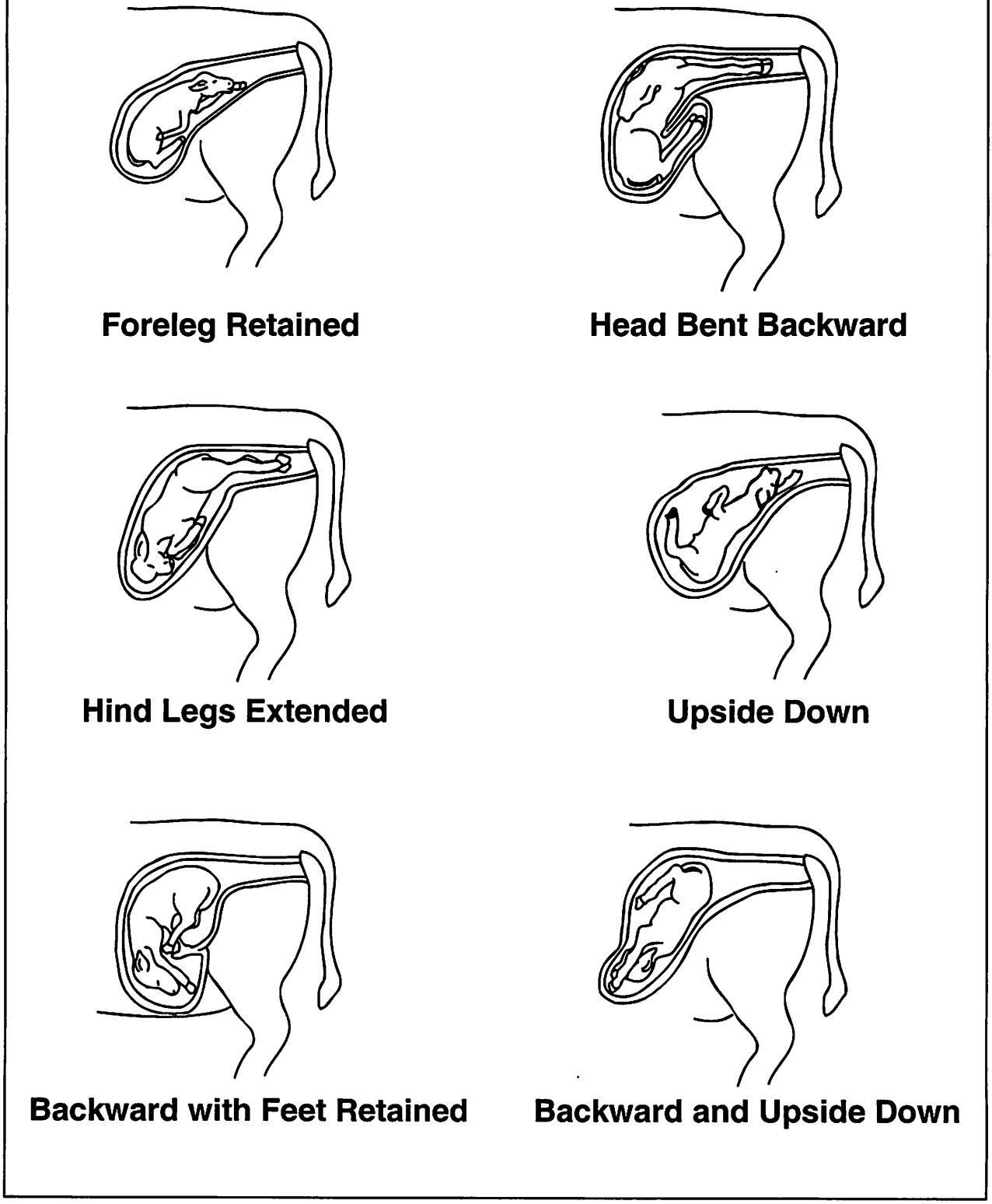
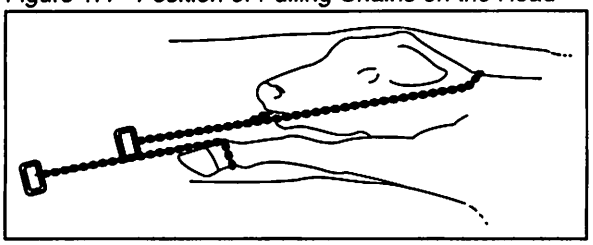


*Figure 1.2 - Abnormal Presentations*



If the shoulders get locked or stuck at the pelvic opening, chains should be attached to the calf's head. The chains wrap around the poll and pass through the mouth. The proper placement is illustrated in Figure 1.4. With the chains in this position, the calf is pulled in such a way that the size of the chest and shoulders is reduced, facilitating delivery.

*Figure 1.4 - Position of Pulling Chains on the Head*



When using pulling chains during parturition, the calf should be pulled out gradually. Dilation of the cervix is a natural response to pressure. If pulling chains are used to apply pressure, they will help increase dilation. If assistance is given too early, the pressure applied by the pulling chains will avoid harming the cow only if it increases gradually and does not interfere with dilation of the birth canal. The cow may be torn internally if the calf is pulled too quickly.

After the head and shoulders are outside the cow's body, repositioning the calf may be necessary. Turning the calf a quarter turn onto its side will help the hind quarters fit through the birth canal. If this procedure does not work, the producer should grab the forelegs and pull downward toward the cow's rear feet.

The hips may get locked in the birth canal. If this occurs while the cow is lying down, the calf should be pushed back slightly and then turned a quarter turn. Rotating the calf repositions it so that one hipbone will pass through the cervix before the other, making it less likely to lock in place. If the calf cannot be turned, the forelegs should be pulled between the cow's hind legs and toward its chin.

With abnormal presentations, repositioning the calf so that the birth may proceed normally may be possible. Some abnormal presentations may require the assistance of a veterinarian to correct, but for others, an experienced producer can reach into the cow and reposition the calf to the normal position. Before reaching into the cow's uterus, he or she should be sure to wash using soap. If possible, gloves should be worn to prevent the spread of bacteria. If a foreleg is retained, the leg can be pulled forward. If the calf's head is bent back, the producer may be able to push the calf back into the uterus and then bring its head forward between its legs. When the calf is upside down, it may be possible to turn it to the normal position.

A calf that is backward in the uterus may be delivered hind legs first if the legs extend into the birth canal. If the calf is exiting the cow's body rear feet first, the umbilical cord is likely to be pinched or broken. The birth may proceed without assistance, but it must occur quickly. If it does not, appropriate assistance should be given immediately. Pulling chains should be attached to the rear legs around the fetlock. Because the calf will be pulled out backward, plenty of lubrication is necessary to counter the direction of hair growth. The calf should be turned a quarter turn to facilitate its passage, and the rear legs should be pulled gently one at a time. If delivery is slow or unsuccessful, the veterinarian may need to perform a caesarian section.

As soon as the umbilical cord breaks, the calf must begin to breathe in order to get oxygen and survive. With a normal presentation, the cord breaks as it is pressed between the calf and the cow's pelvis during calving. Because the calf's head is outside the cow's body, the calf can begin to breathe air. A great danger when dealing with abnormal presentations is that the umbilical cord may break or be pinched while the calf's head is still within the cow's body. If this happens, the calf will suffocate and die. With this in mind, if the delivery is difficult but the calf's head is outside the cow, the producer should take the time to be sure that the calf is breathing normally.

### Managing the Cow after Parturition

After calving, the cow should expel the afterbirth, which consists of the placenta and other fetal membranes. It is normally passed by uterine contractions two to eight hours after delivery of the calf. Producers should watch for the membrane and be sure that the cow has expelled all of it. If the afterbirth remains within the body cavity of the cow, it will decompose. This may result in internal infections and problems rebreeding. If the cow has not passed the membranes in 24 hours, they may need to be removed manually. Only experienced producers or veterinarians should attempt to remove the placenta. If it must be

removed, they should prepare by washing their arms and hands and wearing a long glove with an approved obstetrical lubricant. All the pieces of the placenta must be found and gently pulled out of the cow's body. If the cow seems to be functioning normally, has a healthy appetite and adequate milk production, and shows no signs of abnormal vaginal discharge, leaving the placenta within the cow's body may be better than risking the possibility of infection by entering the birth canal.

Another problem associated with parturition that producers should watch for is uterine prolapse. The uterus becomes inverted and is forced out of the cow due to the extensive pushing and the effect of the calf leaving the cow's body. Uterine prolapse may also be the result of the calf being pulled too rapidly in an assisted birth. The cow will die if appropriate medical attention is not provided immediately. Only a veterinarian should treat a cow with a uterine prolapse. The cow should definitely not be rebred, since it is likely to suffer another prolapse. Many managers try to get the cow to stand up as soon as possible after parturition as a preventive measure.

A cow that has recently calved needs good nutrition to produce enough milk to feed her calf, recuperate from parturition, and prepare the womb to hold another fetus. Improper nutrition at this point may result in uterine infections, metabolic problems, and delayed heat cycles.

A major concern with dairy cattle is parturient paresis, or milk fever. This disease is the result of a lack of calcium salts in the blood of a cow and is more common in high-producing cows. Symptoms generally arise a few days after parturition and include a dry muzzle, reduced defecation, cold skin, loss of coordination, paralysis, depression, excitability, and lying on the brisket with the head turned backwards. If untreated, the cow will die. A veterinarian can treat the cow with an injection of calcium.

With beef cattle, a good practice is keeping cows and new calves separate from the rest of the herd for a few days before turning them out to join the herd. Dairy cows are kept with their calves only long enough to pass on their colostrum. The calves are then separated from them and held in individual pens so the milk produced by the cows can be processed and sold.

## Records

Important information that should be recorded as soon as possible after calving are the date of calving, sex of the calf, sire, identification number, birth weight, and difficulty during parturition. Any medications given to the cow or her calf should be included in health records. Post-delivery problems such as a retained placenta or uterine prolapse should also be noted. This information should be included on records for both the cow and the calf since many parturition problems can be passed genetically.

## Summary

Producers should prepare for parturition by keeping accurate breeding records so they know when to expect their cows to deliver calves. Also, they should recognize the signs of parturition and prepare the facilities and any necessary equipment ahead of time. For normal births, producers should "start" the calves that are not breathing. They may be able to provide assistance for calving problems, but it may be necessary to call in a veterinarian. Cows should receive appropriate management after parturition to prepare for rebreeding. Birth records should include information such as birth weight, difficulty during parturition, medications given, and post-delivery medical problems.

## Credits

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University Extension agricultural publications, University of Missouri-Columbia.

G2035: Calving Difficulty in Beef Cattle
G2007: Assisting the Beef Cow at Calving Time

## *Lesson 2: Farrowing*

Swine are different from cattle in that sows utilize both uterine horns to hold and nourish their young, so they are able to produce large litters. Another big difference is that pigs can be born normally in more than one position. Assistance in farrowing is labor intensive, as is the case with cattle, yet the animal itself is smaller, which makes the entire experience different for the producer. However, just as with cattle, a good manager will know when to expect sows to farrow by keeping accurate breeding records. He or she will be aware of which sows are approaching farrowing time and will recognize signs of parturition.

### Signs of Parturition

One behavioral sign of parturition among sows is the desire to build a nest. Even in a confinement facility with a cement floor, a sow will root and paw at the floor as if making a nest. If a sow is on pasture, she will actually drag sticks and whatever else, she may find to construct a nest for her offspring. A sow will generally exhibit this nest-building behavior a day or two before farrowing.

Whether a sow is on pasture or in a confinement system, she will most likely exhibit two sure signs of parturition, a swollen vulva and bagging. Bagging refers to the swelling of the mammary glands as they fill with milk. The swelling is obvious, and some older sows may actually have milk dripping from their teats at this point.

Other signs of parturition include slight frothing at the mouth and chomping, or chewing on nothing, especially in younger, less experienced sows. When a pregnant sow of any age begins to exhibit restlessness, farrowing will usually occur within six hours after the onset of such behavior. A slight mucus discharge from the vulva indicates that the sow is extremely close to farrowing.

### Management Techniques For Parturition

Pregnant sows should be moved gently to farrowing facilities about a week before the expected farrowing date. Before moving the sows, the facilities should be cleaned and disinfected thoroughly. The sows should also be washed with soap and water before being placed in the farrowing facilities to maintain the most sanitary environment possible for the newborn pigs. The introduction of bacteria from outside sources should also be discouraged by keeping human traffic through the farrowing barns to a minimum.

The farrowing facility should have the equipment needed to ensure the survival of the young pigs. A nursery generally has farrowing crates that do not allow the sow to turn around; guard rails protect areas for the young pigs. Open pens with guard rails may also be used for farrowing. The rails are designed to help prevent sows from accidentally crushing their offspring. Heat lamps should also be provided for the newborn pigs. They are hung next to the sow over the area where the newborns are protected by the guard rails. The lamps should be high enough that they are out of reach of the sow. A temperature of 90 to 95 degrees Fahrenheit should be maintained at first, which is then lowered to 80 to 85 degrees after a period of four or five days.

Certain supplies should be kept on hand for assisting with farrowing. These supplies include an obstetrical lubricant, obstetrical gloves, clean towels, syringes, and oxytocin, a hormone that induces delivery.

### Assisting with Normal Births

Generally, if a manager is present during farrowing, the pigs have a greater chance of survival. While pigs may be born in many different positions, certain presentations are considered normal. These presentations include having the forelegs forward with the head resting between them or backward with the hind legs first, and the sow should not require assistance with either of these positions.

The manager should carefully observe the new pigs and be ready to assist them if necessary. The pigs may need to be freed from the fetal membranes. Their snouts should be cleaned, and the newborns should be checked to see if they are breathing. Starting their breathing may be necessary, either by gently yet firmly slapping the animal or by picking it up by the hind legs and patting it on the sides until it coughs up mucus. All the new pigs should be dried off with towels and placed under the heat lamps.

Producers should be aware that sows carry their fetuses in both uterine horns and only will give birth to their young one horn at a time. After a sow gives birth to all of the piglets in the first uterine

horn, she will pass the placenta of that horn before giving birth to the rest of her offspring. The sow will then pass the second placenta. If the producer leaves before the sow has given birth to the offspring in the second uterine horn, the other newborns may die because they needed assistance to breathe or suffocated inside the placenta. The producer should be sure that both placentas have passed. As soon as the placentas are expelled, they should be disposed of in the dead animal or waste disposal facilities. The producer should also dispose of stillborn and mummified pigs; mummies are the remains of fetuses that died in the sow's uterus and have been partially reabsorbed, leaving only the skeletons and other nonabsorbable parts.

### Assisting With Abnormal Births

Assistance may be needed with some abnormal births. Abnormal birth presentations for swine include having the head turned back, presenting the rump first, and presenting the back first. Assistance is also required if the fetus is too large to exit the birth canal.

When a sow begins to give birth, producers should pay close attention to the process. If the sow delays for half an hour after giving birth to some of her young or is struggling from the onset of parturition with little success, the birth canal must be examined. A sow's birth canal should be entered as little as possible to prevent disease, and obstetrical gloves and plenty of obstetrical lubricant are necessary. When examining the sow, the producer should first check to see if anything is in the birth canal. If a pig is in the canal but cannot pass through it for some reason, the manager should pull it out. Generally, pigs may be swiftly pulled out of the sow's body by grabbing the baby pig's legs.

If nothing is blocking the birth canal of a struggling sow, she may need to be given a shot of oxytocin. Producers may inject the sow with three shots of oxytocin given at 20-minute intervals over the course of an hour. A sow should never receive oxytocin unless the birth canal has been checked and cleared of any pigs. If a pig is in the birth canal in an abnormal position for delivery, a shot of oxytocin will stimulate the sow to push the pig through the wall of the birth canal, causing her to bleed to death.

Temperature has an effect on sows. When they are hot and tired, they will give up and let their offspring die inside their bodies rather than give birth. If the weather is too hot and the sows get overheated under the heat lamps, producers may have to pull many of the pigs. Pulling large numbers of pigs can be hard work, and few instruments are available to aid in the process. Producers generally rely on birthing tongs, oxytocin, and well-trained and experienced employees to help during abnormal parturition.

### Sow Management after Parturition

A nursing sow needs extra nutrients to produce the milk that will nourish her young. The feed provided needs to be nutritionally complete. Sows will also need to consume larger amounts of feed.

Some producers give their sows injections after farrowing. A common practice in the commercial pork industry is to inject sows with oxytocin to help expel the placenta and promote milk let down. Producers may give their sows penicillin after farrowing as a preventive measure against infections.

Sows should be allowed to nurse their offspring for 14 to 15 days after farrowing, and then the young pigs should be weaned. Natural estrous synchronization of sows can be achieved if the young pigs are weaned on the same day; after four days, the sows are exposed to the boar and bred. If a sow does not come into heat with the rest of the herd naturally, an injection of the hormone prostaglandin can induce heat.

### Records

Important information that should be kept in the sow's records include the litter number, sire, date of farrowing, temperament of the sow at farrowing, the amount of farrowing difficulty, the number of pigs born alive, the number of stillborn pigs, the number of mummies, and the average birth weight of the pigs. During the period that the young are nursing, the producer may record mortality rates. The information should include the date, the number found dead, and the cause of death, such as abscesses or being crushed.

In addition to these records, a swine litter record can be kept. In this record, in addition to some of the same information recorded for the entire litter in the sow's records, individual information on

each pig is listed. This information includes the pig number, sex, number of teats, birth weight, and defects.

## Summary

A producer should be able to recognize the signs of parturition, especially the two most common signs, a swollen vulva and bagging. Pregnant sows should be moved to clean, disinfected farrowing facilities before their expected farrowing dates. The facilities should have heat lamps and farrowing crates that discourage the crushing of the young pigs. The presence of producers to provide assistance during farrowing will greatly increase the success of any operation. While they may have to provide some assistance in normal births, such as making sure the young pigs are breathing, producers should be prepared to help the sow by pulling the pigs if necessary. Sows should receive plenty of care and nutrients to help with milk production and to allow them to prepare for rebreeding. Mortality, health, and farrowing difficulty records should be kept accurately to provide future information about parturition for a sow.

## Credits

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### *Lesson 3: Lambing*

Although sheep give birth to fewer numbers of offspring at one time than swine, lambing can be more complicated. Good flock managers will know how to assist with both normal and abnormal births. They should also be able to recognize the signs of parturition in sheep in order to prepare to manage the birth of the lambs.

## Signs of Parturition in Sheep

Sheep display several behavioral signs of lambing. Ewes normally seek solitude before lambing. They may have an uneasy disposition and repetitively stand up only to lay back down again. A ewe may also dig into the ground with her hooves before laying down as if she is building a nest. Ewes may be more vocal before lambing, especially those carrying more than one lamb.

Physical signs also signal parturition. A common sign of parturition in sheep is dropping, which gives the ewe a sunken appearance in front of the hip bones and may make her appear sway-backed. The vulva will relax and appear slightly more pink than usual, although it should not seem reddish or stick out abnormally, which are early signs of prolapse. A broken water bag is a sure sign of lambing. Usually the ewe will give birth within 30 minutes to an hour after she expels the water bag. However, it is easy to miss the breaking of the water bag unless the ewe is being observed very closely.

## Management Techniques for Parturition

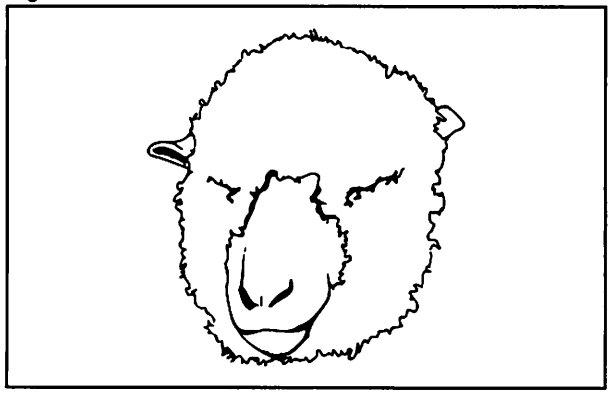
As lambing time approaches, producers should be sure to have lambing supplies available and easily accessible. Important supplies to have on hand include soap, obstetrical lubricant, obstetrical gloves, clean towels, and lambing snares or loops for pulling lambs.

In anticipation of lambing, producers may shear their ewes three to four weeks before lambing. Shearing the ewes has many advantages. The physical signs of parturition are more apparent if the ewe is not hidden underneath a thick layer of wool. When the lamb passes out of the birth canal, it does not come into contact with the ewe's dirty wool. The suckling lamb can find the ewe's teats more easily if no wool tags are in the way; lambs may mistake these tags, which are often dirty and infested with bacteria, for teats and suck on them instead. If the birth happens to be abnormal, providing assistance is easier if no excess wool is in the way. Identifying a prolapse before it becomes serious is also easier. Studies show that a shorn ewe is less likely to lay on her offspring, and she is more likely to find shelter for both herself and her lamb in bad weather.

Producers may also crotch their ewes instead of completely shearing them. Crotching involves shearing the wool from the crotch, udder, and stomach a few inches in front of the udder. The limited shearing involves less labor and holds many of the same advantages provided by completely shearing the ewe.

Another practice common among producers is called facing, which involves trimming the wool from the ewe's face. Many producers will face and crotch the ewe at the same time. An advantage of facing ewes is preventing wool blindness, or the obstruction of vision due to a thick growth of wool around the eyes, as shown in Figure 3.1. If the ewe has trouble seeing her lamb, she will not tend to it as much as she would if she could see. A ewe with an open face tends to seek shelter in poor weather conditions for both herself and her lamb more often than a closed-faced ewe.

*Figure 3.1 - Wool Blind Ewe*



At lambing time, producers must keep a very close eye on their ewes. Pregnant ewes prefer to give birth without confinement, but for safety reasons many producers choose to bring them into lambing pens after the lambs are born. Usually the lamb and ewe will have established a bond that allows the producer to identify which lamb belongs to which ewe if more than one ewe has given birth. Other producers prefer to confine ewes during the lambing season to observe them more easily. The producer can then be present to assist the ewe if the birth is abnormal.

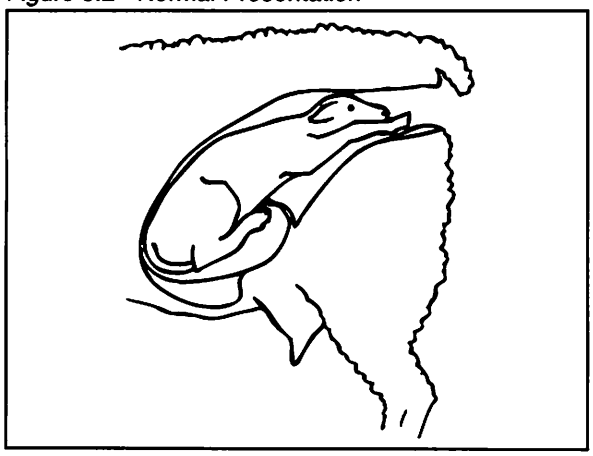
Producers should have their lambing pens ready for pregnant ewes close to parturition. They should also have jugs, or panels used to separate ewes in pens, ready so that the ewe and her offspring have a safe and private place in which to bond. These areas typically range in size from 4 feet by 4 feet to 6 feet by 6 feet and should provide a clean, dry environment for the ewe and her lamb. Pens should have plenty of clean, dust-free bedding, a small hay feeder, and water in a container that is small enough so that the lamb cannot fall in and drown. The facilities should be cleaned and disinfected before lambing. Although the area should be free of drafts, it should have good ventilation to avoid ammonia buildup from manure and urine. If heat lamps are used, they should be positioned to prevent the ewe from coming into contact with them. Ewes and their lambs can be grouped for lambing, but pens should hold no more than ten ewes and their lambs.

## Assisting With Normal Births

Producers should be present during lambing time, which is the most labor-intensive time of the year for any lamb production system. Producers may go so far as to sleep in the barns near their ewes so they may be there to give assistance at night.

Producers should give the ewe time to give birth unassisted. The beginning of the birth process is marked by the ewe lying down on her side with her nose pointed upward as she begins to strain. The ewe should be able to give birth within an hour and a half to two hours after she begins labor. The normal position for a lamb to exit the birth canal of the ewe is with the front feet first and the head between them, which is illustrated in Figure 3.2. After the birth, the producer should wipe the mucus from the newborn lamb's nose.

*Figure 3.2 - Normal Presentation*



If the lamb has trouble breathing, the producer should hold it firmly by the hind legs and swing it sharply up and down in an arc to expel any mucus lodged in the lamb's respiratory tract.

## Assisting With Abnormal Births

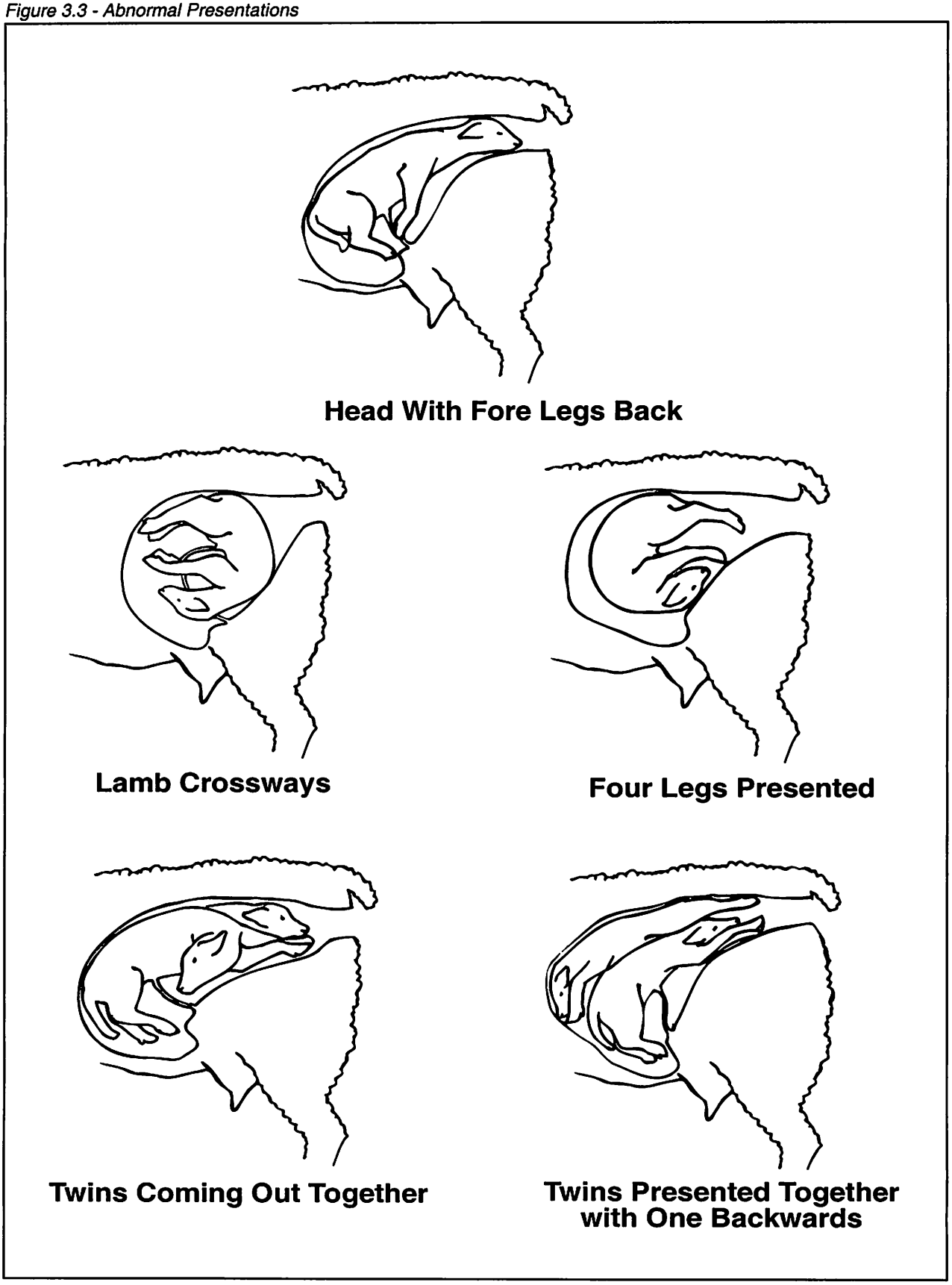
If a ewe has been struggling for an hour after the water bag has broken or for two hours of labor with no success, the ewe requires assistance. The first step is to determine whether the lamb is in an abnormal position, which is anything other than front feet and nose first. Many of the abnormal presentations in sheep are similar to those for calves pictured in Lesson 1 of this unit. Other abnormal presentations are pictured in Figure 3.3.

Some abnormal presentations are more serious than others, and the producer should determine the position of the lamb before trying to pull it. The producer should begin by washing his or her hands and arms as well as the genital area of the ewe and then putting on gloves. He or she must lubricate one hand and pass it gently into the birth canal of the ewe. The producer feels for legs to determine if the legs are the hind legs or the front legs. The hind legs have an obvious tendon, and the knee joint bends in the opposite direction from the joint at the back foot. The front legs have prominent muscles in the upper leg, and both joints bend in the same direction. For multiple births, the producer may also need to determine which legs belong to which lamb.

After the producer has determined the lamb's position, she or he should attempt to adjust it to the normal presentation. The repositioning is done as gently as possible, taking extra care not to snap the umbilical cord. If the cord is broken while the lamb is still within the ewe's body, the lamb will naturally try to breathe and will suffocate within minutes. Some devices are available to help reposition a lamb. Lambing snares and loops can be very useful tools for both repositioning and pulling.

When the lamb is the normal position, the producer assists the ewe by pulling the lamb outward and downward in conjunction with the ewe's contractions. The ewe may be exhausted at this point. If the producer pulls the lamb, the activity can stimulate the ewe into trying to deliver the lamb again.

*Figure 3.3 - Abnormal Presentations*



If it is too difficult to reposition the lamb to the normal presentation or if the ewe is in great pain and has been in labor for more than an hour, a veterinarian should provide assistance to the ewe. The veterinarian may perform a caesarian section or other procedures that require experience and training.

### Ewe Management After Parturition

After the stress of lambing, a ewe is thirsty. She should be given warmed water, perhaps with a little molasses in it to provide energy. If the water is very cold, ewes tend to reject it.

The producer should evaluate the ewe's milk production. Poor production can lead to poor lamb performance, and the ewe's udders should contain plenty of milk. However, if the ewe produces too much milk in the first day, the producer may want to milk the ewe and freeze some of her colostrum for emergency use in the future. Colostrum can be kept in a freezer for more than a year if it is frozen solid in a sealed container. Mixing frozen colostrum with that of other ewes is useful for providing antibodies.

The feed intake of the ewe should also be evaluated. The amount of feed should be halved for the first two to three days after parturition. Excess feed may cause the ewe to produce more milk than the offspring can consume, which can lead to mastitis problems.

### Records

Parturition records are useful in monitoring ewe and ram performance and keeping track of rates of gain for their offspring. Producers should record the birth date, sire, identification number, sex of the lamb, type of birth (single or twin), type of rearing, birth weight, milking ability, inverted eyelids and other defects, and problems during parturition such as a prolapse or malpresentation.

### Summary

A good flock manager will be familiar with the common signs of parturition. Before the onset of lambing, equipment and pens should be cleaned and ready for use. Many producers choose to shear, face, or crotch ewes before lambing. During a normal birth limited assistance is required, although producers should be sure that the newborn lambs are breathing and have nursed. If the ewe has problems during lambing, the producer should attempt to assist, although in some cases a veterinarian may need to be called. After parturition, the ewe should receive proper care. Also, records should be accurately filled out for both the lamb and the ewe.

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## *Lesson 4: Foaling*

With most livestock species, females approaching parturition show specific signs. Horses are an exception because at times figuring out when a horse is going to foal may be very difficult. A wise breeder will have kept accurate breeding records so he or she will know when to begin observing the mare closely for signs of parturition.

### Signs of Parturition

Several physical signs indicate that a mare will soon foal. A few days before foaling, the foal may drop as the ligaments of the pelvis relax. The mare will have a sunken appearance along the flanks and on both sides of the root of the tail. A mare's udder is likely to fill with milk close to parturition, and waxing occurs in about 50 percent of mares. Waxing refers to the appearance of dried colostrum, which has a waxy texture, on the ends of the mare's teats. If waxing is apparent, the mare is likely to foal within 24 to 48 hours. About 24 hours before foaling, the mare's vulva may appear relaxed and elongated for the act of giving birth.

The mare's behavior may also signal foaling. Mares do not like to be watched during parturition, and they will often seek solitude, avoiding other horses as well as humans. A mare may also show irritability toward other horses. She may demonstrate restlessness by repeatedly laying down and then standing back up again. A mare may paw at the ground with her hooves and curl her upper lip. Some mares will actually prepare an area for foaling by making a nest with the bedding or urinating in small amounts around the area. Sometimes mares begin sweating, either in patches or all over, when they are about to give birth.

Breeders should watch mares closely to check for the passage of the cervical plug, which is a wad of thick mucus that closed off the cervix during gestation. If the cervical plug has been passed, the mare will foal within a few hours.

The breaking of the water bag may not be apparent in mares. Sometimes it will be obvious, with water gushing rapidly from a mare's body. Other mares may only experience a slow trickling of water from the vulva that is hardly noticeable.

### Management Practices for Foaling

Before foaling occurs, the breeder should assemble any necessary equipment and supplies. These materials should include clean towels, iodine solution, tail bandages, tape, soap, obstetrical gloves, and obstetrical lubricant. These supplies should be kept in an easily accessible area.

A mare kept in a stable should be moved to foaling quarters two weeks before the expected foaling date. A foaling stall should be large enough to allow the mare to lay down and stretch out. It should be free of drafts and have clean, deep, dust-free bedding.

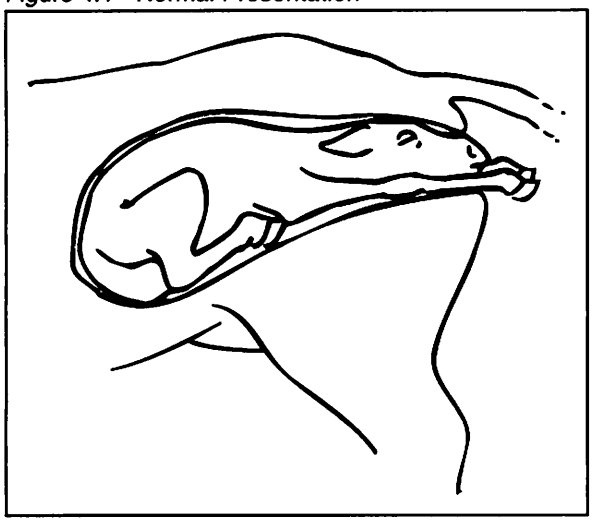
The breeder should take several steps to prepare the mare for foaling after placing her in the foaling quarters. The mare's tail should be wrapped and taped to prevent germ-laden dirt and debris from touching the foal as it exits the birth canal. The wrappings should extend 12 to 14 inches from the base of the tail. As a further precaution against the spread of germs, the external genital area is washed with soap followed with a mild disinfectant rinse of 7 percent iodine solution. The breeder should also wash and disinfect the udder area so the foal does not ingest dirt and bacteria while attempting to nurse. Dirty buildup should be removed from between the halves of the udder. The area is then rinsed with clean water so the foal does not swallow any disinfectant when nursing.

Mares may also foal on pasture. A mare should not be pastured with geldings, because they may harm the newborn foals. The pasture should be as free as possible of hazards, such as old fencing supplies, gullies and ditches, or other equipment. If possible, mares should be kept where the breeder can observe them easily because an abnormal birth requires rapid assistance.

### Assisting with Normal Births

The mare should give birth within an hour after the onset of sharp contractions. The actual passage out of the birth canal can occur in as little as 15 minutes and generally should take no longer than 45 minutes. Sometimes a mare may stop pushing and rest with the foal halfway out of the birth canal. In a normal birth, the foal will exit the birth canal front feet first with its nose between its legs, as shown in Figure 4.1.

*Figure 4.1 - Normal Presentation*



Mares often prefer to lay down while foaling; however, if they are aware of being observed, they may choose to foal standing up. In this case, the breeder should support the foal to avoid injuries caused by dropping to the ground.

When the foal's head is outside the mare's body the breeder should remove the membranes that cover the muzzle. The membranes should be removed even if the foal has not been expelled completely from the mare's body because the umbilical cord breaks when the foal is about halfway out. Once the cord has broken, the foal can only receive oxygen from its own lungs and will attempt to breathe. Mucus is cleaned from the foal's mouth by reaching in and gently removing any excess fluids. The breeder should make sure that the foal is breathing freely.

If a foal is not breathing, the breeder should stimulate respiration. Many breeders stick a piece of straw inside one of the foal's nostrils to cause it to sneeze. Others throw a glass of cold water over the foal's head to shock it into breathing. A common approach is to hoist the foal up by its hind legs so that it hangs upside down. The breeder cleans its throat out with his or her hands and then begins to slap the foal repeatedly on the chest, first on the right side and then on the left. This practice helps clean out mucus that may be lodged inside the foal's respiratory tract. The breeder should continue to slap the foal for ten minutes, stopping every three minutes to tickle its nostrils with a piece of straw, until it starts to breathe. A more scientific approach is to use an oxygen mask from a veterinarian; the mask is placed over the foal's muzzle to force oxygen into its lungs. A veterinarian can also inject the foal with a drug that stimulates the areas of the brain that control the respiratory system.

The navel cord has a natural breaking point, but sometimes it does not break immediately. The newborn foal may remain connected by the navel cord to fetal membranes that are still within the mare's body. As long as the mare is calm, the two animals should be left alone. The blood from the membrane will be passed on to the foal. The breeder should also let the foal alone if it is attached to membranes that the mare has already expelled. The cord is usually broken as the foal struggles to stand up.

### Assisting with Abnormal Births

The mare does not require assistance unless she has not foaled after an hour of labor. The veterinarian should then be called immediately. Both the mare and the foal can be lost rapidly if complications occur. Abnormal births are dangerous in mares due to their strong abdominal muscles. The mare's muscles will continue to work to expel the abnormally positioned foal, injuring the foal and damaging the mare internally. To avoid losses during foaling, some breeders choose to have a veterinarian on hand to ensure safe and successful parturition.

As stated in the preceding section, the normal presentation for foals has the front legs and head appearing from the birth canal first. Having one leg appear 6 to 8 inches ahead of the other is not considered abnormal, but any other position is. If the mare is trying to foal and part of the foal is showing but no progress is made within the next 3 or 4 contractions, the breeder or a veterinarian should examine the mare to determine if the foal is positioned abnormally. An abnormal presentation should be treated as an emergency, and a veterinarian should be called if one is not already present.

To determine the position of a foal, the breeder should put on obstetrical gloves before sliding a lubricated hand gently into the mare's vulva, taking care to avoid catching his or her arm between the foal and the mare's pelvic bone. The mare is capable of breaking the breeder's arm if she tries to push the foal from her body. To make matters worse, the mare is stimulated to push harder by the increased pressure from the arm.

Determining the position of the foal can be difficult. The breeder should try to find the legs and feet to determine the direction of the foal. The hind legs have a small, triangular hock, while the front legs have large, bony knees. If the feet protrude from the mare's body, the hind feet will usually point down, with the bottom of the hooves facing upward. The front feet will point upward, with the bottom of the hooves facing downward. The breeder should try to feel for the tail to confirm whether the hind legs are being presented.

After determining that the presentation is abnormal and calling the veterinarian, the breeder should try to correct the foal's position while waiting for the veterinarian to arrive. Because of the severity of the problems related to abnormal births, trying to correct the position is better than waiting. For example, if the foal's head is bent back or if three legs are presented at once, the foal must be pushed back into the birth canal. It can then be turned around to straighten it out into the normal foaling position.

If the foal is exiting the birth canal hind feet first, it must be pulled from the mare's body within five minutes, because the umbilical cord will break when the foal is halfway through the mare's pelvic bones. To assist the mare, the breeder should grasp the hind feet of the foal using clean towels to get a good grip. The key to assisting the mare is not pulling the foal straight outward, which will wedge the hips of the foal in the birth canal at the mare's pelvis. Instead, the foal should be pulled downward, as if the mare's hind heels were to meet the foal's. The breeder should try to work with the mare, pulling fairly hard but timing each pull to the contractions of the mare.

Sometimes a foal's front feet will push into the mare's rectum or in the direction of the rectum. The position will be apparent externally, with the mare exhibiting a bulge in the rectal area. This condition is dangerous for both the mare and the foal. The sharp hooves of the foal can rip through the dividing tissue between the rectum and the vagina, an extremely serious and painful experience for the mare. The breeder should immediately grip the foal's hooves and pull forward and downward, away from the rectum, until the foal exits the birth canal normally.

## Management of the Mare after Parturition

After the mare has given birth, a breeder should observe the placenta, which should be expelled from the mare's body within one or two hours after the birth. The afterbirth should be spread out on the ground and examined to be sure that it is normal and that none of it remains inside the mare. A retained placenta can lead to a variety of diseases and bacterial infections. If the placenta has not been passed after eight hours, a veterinarian should remove it; the breeder should never attempt to remove the afterbirth by pulling on it, because small pieces may be retained inside the mare. If the placenta is abnormal, the mare should not be bred during her post-parturition estrus.

The breeder should examine the mare after foaling, especially if it was a difficult birth. Gently rinse the mare's genital area with iodine. The vagina should be spread apart and searched for any signs of bruising or tearing. After foaling, the vaginal area of the mare will usually be a little redder than normal. Bruises will appear blue-black.

After a difficult birth, the mare should have an internal examination to determine if her reproductive organs were damaged. The breeder should insert an arm into the vagina and feel around for cuts or tears. The mare is healthy if the vaginal walls feel smooth. If any tears are present, a veterinarian should further inspect the mare to determine if they need suturing.

## Records

Information about the birth should be saved for record keeping purposes and to help determine whether a mare should be bred in the future. Among the items included in the records are the sire, date of foaling, temperament of the mare at foaling, any problems with parturition, vigor of the foal, sex of the foal, and identification of the foal.

Mares often exhibit the same signs of foaling with every foal born. To predict foaling in the future, a breeder may want to record the number of days of gestation, when the udder begins to fill, and when the mare begins to wax.

## Summary

Like other livestock, mares will show signs of parturition, including both behavioral and physical signs, although they may be more difficult to detect in horses. Before parturition, the mare should be moved to foaling quarters and prepared for foaling. Mares that will foal on pasture should be held in clean, safe areas that are easily accessible. When parturition occurs, the foal will normally be presented with the front feet forward and the nose between them. The birth should occur within an hour after the start of contractions. If the birth is abnormal, it should be considered an emergency, and the veterinarian should be called as soon as possible. The breeder should attempt to assist with the delivery while waiting for the veterinarian. Proper postpartum care for the mare is necessary after foaling to ensure that the mare remains healthy. Accurate records should be kept for both the foal and the mare, particularly records that will help the breeder predict when foaling will occur in the future.

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## *Lesson 5: Incubation and Hatching of Poultry*

Unlike other livestock, the majority of embryo growth takes place outside of the mother's body in poultry species. Humans have successfully replicated the natural environment a hen would provide when sitting on eggs by creating mechanical incubators. The eggs are placed in incubators while the embryo develops.

### Incubation Periods for Poultry

Egg incubation periods vary for different poultry species. Table 5.1 shows the incubation periods for several poultry species.

*Table 5.1 - Incubation Periods*

| Species | Days of Incubation |
|---|---|
| Chicken | 21 |
| Turkey | 28 |
| Duck | 28 |
| Muscovy duck | 33-35 |
| Goose | 28-34 |
| Pheasant | 23-28 |
| Bobwhite quail | 23 |
| Guinea | 28 |

### Appropriate Conditions for Incubation

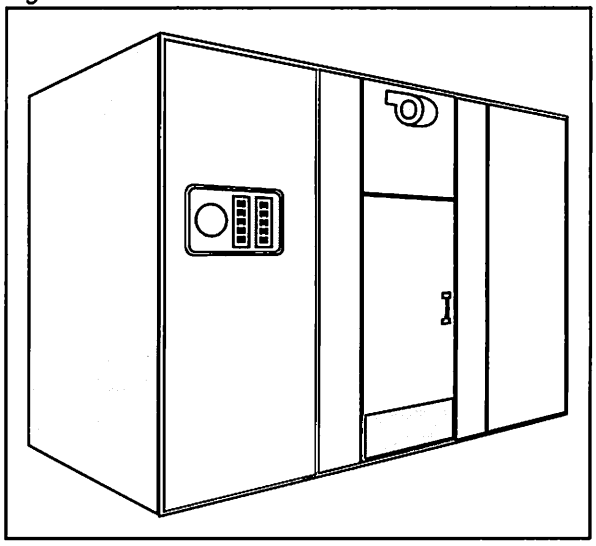
Before being placed in incubators, hatching eggs can be stored in a room at cool temperatures for up to two weeks. Producers use this flexibility to their advantage by placing full loads of eggs in the incubators. They can then schedule specific hatching dates.

Eggs should be set in the incubators with the large end up. The embryo will then develop with its head in the air pocket of the egg. When it begins to use its lungs, it will breathe the air in the pocket. Eggs should also be placed with the large end up to allow for pipping, which is when the bird pecks the shell open. If the small end is up, it will not have enough space to properly reposition its head after the first peck and will be unable to hatch.

Several factors are important for hatching efficiency. Four of these factors relate to the environment provided by the incubator. Temperature, humidity, turning, and ventilation are crucial to the proper development of the embryo within the egg. A fifth factor that affects hatching efficiency is sanitation.

Both still-air and forced-draft incubators are used for poultry production. Most modern incubation systems use forced-draft machines because they maintain a more uniform environment within the incubator. A commercial incubator is shown in Figure 5.1.

*Figure 5.1 - Commercial Incubator*



When incubating chicken eggs, a still-air machine is set at 101 degrees Fahrenheit, while a forced-draft machine is set at 99.5 degrees Fahrenheit plus or minus 0.5 degrees. Turkey eggs are usually incubated at 99.5 degrees. Changes in the temperature within an incubator will have a dramatic effect on the hatchability of the eggs. Developing embryos are extremely sensitive to high temperatures, which will reduce hatching rates. During the last phases of embryo development the eggs will give off enough heat to change the temperature within the incubator. Commercial incubators feature cooling devices that will counteract such heat increases.

Relative humidity in the incubators should be set at 65 percent for chickens and 80 to 85 percent for turkeys. This level of humidity will prevent moisture from evaporating from the eggs. Without proper humidity, chicks will stick to the shell membrane. They will have trouble hatching or may not hatch at all.

Developing embryos will also stick to the shell membrane if the eggs are not turned regularly. In large commercial incubators, the eggs are set with the large end up and rotated 90 degrees five or more times a day. Some of these machines will turn each egg individually, while others simply turn the entire tray.

Ventilation is also crucial to proper embryonic development. The incubator must provide a constant supply of oxygen and remove the carbon dioxide given off by the embryo during respiration. Commercial incubators have precise programs that are able to regulate the exchange of oxygen and carbon dioxide without disrupting the humidity and temperature levels. Proper ventilation is necessary in the room that holds the incubator so that the machine has enough fresh air to pump into the incubator.

Even if a manager provides incubated eggs with proper temperatures, humidity, turning, and ventilation, hatchability rates will be low if sanitation is poor. Unsound eggs should not be incubated, including those that have cracks or are abnormally shaped, have droppings on them, or are dirty. The incubators should be cleaned and disinfected between batches by fumigating with an effective sanitizer according to recommended procedures.

## Appropriate Conditions for Hatching

Three days before the expected hatching date, chicken eggs should be transferred gently but rapidly to the hatching incubators. Hatching incubators are set to provide slightly different environmental conditions. The temperature will be slightly lower, being set at 98.5 degrees Fahrenheit for chickens. The relative humidity should be set at 70 percent. Ventilation should also be increased. Eggs do not need to be turned at this point in the chicks' development, so they are simply set on their sides in a hatching tray. It is important that the chicks hatch on their own with no assistance from the producer. The trays are removed from the hatching incubators after hatching, and the newly hatched birds are taken to a hatchery service room for processing.

## Records

The machine number, date set, and number of eggs set should be recorded when eggs are placed in the incubator. Temperatures should be checked and recorded periodically to identify fluctuations. During incubation, the eggs should be tested for infertile eggs and dead germs, which are embryos that have died; the date of testing, the number of infertile eggs and dead germs, and their percentage of the total number of eggs should be recorded. At hatching, hatching rates are recorded by noting the number of chicks and the percentage of fertile eggs. Records kept in hatchery systems may also include information on ventilation, turning, and relative humidity for each batch of eggs.

## Summary

The goal of incubation is to simulate the natural environment that a hen would provide for her eggs for the appropriate incubation period. Factors that must be considered when placing the eggs in incubators include temperatures, relative humidity, turning, ventilation, and sanitation. The eggs are moved to hatching incubators three days prior to the expected hatching date. Records that should be kept in incubation and hatchery management include number of eggs set and number hatched, as well as other factors controlled by the incubators.

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## *Lesson 1: Health Problems in Cattle*

Raising any type of livestock is hard work with many uncertainties. Many of these uncertainties, such as prices, cannot be controlled directly by the producer. One factor that no one can totally control is the health of the stock. No matter how good of a manager a producer may be, he or she will encounter livestock health problems. Knowing what to do if these problems occur is the key to resolving them quickly and producing healthy cattle.

### Observing Herd Health

One important aspect of achieving and maintaining good herd health is proper observation of stock. Knowing the animals is important. Producers should try to become as familiar with their stock as possible. Becoming familiar with the stock makes it easier to observe the health condition of different animals. If a producer knows what an animal normally looks like when it is healthy, then he or she will be able to tell when the animal looks abnormal and is possibly sick or injured. The frequency of observation depends on a producer's particular herd health situation. If a herd regularly displays good health and has no major problems, checking them as often as they would be checked if the animals were in poor health is not necessary. For most healthy animals, viewing them once daily is sufficient. If a producer is experiencing a particular problem, such as a disease in the herd, she or he may want to examine them more often. During calving time, observing animals more frequently may be necessary in case any cows or heifers need assistance.

Practices for observing herd health in a beef cattle herd may vary. The way in which animals are observed depends on personal preferences. Some people may choose to drive through them, while others may call them in and observe them while feeding. When animals are observed, producers must see them all. A producer should always be prepared to go looking for an animal if he or she cannot account for all of them.

To ensure the production of the highest amount of quality milk possible, maintaining good health in the dairy herd is imperative. Watching for health problems is sometimes easier in dairy cattle than in other types of livestock because the animals can be observed at milking time every day. Observing non-milking animals is important as well. A producer should take time each day to observe animals, including dry cows, steers, and heifers, and check for any abnormalities. Any problems, no matter how small, should be dealt with immediately so that they do not affect the production of milk within the operation.

No matter which observation method is chosen, counting the cattle often is a good idea. The absence of an animal may be a sign that it is sick or injured. By knowing that an animal is missing, the producer may be able to get to an animal that is injured or too sick to be up and with the herd. Keeping a count of maternity cows, or cows or heifers that are nearing parturition, can also let a producer know if he or she has an animal that has begun parturition.

### Indications of Health Problems

Early detection of diseases or injury is important to the proper diagnosis and treatment of the problem. Detecting problems is not always easy, but regular observation of animals allows the producer to notice common signs of illnesses and take the proper steps toward a solution. Some common signs usually point to poor animal health. These signs include loss of appetite, droopy ears, and coughing or wheezing. An unhealthy animal may lack spirit and appear depressed, hang its head, have a hump in its back, or separate itself from the rest of the herd. Signs that are commonly observed in dairy cattle are a decrease in the production of milk, abnormalities in milk such as clumping or blood, and a swollen or misshapen udder. These signs usually show themselves as a result of one or more conditions that are seen mainly in dairy cattle.

When signs of health problems are observed, producers should try to check the vital signs of the animal in question. Body temperature can be taken rectally. If the temperature varies by more than a couple of degrees either way, it should be considered a problem, and the producer should look for a reason for the variation. A veterinarian can help decide if an animal's respiration or heart rate is abnormally high or low. Respiration rate can be measured by listening to the animal breathe and counting breaths per minute. Heart rate is measured by counting the number of beats per minute.

Abnormal vital signs can sometimes be a sign of a health problem. Important vital signs include body temperature, respiration rate, and heart rate. Normal vital signs for beef cattle are shown in Table 1.1.

*Table 1.1 - Normal Vital Signs*

| Vital Sign | Average |
|---|---|
| Temperature | 101.5° Fahrenheit |
| Respiration Rate | 30 breaths/min. |
| Heart Rate | 50 beats/min. |

## Health Problems in Beef Cattle

As with any type of livestock, no matter how well cattle are managed, problems with herd health will be experienced from time to time. Some problems that producers face, and some possible methods for dealing with them, are described in this section.

Scours (bacterial and viral) - *Escherichia coli*, rotavirus, corona virus, feeding too much milk, and improperly formulated milk replacers are common causes of scours. Bacterial or viral scours can cause a rough coat, weakness, loss of appetite, diarrhea, and dehydration. These symptoms are usually more severe when associated with viral scours. This condition can be treated with fluids (intravenous or oral) to prevent dehydration and antibiotics to prevent secondary infections. In advanced cases of viral scours, fluid treatment is not usually effective, and the animal dies within several days of the onset of the illness. Early diagnosis is important.

Bovine viral diarrhea (BVD) - BVD is an infectious disease caused by bacteria and viruses. It causes diarrhea and digestive ulcers, as well as coughing, fever, nasal discharges, and oral lesions. This disease may result in reduced feed intake. It can also cause damage to the immune system. BVD can be diagnosed through careful visual observation, looking for depression, lack of appetite, and separation from the herd. BVD can also be diagnosed through blood testing. It has a low mortality rate, except for cases of acute BVD, which can kill the animal in 48 hours. Producers should vaccinate animals for BVD during calfhood, but the disease can be treated with antibiotics and sulfonamide drugs if it is contracted.

Brucellosis - Brucellosis is caused by a strain of bacteria called *Brucella* that is dangerous to humans, causing undulant fever. In cattle, the disease is also known as contagious abortion or Bang's disease. Humans can also contract brucellosis. The bacteria is spread through any physical contact between animals and can affect an entire herd. It may also be spread through milk, an aborted fetus, or afterbirth. This disease causes abortions during the last half of pregnancy in infected animals and can render cows and bulls sterile. It also causes decreased milk production, weight loss, and lameness. Signs of brucellosis include a drop in fertility, poor conception rates, uterine infections, and inflamed joints. Animals should be vaccinated for brucellosis during calfhood. No treatment exists for this disease. Animals that catch brucellosis must be slaughtered to keep it from spreading.

Vibriosis - Vibriosis is a reproductive disease spread among females by the bull during breeding. It is caused by bacteria in the reproductive tract of cattle. Infected cows experience delays in becoming pregnant and come into heat at irregular times. It also causes abortions and decreased fertility. This condition may be hard to diagnose due to a lack of outward signs. Animals can be vaccinated for vibriosis. Vibriosis has no treatment. Cows that have recovered have a strong immunity that will prevent reinfection for a period of time.

Leptospirosis - Leptospirosis is caused by bacteria that thrive in water. The disease is spread through the urine of infected animals, including wildlife and rodents. Cattle become infected through abrasions or when mucous membranes in the eyes and mouth come in contact with the bacteria. Leptospirosis causes fever, rapid respiration, lack of appetite, and abortions. It can cause a drop in milk production and an inflamed udder. Milk may also be bloodstained or yellow. Leptospirosis can be fatal to calves. Animals can be vaccinated for leptospirosis or treated with antibiotics if they contract the disease. Producers should try to isolate all infected animals.

Infectious bovine rhinotracheitis (IBR) - This disease, which is also referred to as rednose, can cause respiratory ailments, nasal discharge, fever, abortions, pinkeye, and stillborn calves. It is spread by coughing, nose-to-nose contact, and sexual contact. Animals should be vaccinated for IBR. Antibiotics will not cure the condition but may cut down on secondary infections. Infected

animals should be isolated from the rest of the herd.

Bovine respiratory syncytial virus (BRSV) - BRSV causes an acute viral pneumonia in preweaning and weaning calves and yearlings. Infected calves may suffer from a dry, hacking cough. Other symptoms include slobbering, tearing, clear nasal discharge, increased respiratory rate, and mild depression. The treatment for BRSV includes antibiotics, antihistamines, vitamins, and supportive therapy (administering fluids through a stomach tube and keeping the animal out of the cold). Some animals may require increased fluids to combat dehydration. BRSV vaccine is available. Two injections of this vaccine are needed to produce adequate immunity.

Shipping fever - Shipping fever is a respiratory disease that affects livestock. Shipping fever affects calves about one week after they are transported from the cow/calf operation where they were born to the feedlot where they will finish their growth. It is the biggest killer of beef cattle in feedlots. This disease is caused by three different bacteria: *Pasteurella haemolytica, P. multocida, and Haemophilus somnus.* Animals that look healthy before being transported may arrive at their destination with decreased appetite, fever, diarrhea, coughing, and nasal discharge. If they survive, beef cattle grow poorly and need more time and feed to reach market weight. A vaccine for shipping fever is available to prevent the disease.

Parainfluenza (PI-3) - Parainfluenza generally works with other diseases, including IBR, BVD, and BRSV. It is found worldwide, infects other species of farm animals, and can infect humans. It is described as a form of shipping fever and is difficult to distinguish from other virus-induced pneumonia in cattle. Symptoms include increased respiration rates, coughing, fever, and watery to yellow discharge from the eyes and nose. Prevention includes good management practices, such as feeding good quality feeds and providing ready access to fresh water and shelter during adverse conditions. This disease is also prevented through vaccinations. Treatment involves administering antibiotics.

Pinkeye - Pinkeye is an infectious eye ailment. A bacterial form of this disease may be affected by a vitamin A deficiency, eye injuries, dust, insects, or strong sunlight. The disease is spread by direct contact between animals and by flies. Symptoms include a liberal flow of tears, a tendency to keep the eyes closed, and redness and swelling of the membrane lining the eyelids and sometimes the visible part of the eye. Advanced stages may include a discharge of pus and ulcers of the cornea. If unchecked, blindness may occur. The disease is widespread across the United States and affects about 3 percent of all cattle. Prevention involves good nutrition with adequate vitamin A in the ration, vaccination, and controlling flies. The most common treatment is the application of antibiotics or sulfa drugs to the affected eye in the form of an ointment, powder, or spray. Some producers use a commercially produced eye patch that drops off in seven to ten days.

Fescue toxicosis - Fescue toxicosis, also called summer slump, is caused by the endophytic fungus *Acremonium coenophialum.* It can cause a reduced rate of gain, lameness, greater susceptibility to heat stress, roughened hair, reddish hair on a black animal, and no milk production. In extreme cases, it results in the loss of extremities, such as hooves and tails. The best way to prevent the disease is feeding endophyte-free fescue. The effect of the fescue can also be diminished by adding legumes to endophyte-affected fescue stands.

Bloat - Bloat is commonly caused by the formation of a stable foam in the rumen, which traps the gasses produced during fermentation in the stomach. Bloat causes distention of the left side of the abdomen. Bloat can lead to a decrease in milk production. Other symptoms include frequent urination, heavy breathing, and restless movements. It can cause death due to suffocation if left untreated. A cannula may be inserted into the rumen from outside the body for immediate relief of pressure in extreme cases. Sometimes a larger boring tool may be needed. A stomach tube can also be inserted into the rumen through the throat to release gases. A defoaming agent, which neutralizes the gas, may be needed if the animal has a type of bloat called frothy bloat.

Grass tetany - Grass tetany is generally found in cattle during lactation. It occurs most often when cattle are grazing on pastures that are deficient in magnesium. Symptoms include excitement, loss of appetite, loss of coordination, trembling, convulsions, and coma. Death can occur quickly, sometimes within 30 minutes. Prevention includes feeding magnesium in the ration in areas where

this element is deficient in the soil. Including legumes in the ration also helps to prevent grass tetany. Treatment involves injecting a calcium and magnesium solution into the jugular vein as soon as this problem is identified. The animal should be handled carefully because stress may kill it.

Nitrate poisoning - This condition is caused by animals consuming feeds with high nitrate levels due to the application of fertilizer, drought, or other causes. It may also be caused by the animals ingesting nitrates through contact with fertilizers or drinking pond water containing fertilizer. The actual poisoning is caused by the nitrate being converted to nitrites by the digestive system. Symptoms include accelerated respiration, accelerated pulse rate, bluish mucous membranes, frothing from the mouth, diarrhea, frequent urination, loss of appetite, weakness, and a staggering gait. Freshly drawn blood may be dark brown in color. Prevention involves good management to limit access to sources of nitrates. If a producer is in doubt about the nitrate level in feed or water, she or he should have it tested. Treatment involves having a veterinarian administer an intravenous solution consisting of a 4 percent solution of methylene blue in either a 5 percent glucose solution or a 1.8 percent solution of sodium sulfate.

Prussic acid poisoning - Under certain conditions, sorghums and some other plants are capable of releasing prussic acid, making them potentially dangerous for grazing. Generally, the plant has to be damaged to cause the acid to form. This damage could be the result of chewing, a hard freeze, or mechanical action such as that caused by a hay crimper. Once ingested by the animal, the acid is readily absorbed by the bloodstream. It prevents the cells from receiving oxygen. Prussic acid is a fast-acting poison, and animals are often found dead. Symptoms that may be observed include excitement, a rapid pulse, muscle tremors, rapid and labored breathing, staggering, and collapse. Freshly drawn blood from animals affected by prussic acid poisoning is bright cherry red just prior to and during death. The problem is that once the symptoms are noticed, it is often too late to save the animal. Prevention involves management practices: avoiding turning cattle into a new sorghum field until they have been fed some hay, using rotational grazing methods to prevent the overgrazing of lush young growth, allowing plants to reach 18 to 24 inches in height before grazing, preventing grazing after a frost until all the plants have cured, and avoiding the application of excessive nitrogen fertilizer. The only treatment involves the administration of sodium thiosulfate and sodium nitrate by a veterinarian.

## Health Problems in Dairy Cattle

Dairy cattle are susceptible to all of the diseases of beef cattle discussed in the previous section. In addition, some illnesses are more commonly associated with dairy cattle, although they may sometimes affect beef animals. Some common dairy health problems are discussed in this section.

Mastitis - Mastitis is an illness caused by bacteria, either *Streptococci, Staphylococci, or E. coli,* that infects the mammary tissue and ultimately affects milk production. The bacteria enters the udder through the teat end. Mastitis is very common and is the most costly disease among dairy cattle in the United States. It can be caused by injury or leaving the milker on too long. Mastitis can result in inflammation of the udder, decreases in milk production, fever, and abnormality in milk, depending on the type contracted. Milk abnormalities associated with mastitis include watery milk or yellow clots in the milk. Mastitis can be treated with intramammary or intravenous injections of antibiotics. The type of antibiotic used is dependent on the type of bacteria that is causing the disease.

Milk fever - Milk fever is a result of a blood calcium deficiency. It occurs at the onset of lactation within 72 hours of parturition. Milk fever causes muscle weakness in the cow and can cause a lack of coordination. This disease can also cause loss of appetite and dullness. If untreated, a coma ensues, and the cow eventually dies. Milk fever can be prevented by properly balancing calcium and phosphorous in a 1:1 ratio in the diet of dry cows. Feeding grassy forages can also help prevent milk fever; legumes should be avoided during the dry period. Supplementing dry cow rations with anionic salts may also be possible. Treatment involves an intravenous injection of a calcium product, such as calcium borogluconate.

Ketosis - Ketosis is a nutritional problem that may be seen in cows during period of high lactation shortly after calving. A lack of carbohydrates in the diet results in an excessive metabolism of stored fats to supply energy. As a result of this process, ketones accumulate in the body and

become toxic to the animal. Animals exhibit lack of appetite, depression, weight loss, a fruity odor to the breath and milk, and reduced milk production. Prevention involves good management of the cow's diet, especially during the week before calving. Treatment of ketosis involves intravenous administration of glucose or a glucocorticoid injection.

Laminitis - Laminitis, also referred to as founder, is usually caused by overeating concentrated feeds or lush pastures. Symptoms include extreme abdominal pain, high fever, and a reluctance to move. If neglected, it causes a degeneration of the joining between the foot and the laminae, which are the tissues beneath the outer hard surface of the hoof. The disease can cause distortion of the hoof. If the degeneration is severe, the coffin bone may rotate and come through the bottom of the foot. This condition does not result in death, but it does cause poor milking performance. Prevention involves good management to avoid overeating. No standard method of treatment exists. Mineral oil may be given to the animal to aid in the passage of the feed. Painkillers may be given to provide relief, and antibiotics are supplied to prevent infections of the foot. Foot trimming may also be required.

Uterine infections - Uterine infections are caused by bacteria at the time of calving. Signs of an infection include a swollen vulva as well as inflammation and the appearance of pus in the uterus. Early detection is important in the treatment of the infection. After it is diagnosed, antibiotics, hormones, or prostaglandin may be used to treat the infection. All cattle are subject to uterine infections, but these infections seem to be more prevalent in dairy breeds.

## Summary

One of the most important aspects of beef and dairy production is maintaining good herd health. Maintaining good health depends on the producer's knowledge of potential problems and the steps she or he uses to prevent or treat them. A producer utilizes proper observation, the ability to recognize signs of poor health, and knowledge of how to react to these signs. Understanding the problems that cattle commonly experience can save a great deal of time, labor, and money in the long run.

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## *Lesson 2: Herd Health for Cattle*

The success of a beef or dairy operation depends upon its management. One of the most important aspects of management is maintaining herd health. If animals are in poor health, the operation will not prosper. A way to ensure that animals remain healthy is through the implementation of an effective herd health plan. This plan deals with all aspects of herd health from transportation to controlling parasites. The following information should help in developing an effective health program.

### Regulations Affecting Purchases and Sales

One important aspect of managing a herd of beef or dairy cattle is transportation. The producer has the responsibility of ensuring that the animals being transported are safe and disease-free. To ensure that basic precautions are taken, regulations affecting transportation have been set forth by the Department of Agriculture at the federal and state level. In Missouri, the state regulations are modeled after the federal regulations, so they are essentially the same.

The first and most important requirement for all animals entering Missouri is that an official Certificate of Veterinary Inspection, shown in Figure 2.1, must accompany them. This certificate must be signed by an approved, accredited, licensed veterinarian. It certifies that an animal is free of any sign of infectious or contagious diseases. The only exception is animals being transported to a federal- or state-supervised slaughter facility within the state, since they will not come into contact with animals to whom diseases could be transmitted. This certificate is void thirty days after the date it is issued.

A negative brucellosis status is a requirement for all animals, including dairy cattle, being transported within Missouri or into Missouri from another state. The only animals that are exempt are heifers less than twenty-four months of age that have been consigned to an approved slaughter facility where they will be quarantined. All other animals eighteen months of age and older have to be tested for the disease. If a herd shows no sign of brucellosis, a negative status will be given to the animals. If animals are not from a certified brucellosis-free herd, they must have been officially calfhood vaccinated or tested within the previous thirty days. All animals that have been tested are identified by an official ear tag, tattoo, brand, or registration number on the Certificate of Veterinary Inspection. Any animals being transported into Missouri that have been exposed to brucellosis or are of unknown status must be either returned to the state of origin; quarantined to the farm of origin or farm of destination for retesting at intervals of 30, 120, and 300 days to ensure they remain free of the disease; or tagged, branded with an "S" on the left jaw, and shipped directly to slaughter on a quarantined feedlot.

Another basic requirement for animals entering Missouri from other states is that they have entry permits. These permits are issued by the Missouri Department of Agriculture and can be obtained over the telephone. Information about livestock entering the state is recorded in a database and kept on file for future reference; a permit number is given to the person transporting the cattle.

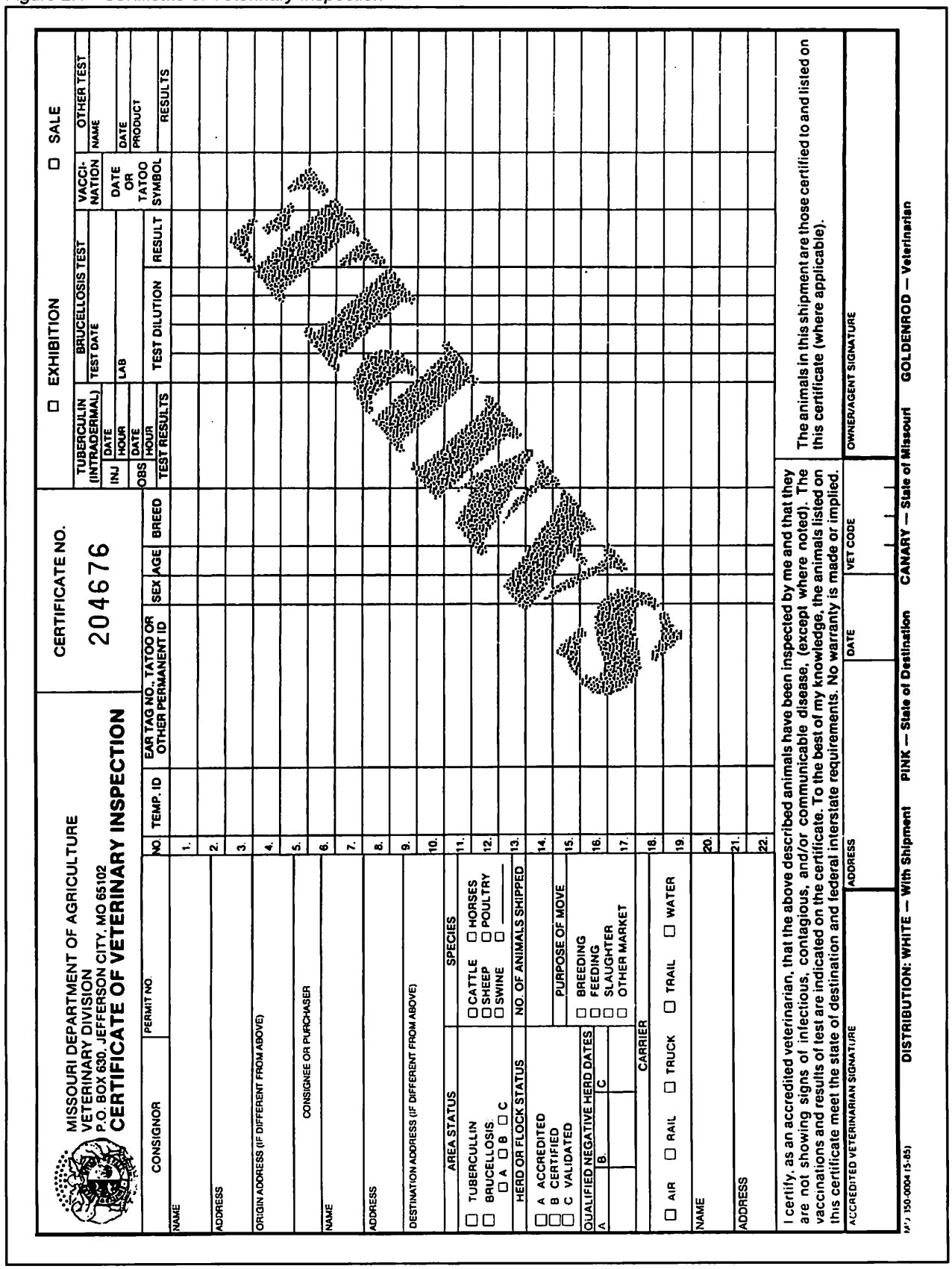
### Introducing New Animals into the Herd

Diseases can spread very quickly through a herd of cattle. Preventing disease, which is the best means of guarding against its spread, is dependent upon the implementation of an effective herd health program. Included in this program should be a plan for introducing new animals into the herd, since they can introduce new diseases.

One method of controlling the spread of disease is purchasing animals from producers with effective herd health programs. If a producer has a history of healthy animals, it is unlikely that they will introduce any infectious diseases. If possible, check on the producer's record before purchasing stock. The best way to check is simply to ask to see his or her health records. Most producers without major health problems in their herd do not mind letting someone else view their records. If a producer does not want to have other people see the records, a potential problem could exist.

Perhaps the most effective method of controlling the spread of disease by new animals is isolating them. When new stock is purchased, the animals should be placed in an area separate from the existing stock where the producer can easily observe them. Every effort should be made to keep the stock separate, since one of the main means of transmitting diseases is through physical

*Figure 2.1 - Certificate of Veterinary Inspection*



MISSOURI DEPARTMENT OF AGRICULTURE
VETERINARY DIVISION
P.O. BOX 630, JEFFERSON CITY, MO 65102

**CERTIFICATE OF VETERINARY INSPECTION**

CERTIFICATE NO. 204676

☐ EXHIBITION ☐ SALE

CONSIGNOR | PERMIT NO.

NAME

ADDRESS

ORIGIN ADDRESS (IF DIFFERENT FROM ABOVE)

CONSIGNEE OR PURCHASER

NAME

ADDRESS

DESTINATION ADDRESS (IF DIFFERENT FROM ABOVE)

AREA STATUS

☐ TUBERCULLIN
☐ BRUCELLOSIS
☐ A ☐ B ☐ C

SPECIES

☐ CATTLE ☐ HORSES
☐ SHEEP ☐ POULTRY
☐ SWINE ☐ _____

HERD OR FLOCK STATUS

☐ A ACCREDITED
☐ B CERTIFIED
☐ C VALIDATED

QUALIFIED NEGATIVE HERD DATES

A ____ B. ____ C ____

CARRIER

☐ AIR ☐ RAIL ☐ TRUCK ☐ TRAIL ☐ WATER

NAME

ADDRESS

NO. OF ANIMALS SHIPPED

PURPOSE OF MOVE

☐ BREEDING
☐ FEEDING
☐ SLAUGHTER
☐ OTHER MARKET

| NO. | TEMP. ID | EAR TAG NO., TATOO OR OTHER PERMANENT ID | SEX | AGE | BREED | TUBERCULIN (INTRADERMAL) INJ DATE | INJ HOUR | OBS DATE | OBS HOUR | TEST RESULTS | BRUCELLOSIS TEST DATE LAB TEST DILUTION | RESULT | VACCINATION DATE OR TATOO SYMBOL | OTHER TEST NAME DATE PRODUCT RESULTS |
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| 22. | | | | | | | | | | | | | | |

I certify, as an accredited veterinarian, that the above described animals have been inspected by me and that they are not showing signs of infectious, contagious, and/or communicable disease, (except where noted). The vaccinations and results of test are indicated on the certificate. To the best of my knowledge, the animals listed on this certificate meet the state of destination and federal interstate requirements. No warranty is made or implied.

The animals in this shipment are those certified to and listed on this certificate (where applicable).

ACCREDITED VETERINARIAN SIGNATURE | ADDRESS | DATE | VET CODE

OWNER/AGENT SIGNATURE

VS 150-0004 (5-85) DISTRIBUTION: WHITE — With Shipment PINK — State of Destination CANARY — State of Missouri GOLDENROD — Veterinarian

contact and contact with bodily fluids such as urine and saliva. New stock should be separated from the rest of the herd for no less than 21 days. This period of isolation should provide time for any diseases to become apparent and allow the animals to adjust to their new environment. After this isolation period, the new stock can be released with the rest of the herd.

A producer should be sure to see a copy of the Certificate of Veterinary Inspection for the new animals. The certificate will indicate whether they have shown any symptoms of infectious disease.

## Vaccinations

Preventing diseases depends not only on separating animals that may carry diseases from the herd but also on vaccinating the animals for potentially dangerous and costly diseases. A vaccination schedule should be strictly followed to ensure herd health. Producers should check with a local veterinarian to determine which diseases are a problem for a particular area. Figure 2.2 provides a sample herd health calendar for beef cattle.

*Figure 2.2 - Sample Beef Herd Health Calendar*

January
•Examine for mange.
•Treat for lice.
•Check for abortions.

February
•Watch for foot rot.
•Consider administering *E. coli* vaccines for control of calf scours to cow before calving.

March
•Provide a clean, dry calving stall.
•Prepare for calving.

April
•Prevent grass tetany by providing magnesium oxide in the mineral mixture.
•Deworm all cows before turning out to pasture; repeat in three weeks.
•Castrate and implant all bull calves.
•Dehorn before fly season.

May
•Check bulls for fertility.
•Vaccinate open cows for vibriosis, IBR, BVD, and leptospirosis before breeding.
•Begin fly control program.
•Vaccinate all calves and young stock for pinkeye.

June
•Prepare for AI or natural breeding.
•Check on the use of estrus synchronization products.
•Implant calves with growth promotant.

July
•Vaccinate all calves more than three months old for pinkeye, clostridial group, pasteurella, and BRSV.
•Vaccinate heifer replacements for brucellosis at 4 to 12 months.

August
•Check for pinkeye; treat with antibiotics.

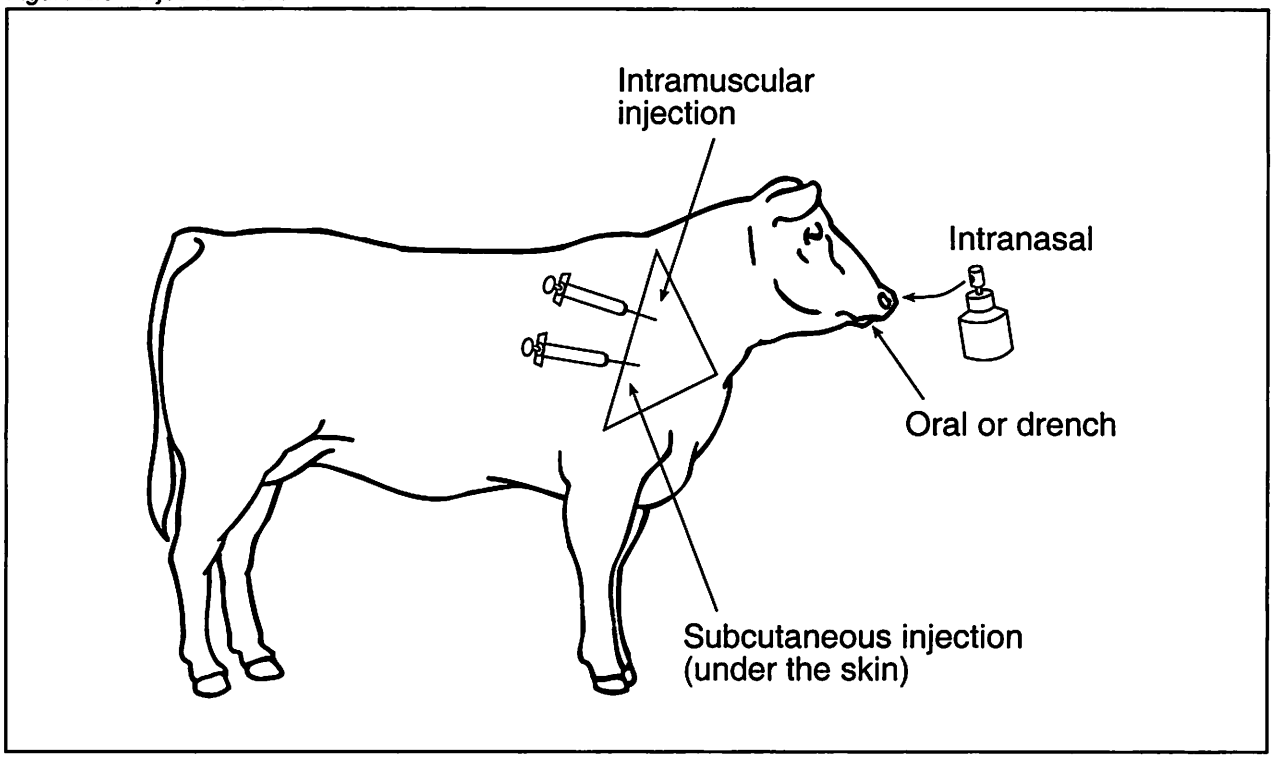
September
•Observe for grass tetany and foot rot.
•Check fly control.

October
•Pregnancy-check cows.
•Deworm and treat cows and calves for external parasites.

November
•Wean calves.

December
•Check cows for abortions and heat.

*Figure 2.3 - Injection Sites*




Vaccines and other medications may be administered in several ways. Some are given as intramuscular (IM) injections, in which the vaccine is injected into a muscle. Subcutaneous injections are given under the skin. In addition to injection, some vaccines or medications are designed to be given to the animal through feeding or drinking, while others may be administered through the nasal passages as a spray or aerosol. Drenching involves using a syringe to introduce health products into the mouth. Figure 2.3 shows routes of administration for vaccines given to cattle.

Vaccines should always be adminstered properly. The following practices are recommended to ensure the proper use of vaccines.

- The proper needle size as recommended by a veterinarian should be used. The needle size would be dependent on the stage of growth of the animal. A needle that is too large could injure a young animal. If the needle is too small, the needle may break.
- The producer should be careful when selecting a site for intramuscular (IM) injections. The injection may cause damage and reduce the value of the meat when slaughtered.
- Air should be kept out of the syringe. When making an injection, a small amount of air is drawn into the syringe prior to inserting it into the vaccine bottle. The air is then injected into the bottle. The proper amount of vaccine is slowly drawn out, allowing the syringe to fill without permitting air to enter. Injections of air bubbles into the bloodstream could harm the animal.
- The producer should read and follow the directions on the label. The correct vaccine must be used for the ailment. Producers should always follow the instructions on the bottle for usage and storage. Some vaccines must be refrigerated.
- Equipment should be kept clean. Diseases and infections may be transmitted by the use of dirty needles and syringes.
- The producer should take care not to contaminate injectables. Dirty needles and/or needles used with another type of

vaccine should not be inserted into a bottle of vaccine.

- The vaccine should be warmed to room temperature before injecting it. The time to remove the vaccine from refrigeration will be determined by the size of the bottle.

- The producer should inject a clean area of the animal. Inserting needles into a dirty area on the animal is likely to also carry a small amount of dirt into the animal's system and could cause an infection.

Beef producers should implement a plan to prevent disease and control parasites as soon as possible after calves are born. Some preventive measures can even be taken before calving. For example, a vaccine should be given to cows approximately three weeks before calving to guard against calf scours.

Missouri does not have regulations that require vaccinations, but some vaccinations are commonly administered to beef cattle. Most producers use a 5-way vaccination program, vaccinating for leptospirosis, infectious bovine rhinotracheitis (IBR), bovine viral diarrhea (BVD), pasteurella (PI-3), and the clostridial group. Feeder calves may also be vaccinated for bovine respiratory syncytial virus (BRSV), while replacement bulls and heifers may be vaccinated for vibriosis. At four to twelve months of age, all replacement heifers should be vaccinated against brucellosis. Some of these vaccines may require booster shots after the original vaccination. While the number of vaccinations may seem excessive, it should be noted that many of them can be purchased in combination with others, cutting down on the number of vaccinations given.

In addition to giving booster shots to calves, some vaccines require that booster shots be given to mature cattle. Some booster shots that may be necessary for mature beef cows are vaccines for leptospirosis, vibriosis, BVD, IBR, and the clostridial group.

Dairy cattle also require reliable disease prevention. Most vaccines are given beginning around the age of four months. The vaccines given between birth and six months of age include the following: brucellosis, infectious bovine rhinotracheitis (IBR), parainfluenza, the clostridial group, and bovine respiratory syncytial virus (BRSV). The producer should vaccinate cattle for bovine viral diarrhea (BVD) two weeks after administering any other vaccines. The brucellosis vaccine should be given sometime between four and six months of age.

Between thirteen months of age and two months before the first breeding, leptospirosis and vibriosis vaccinations need to be given to dairy cows. Booster shots should also be given at this time for the IBR, BVD, and BRSV vaccines.

Mature dairy cows may also need to be given boosters to ensure continued protection from certain diseases. Boosters should be given for leptospirosis, vibriosis, IBR, and BVD. Figure 2.4 provides a sample herd health calendar for dairy cattle.

### Anaphylactic Shock

Anaphylactic shock is an allergic reaction that occurs in sensitized animals following injections of vaccines or drugs, ingestion of certain foods, or insect bites. Clinical signs occur within seconds after the substance enters the bloodstream. In most domestic farm animals such as cattle, the condition primarily affects the lungs, although the blood vessels are also affected. Airways and pulmonary veins are constricted. This constriction causes pooling of the blood in the veins and severe respiratory distress. The result is shock, colic, agitation, nausea, hypersalivation, and in severe cases, death. Anaphylactic shock is treated with an intravenous injection of epinephrine to counteract the effects of the allergic reaction.

### Controlling Parasites

A parasite is an organism that gets its nutrients from a larger host. Parasites, both internal and external, can be a serious problem in a cattle herd. Parasites can cause a lowered rate of gain, weight loss, discomfort, illness, and even death in extreme cases. Proper parasite control is an important part of a successful herd health program.

Internal parasites attack the organ systems of cattle. While internal parasites can affect many systems, the greatest problems are associated with the digestive system. Internal parasites can cause anemia, diarrhea, traces of blood in the feces, lowered milk production, and a lowered rate of gain. Examples of internal parasites that may

*Figure 2.4 - Sample Dairy Herd Health Calendar*

Newborn Calves:
•Hand-feed first colostrum.
•Treat naval with iodine.

Vaccination:
•2 to 6 months of age: brucellosis.
•4 to 6 months of age:
IBR, parainfluenza, clostridial group, and BRSV.
BVD, two weeks after those above.
•11 to 13 months of age, or two months before breeding:
Leptospirosis.
Repeat IBR, BVD, and BRSV.
•Mature cow: Administer booster vaccinations for leptospirosis, IBR, and BVD.

Reproduction:
•Herd examination by a veterinarian every three weeks.
•Pregnancy exam of cows 30 to 45 days after breeding.
•Exam of cows that have not conceived after 3 or 4 services.
•Exam of cows by two weeks after calving and about 30 days after calving.
•Exam of cows in which heat is not observed by 60 days after calving.

Parasite Control:
•Worm heifers during first grazing season.
•Use approved insecticide on all stock continuously for control of external parasites.

Mastitis:
•Use recommended milking practices.
•Monitor with the California Mastitis Test and/or somatic cell count reports.
•Identify all cows treated for mastitis and withhold milk.

Emergencies:
•Call veterinarian at calving on very large and/or abnormal presentations.
•Arrange for immediate examination by a veterinarian for aborted fetuses and dead animals.

affect a herd include stomach worms, grubs, tapeworms, lungworms, intestinal roundworms, and whipworms.

Sound management practices can help prevent internal parasites from becoming a problem. For example, some parasites favor warm, wet conditions. Controlling climatic conditions in the environment of the animals can help eliminate these parasites. Intermediate hosts that can carry parasites, like mice and rats, should be controlled in livestock facilities. If parasites are detected in livestock, the rest of the herd should not graze where the infected animals have been so that they do not ingest the parasites or their eggs.

Many products are on the market for controlling internal parasites. Some of these products have a broader spectrum, affecting more parasites, than others. Methods used to administer wormers are drenching, administering boluses (large pills), mixing drugs with feed or minerals, or injecting drugs. Sometimes the most convenient time to apply products for parasite control is at the time of vaccination. Dairy producers should always check withdrawal periods when treating lactating cows so that residues that could potentially be dangerous to people are not passed along in the milk.

External parasites can cause great discomfort to animals. These parasites, such as lice, flies, ticks, and the mites that cause mange, live off of the flesh and blood of the animals. They can also transmit infectious diseases. Animals affected by external parasites can experience decreased milk production and rate of gain, so controlling them is important. Insecticides are commonly used to control external parasites. Types of insecticides that are frequently used are sprays, foggers, and dusts. Other control methods include insecticide

ear tags, back rubbers treated with chemicals, and pour-on treatments. Pour-on treatments should not be used for *Bos indicus* cattle. They have large pores in their skin, and absorption of the chemicals may kill them. Pour-ons should also not be administered to lactating cows. External parasite control is generally necessary only in warm weather.

Producers should check with a veterinarian to learn which method of controlling parasites is best for their operation. Following label directions is always important.

## Record Keeping

Producers need to keep herd health records. Keeping these types of records enables the producer to determine the productivity of her or his stock and to quickly index health and productivity information. They also help the producer know what health care the animal has already received and provide proof of vaccinations and treatments for future buyers.

One type of record that should be kept is a veterinary record. The veterinary record should show all routine health care for an animal. The information should include any implants and additives used. The dates and types of vaccinations given and worming dates should also be included. In addition, withdrawal periods should be noted in the records. The sites of vaccinations or implants should be recorded as well.

Records should also be kept regarding any health problems that the animal has experienced. Included in this record should be all information concerning the management of the problem, such as the symptoms, diagnosis, treatment dates, type of treatment, and results. This information can be useful when dealing with future health situations. Mastitis treatment records are especially important for dairy cattle because the milk from cows receiving treatment cannot be sold.

## Summary

The success of any beef or dairy operation depends on its management. If animals are managed well, they will be more productive. An important factor in the management of the herd is maintaining the herd's health. To ensure good health, establishing and maintaining a good herd health program is vital.

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## *Lesson 3: Health Problems in Swine*

Swine production is an important agricultural industry in the state of Missouri and in the United States. In 1995, Missouri produced approximately 3.5 million hogs and pigs. For production levels to remain high, the herd must remain healthy. The producer can achieve a high level of herd health by knowing what indications of illness to look for and what to do if health problems arise. Much of this knowledge comes from experience, but an understanding of common problems and practices is useful to a producer as well.

### Observing Herd Health

As with any other type of livestock, the key to maintaining a high level of herd health in swine is observation. Proper observation is the best way to become aware of the diseases that can reduce production and profits. Disease can spread quickly through a swine herd and can affect a large number of animals if symptoms are not recognized early. Producers should try to observe animals at least once daily and possibly more often if health problems exist. Some producers choose to walk through the pens slowly and observe each animal. They should pay close attention to feeders and waterers at this time. Producers with large operations may need several employees to assist in this practice. This practice may be time consuming, but it is effective and will pay off in the long run. Animals that are pastured may be observed by driving through the animals' pasture or when they are fed.

Disease can be a special problem in nurseries and finishing facilities due to the close contact that the animals have with one another. The close proximity of animals makes it especially important to identify problems early. This will not only keep disease from spreading but also prevent problems like infections and injury from becoming worse over time and decreasing production. An understanding of air flow and ventilation are also critical to preventing the spread of disease.

Young pigs are especially susceptible to disease and therefore generally require more observation and attention than do mature animals. It is extremely important that their health is monitored constantly to ensure that any disease, infection, or injury is taken care of quickly. Addressing these problems quickly is important not only because young animals are more susceptible to disease, but also because these problems are more likely to kill an immature animal than a mature one. Methods of observation will vary depending on the size and type of operation, but a method should be chosen that allows the producer to observe each animal and provide early treatment for any problems.

Observation of growers/finishers is also an important part of production. At this stage, the pigs are not as likely to die from health problems, but they are still quite vulnerable to disease. Health problems decrease as the animals mature, so animals that have recently been placed in the finishing stage are likely to have more health problems than those that are nearing finish. Observation of these animals may be more difficult but is still important to the success of the operation. As with nursery pigs, producers should take time to examine each animal and deal with each problem accordingly. Observing the animals two to three times a day is best. Facilities and equipment can also be evaluated at this time to make sure that all the equipment is functioning and the facilities are in good condition.

Observation of breeding stock is important to the success of an operation for many reasons. These animals are usually the foundation of the operation, so any problem that could affect the way in which they reproduce should be recognized and dealt with quickly. Keeping these animals comfortable as well as disease-free is important to aid in conception and make sure that a higher number of pigs is born. In most confinement operations, breeding animals are usually kept separate from one another, making it easy to observe and treat each individual animal. In most nonconfinement operations, checking animals when they are fed is usually most convenient. When observing animals for health problems, one can also use the time to look for estrus and examine equipment and facilities.

### Indications of Health Problems

Observation is important, but it is only successful when combined with a knowledge of the signs of illness. Many of the signs are the same as they are for other animals, like cattle. Common signs include listlessness, lowered head or humped back, isolation from other animals, coughing or wheezing, abnormal feces or urine, and a reluctance to move or an inability to move well.

One of the earliest, and most costly, signs of poor health is loss of appetite, so monitoring feeders is an important aspect of assessing health. The key to profit for pork producers is making sure that animals maintain a high rate of gain. When swine are sick or injured, they usually do not eat as much. When they stop eating, they stop gaining. If an animal appears reluctant to eat or stops eating completely, steps should be taken to determine and correct the problem. Sometimes a diagnosis can be made by the producers; however, they should contact a veterinarian if there are any questions or serious problems.

## Common Health Problems

While swine are generally hardy animals, they are still susceptible to a number of diseases. Health problems are likely to be intensified as the number of animals in an operation increases. The following diseases are likely to occur in swine. Knowing the symptoms of these diseases and what to do if they occur can cut down on the amount of time and money the producer has to spend to deal with them.

Brucellosis - This disease can be a major problem in swine as well as cattle. Brucellosis is spread mainly through close contact among animals. It can also be spread from sow to sow by infected boars through the mating process and occasionally by sows to suckling pigs. Brucellosis is most common in breeding hogs but can also occur in younger pigs. Symptoms include abortions, permanent or temporary sterility, lameness, and formations of abscesses in the extremities. Brucellosis has no treatment.

Leptospirosis - Leptospirosis is a disease that is generally spread through the urine of infected hogs or wildlife. Infected hogs may excrete large amounts of the bacteria that cause the disease for up to a year after an acute infection. Leptospirosis is an infection of the mucous membranes. Some of the most common signs of leptospirosis include fever and hemorrhages, but other symptoms include anorexia, spasms, poor weight gain, and circling (appearing dizzy or disoriented, with a loss of balance). This disease can also lead to abortions, stillbirths, and death. Animals may be vaccinated for this disease or treated with antibiotics.

Atrophic rhinitis - Atrophic rhinitis is caused by bacteria. This disease is characterized by atrophy of the bones in the nasal passages. The most common signs of atrophic rhinitis include sneezing, nose rubbing, eye discharge, and excessive yellow to white nasal drainage. Bleeding from the nostrils may occur as the disease progresses. The atrophy can cause distortion of the nasal septum and eventually shortening or twisting of the upper jaw. This disease can lead to reduced market weight, carcass degradation, and small body structure. Controlling the disease involves improving ventilation and sanitation and reducing stocking rates. Protecting pigs from cold drafts and unexpected temperature changes may also be helpful. Antibiotics can also be used for treatment. Vaccines are also available that can be administered if the incidence of rhinitis in a herd increases to too high a level.

Pseudorabies - Pseudorabies is an extremely infectious virus in the herpesvirus group. This disease can cause fever, sudden death in pigs less than three weeks old, loss of appetite, labored breathing, trembling, lack of coordination, abortion, and reproductive failure. Pseudorabies can be transmitted through fluids like semen. Vaccinations can be given to help control this disease. Drugs are not effective in treating pseudorabies. Infected animals should be quarantined and slaughtered. Repopulation, or replacement of the animals in the herd, is usually the only method of completely eradicating the disease.

Transmissible gastroenteritis (TGE) - TGE is caused by a virus. One sign of illness is a high death rate in pigs less than three weeks old. The disease can also cause vomiting, watery to yellow diarrhea, weakness, reduced milk production, and dehydration. This disease is highly transmissible and can cause large losses. TGE occurs most often in the winter. Sows can be vaccinated against this disease. Producers may promote herd immunity once TGE is diagnosed by exposing animals to the disease. Exposure can be provided by feeding minced intestines from infected animals. No drugs are effective against the virus, but antibiotics may be used to cut down on secondary infections. Fresh water and a warm, draft-free environment may reduce losses.

Colibacillosis - This disease is caused by *E. coli* in the small intestine of nursing and weanling pigs. Pigs less than seven days old experience the most problems. The signs of this disease include watery, pale diarrhea, and rapid dehydration.

Colibacillosis can cause death. Vaccinating sows may aid in preventing the disease if a specific strain of *E. coli* can be identified as its cause. Good sanitation and nutrition also help control the disease. Effective treatment is limited. The strain of bacteria must be identified, and then a specific antibiotic treatment should be chosen. A veterinarian should be consulted to determine which drug would be most effective. An effort should be made to use fluid therapy to rehydrate the animals and maintain a high level of electrolytes. Pigs should also be kept warm, clean, and dry.

Swine dysentery - Swine dysentery is also known as bloody scours. It generally affects hogs from 40 pounds to market weight. Dysentery causes degeneration and inflammation of the large intestine that leads to soft feces, which then progresses to diarrhea containing blood and mucus. Animals in the later stages of the disease rapidly lose weight, become severely dehydrated and weak, and eventually die. Antibiotics are effective if started early; water medications usually are the most effective.

Mycoplasmal pneumonia - This infectious pneumonia is generally mild. It causes a dry cough that if left untreated leads to retarded growth accompanied by a persistent dry cough. It can also cause a high incidence of lung lesions; lesions cause labored breathing, which lowers the rate of gain. Nose to nose contact can spread mycoplasmal pneumonia. The disease may be worsened by keeping large numbers of animals closely confined in poorly ventilated buildings. While vaccines are available, at the first sign of an outbreak, a mass treatment with antibiotics should be given to the swine herd to control the disease.

Clostridial enteritis - This disease is a form of scours that affects young pigs. It usually affects piglets during the first week of life, but nursing pigs up to a month of age can sometimes be affected. It is caused by a bacterium, *Clostridium perfringens*. Affected pigs will have diarrhea and be dehydrated. Diarrhea usually begins as watery, yellow feces that may contain traces of blood. After a few hours, the feces become bloody. Pigs may die within a few hours to two days. This disease is sometimes transmitted through overcrowding. No effective treatment exists for this disease.

Parvovirus (PPV) - Porcine parvovirus (PPV) is a virus that causes reproductive failure in gilts and sows. The organism passes from infected pigs in the feces and is ingested orally or nasally by other pigs. Parvovirus has a two to four day incubation period. Some symptoms include delayed return to estrus, small litters, mummified offspring, stillbirths, and abortion. Vaccines are available to prevent the disease; however, no effective treatment exists for PPV infections.

Erysipelas - Erysipelas is a bacterial disease that can infect a wide range of animals. It is caused by a bacteria. Erysipelas occurs in three forms: acute, sub-acute, and chronic. Pigs with erysipelas exhibit a number of symptoms, including fever, lethargy, depressed appetite, and discolored or reddened skin. Vomiting, diarrhea, and discharges from the eyes may occur. The pigs are reluctant to move due to painful or swollen joints. Sows may abort. The disease can be prevented by giving vaccinations. Pigs suffering from erysipelas can be treated with a combination of penicillin and erysipelas serum. Infected animals should be isolated.

Porcine reproductive and respiratory syndrome (PRRS) - PRRS was first reported in the United States in North Carolina in 1987. At first it was known as the "mystery disease" because it could not be readily identified or treated. By the mid-1990s it was considered to be one of the most difficult and costly swine health problems in the United States. As the name implies, the disease consists of two parts. The reproductive component is characterized by late term abortions at day 107 to 112 of gestation, along with large numbers of stillbirths, mummies, and weak pigs. The respiratory component is characterized by piglets in farrowing and nursery houses exhibiting labored breathing, loss of appetite, gauntness, and rough hair coats. Prevention involves evaluating the status of the herd, segregating age groups to better control transmission of the virus, isolating incoming replacement boars and gilts a minimum of 60 days, operating an all-in, all-out management system, depopulating nurseries if necessary, and vaccinating pigs under 16 weeks of age. No specific treatment exists for swine with PRRS. Good nursing and good feed will help. Antibiotics can reduce secondary infections.

## Summary

A sudden outbreak of an infectious disease can be devastating. To protect against losses, a producer must be able to realize that a problem exists and

take the appropriate measures to alleviate it. Knowing the indications of illness is the best way to keep the herd healthy.

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## *Lesson 4: Herd Health for Swine*

Swine production is an important part of the agricultural industry in the United States and in Missouri. A producer's goal is to maximize profits for the animals produced. The animals marketed must be of high quality to bring a premium price. One vital aspect of quality is the general health of the animals. Poor health conditions in the herd are reflected in the animals sold for either meat or breeding stock. The overall health of the animals in any herd is dependent upon the herd health plan followed by the producer. This plan is of great importance to the success of the operation, since many aspects of production are dependent on health, such as feed conversion, fertility, number of pigs born, estrus cycles, and time to finish.

### Regulations for Buying or Selling

When transporting livestock either within or into the state, regulations set forth by the Department of Agriculture must be followed. In Missouri, the state laws and federal regulations are the same. Most local regulations align with these laws as well, but local authorities should be contacted to determine if this is the case.

The first requirement for all swine moving into or within the state (except for slaughter swine) is that they be inspected by a licensed, approved veterinarian, who issues a Certificate of Veterinary Inspection. Animals being brought into the state must also have entry permits. Animals that pass health inspections must be identified by an official ear tag, ear notch, or tattoo. Animals that do not pass inspection are tagged with an official ear tag as well. They are either shipped directly to slaughter or remain on (or are returned to) the farm of origin. If the problem is curable, they may be sold later. All animals must be quarantined for thirty days after any change of ownership.

The two infectious diseases that are of the greatest importance when transporting swine are brucellosis and pseudorabies. All breeding stock, regardless of age, must be from a herd that is certified brucellosis and pseudorabies free to ensure that these diseases are not spread. If any animals are determined to be infected with or exposed to pseudorabies or brucellosis, they must be quarantined, and a clean-up plan approved by the state veterinarian must be devised.

### Introducing New Animals into the Herd

The health status of the herd that animals are being acquired from should be known prior to their purchase. One way of determining this status is for the producer's veterinarian to contact the veterinarian of the previous owner and discuss the health status of the animals on both farms. All of the potential risks for animals on both farms can be discussed, and decisions can be made about what course of action should be taken to minimize these risks. Whenever possible, producers should try to purchase animals from herds with a health status that is equal to or better than their own.

Even if the status of the animals is known, isolation of all new animals is important. Animals being brought into the herd must be quarantined for at least 60 days, but the length of time for which new animals are isolated is dependant on the individual producer. Adequate time should be taken to achieve the outcomes listed below. The producer will have to determine the amount of time required based on his or her circumstances.

- Stabilization of the animals, allowing them to adjust both physiologically and nutritionally to the new facilities
- Diagnosis and control of any diseases or parasitic infections in the animals
- Identification of all new animals
- Exposure to pathogens present in the herd to develop immunity in the new animals

During this isolation period, if contact with the isolated animals is required, the producer should shower and change clothes before returning to the main herd. This practice will control the spread of any diseases or parasites that the new animals may be carrying.

### Routine Vaccination Practices

Disease prevention is an ongoing process. It begins with the sow or gilt prior to breeding and is carried on throughout the life of the offspring. It is important to devise a herd health plan that works well and then to continue with the program. A sample swine herd health calendar is shown in Figure 4.1. Checking with a veterinarian prior to beginning a vaccination schedule can save time, money, and labor, since some diseases may be more prevalent in a particular area than others and will therefore require more attention.

*Figure 4.1 - Sample Swine Herd Health Calendar*

**Birth to Market**

1 day after farrowing
- Provide antitoxin for clostridial disease.

1 to 3 days
- Provide an iron injection.
- Clip needle teeth.
- Ear notch.
- Dock tails.
- Castrate.

3 to 7 days
- Vaccinate for atrophic rhinitis and TGE.
- Begin providing oral iron.

10 to 14 days
- Provide iron either by injection or orally.
- Start creep feeding.

3 to 4 weeks
- Vaccinate for atrophic rhinitis and mycoplasmal pneumonia.
- Expose to pre-starter feed.
- Wean.

Weaning + 10 days
- Deworm and treat for lice and mange.

Weaning + 20 days
- Vaccinate for erysipelas.

10 to 12 weeks
- Vaccinate for pseudorabies and revaccinate for erysipelas.

5 to 6 months
- Follow all feed medication and vaccination withdrawal times.

**Breeding Boars**

4 to 6 months
- Select and bring to farm at lease 60 days prior to breeding.
- Isolate for 60 days and test for diseases not already present in herd.

First 30 days following purchase in isolation
- Test for brucellosis, leptospirosis, parvovirus, TGE, and pseudorabies.
- Deworm and treat for lice and mange.
- Feed unmedicated feed.
- Observe for lameness, diarrhea, pneumonia, and ulcers.

Second 30 days following purchase in isolation
- Vaccinate for erysipelas, leptospirosis, and parvovirus.
- Observe desire and ability to breed.
- Begn fence line and contact with gilts and sows.

Every 6 months
- Revaccinate for pseudorabies, leptospirosis, erysipelas, and parvovirus.
- Deworm and treat for lice and mange.

As with vaccinations in other species, some of the vaccinations may be combined, reducing the number of shots that must be given. Vaccinations cause stress in animals, so the fewer the number of shots that need to be given to provide protection from disease, the better. Most vaccinations of adult swine are given in the neck using intramuscular injections. In young pigs that are easily held by the producer, most vaccinations are given in the flank of the rear leg. Vaccinations should never be given in the front or rear leg. Bruising and staining of the muscle will lead to economic losses when the animals are slaughtered.

Before breeding gilts or sows, some vaccinations should be given to protect the health of the animals as well as the health of their pigs.

*Figure 4.1 - Sample Swine Herd Health Calendar (continued)*

**Breeding Gilts/Sows**

6½ months of age
- Deworm.
- Treat for lice and mange.
- Provide fence line contact with boars.
- Vaccinate for leptospirosis, erysipelas, parvovirus, and pseudorabies.
- Select gilts.
- Isolate purchased gilts for 60 days and test for diseases not already present in the herd.

7½ months of age
- Repeat vaccinations.

8 months of age
- Breed on the second or third heat period.

3 weeks post-breeding
- Pregnancy-check animals that have not returned to heat.

9 months
- Pregnancy-check 35 to 60 days after breeding.

6 weeks prior to farrowing
- Vaccinate for clostridial disease.

4 to 6 weeks prior to farrowing
- Vaccinate for *E. coli*, pasteurella, mycoplasmal pneumonia, TGE, and pseudorabies.
- Treat for lice and mange.

2 weeks prior to farrowing
- Vaccinate for *E. coli*, clostridial disease, mycoplasmal pneumonia, TGE, and atrophic rhinitis.
- May include feed additives for clostridial diseases through lactation.

7 to 10 days prior to farrowing
- Deworm and treat for lice and mange.
- Wash sows thoroughly with detergent before placing them in farrowing facilities.

Farrowing
- Assist with farrowing.

3 to 5 weeks post-farrowing
- Vaccinate for leptospirosis, parvovirus, pseudorabies, and erysipelas.
- Treat for lice and mange.
- Wean pigs.

Ensuring that the sows or gilts remain healthy and free of disease will increase the number of pigs born and improve the health of the pigs. Approximately two to four weeks before females are bred, they should be vaccinated for leptospirosis, erysipelas, and parvovirus. Deworming these animals at this time may be a good idea as well, since it will allow them to get the optimum nutrition that they need to maintain themselves and their unborn pigs.

After sows and gilts have been bred, some vaccinations can be given prior to farrowing. During this time, all vaccines should not be given at once. These animals should be stressed as little as possible. Approximately two to four weeks before farrowing, vaccines can be administered for clostridial enteritis, erysipelas, colibacillosis. Producers may also vaccinate for TGE in the winter. About one week prior to farrowing, sows should be dewormed again.

After farrowing, newborn pigs should be vaccinated for some conditions in the first seven to ten days, with boosters administered in another ten days. These vaccinations include atrophic rhinitis, erysipelas, and mycoplasmal pneumonia. Vaccinations at this early age can guard against potentially costly and time consuming problems.

When pigs reach the grower stage, few vaccinations need to be given. However, in an area where pseudorabies is prevalent, pigs should be vaccinated approximately two weeks after weaning. In Missouri, any vaccine for pseudorabies must be approved by the state veterinarian.

## Controlling Parasites

Swine are at risk for parasites, both internal and external. Preventing these parasites or controlling them after they have infested the animals is possible, however. Producers must establish a plan for dealing with parasites to keep their animals healthy.

Internal parasites impair or destroy tissues, organs, and systems. Infestation of internal parasites can result in a lowered rate of gain, lowered feed conversion, malnutrition, and death. Producers can use management practices to lower the incidence of internal parasites in swine. Proper sanitation is essential when trying to control parasites in swine facilities. Other methods are essentially the same as in other livestock and include creating unfavorable cool and dry conditions for the parasites, destroying intermediate hosts, and making sure animals do not ingest parasites or their eggs.

The use of anthelmintics is an important tool in controlling internal parasites. Medications may be mixed with drinking water or given as an injection. Sows and gilts should be wormed prior to breeding and again prior to farrowing, and pigs should be wormed at approximately 40 pounds. However, the frequency of worming depends on the situation of the particular operation. Producers should always check with a veterinarian before instituting a program for parasite control. The veterinarian can also help determine which anthelmintics would work the best for a particular operation.

External parasites feed on the flesh and blood of animals and are usually controlled by the use of insecticides, such as sprays, foggers, and dusts. Some products that are given as injections are also effective.

## Record Keeping

As with any type of livestock operation, the producer should keep complete and accurate health records. Health records should include worming dates, the vaccination records of the animals, and records of any health tests administered. This record may also include a history of illnesses the animal has experienced. Veterinary records are important for future reference when dealing with health problems or selling stock.

## Summary

Swine operation requires hard work on the part of the producer. The success of the operation depends on the overall health of the animals, which is determined by the effectiveness of the health plan the producer uses. A veterinarian should always be consulted when a health plan is being initiated to ensure that it will be effective for that area.

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## *Lesson 5: Health Problems In Sheep*

The key to being successful with any livestock enterprise is planning, especially for health programs. Raising sheep requires an intensive management program. Sheep are very susceptible to shock and death if they face serious trauma. This trauma can be caused by a predator or a serious illness. Therefore, sheep producers must take steps to successfully manage flock health. Knowing what to do when problems occur and taking steps to prevent future problems is the key to raising a healthy flock of sheep.

### Observing Flock Health

As with any other type of livestock, observation is essential to maintaining overall flock health. Consistently monitoring the animals for signs or symptoms of potential problems is necessary to detect health problems before they get out of hand. Knowing the animals is very important, and producers should be familiar with each of the animals in their flock if possible. Being familiar with the normal condition of the animal will make it easier to recognize when a health problem exists.

Practices for monitoring the animals can vary depending on the producer's preferences and the health of the flock. However, sheep should be observed at least once a day. A flock with health problems should be checked more frequently. A producer may also observe the flock more frequently if the sheep are experiencing stress for some reason because many diseases appear as a result of stress. When checking animals for symptoms of poor health, producers must make sure to observe each animal. Monitoring flock health is usually easiest when the sheep are gathered together at feeding or when they are brought in at night.

### Indications of Health Problems

Detecting health problems is not always easy, but producers who regularly observe their animals should notice signs of illness and be able to take steps to address the problem. Producers may notice several general signs of illness in a sick animal. They include reduced feed consumption or grazing, grinding teeth, coughing or wheezing, panting, isolation from the flock, abnormal feces or urine, and lack of movement. Also, an unhealthy animal may lack spirit and appear depressed. Loss of wool or stringy wool can be another sign of illness.

Abnormal vital signs can be an indication of health problems in sheep. Important vital signs include body temperature, respiration rate, and heart rate of the animal. Table 5.1 shows average readings for these vital signs. When signs of health problems are observed, producers should try to check the vital signs of the animal in question. Body temperature is taken rectally. If the temperature varies greatly from the average temperature, then the producer should begin to look for other symptoms and causes. A veterinarian can help decide if an animal's respiration rate or heart rate is abnormally high or low.

*Table 5.1 - Normal Vital Signs*

| Vital Sign | Average |
|---|---|
| Temperature | 102.5° Fahrenheit |
| Respiratory Rate | 20 breaths/min. |
| Heart Rate | 75 beats/min. |

### Health Problems

In spite of the best efforts of the producer, health related problems will likely occur. Effective treatment of these health problems depends on early and accurate diagnosis. A veterinarian should be consulted for information on the diagnosis and treatment of specific diseases. Below is a summary of some health problems related to sheep, beginning with diseases and health problems of lambs and progressing to adult sheep.

Coccidiosis - Coccidiosis in lambs is caused by single-celled protozoa called coccidia. The disease creates serious economic losses in the sheep industry. Lambs can become infected by ingesting fecal matter while suckling, accidentally ingesting fecal contamination while nosing around their environment, or from eating and drinking contaminated feed or water. Blackish, blood-tinged diarrhea is the most prominent symptom of this disease. Infected animals are also reluctant to eat. The disease can be mild to severe, depending on the resistance of the lamb. Lambs that do recover are often unthrifty. Prevention involves sanitation management in the barns and

lots, medicating lambs prior to and during risk periods, and keeping bedding clean to keep the ewe's teats free of fecal contamination. Infected lambs can be medicated with a dose of a coccidiostat. Lambs build up an immunity after six weeks of age.

White muscle disease - White muscle disease is a result of a deficiency of selenium or vitamin E. They are essential nutrients that protect muscle cells from the harmful effects of dangerous chemicals or substances that accumulate in the body from natural foodstuffs or exercise. Two forms of this disease affect sheep. The first affects newborn lambs as a result of underfeeding vitamin E or selenium to the pregnant ewe. Affected lambs are reluctant to move and prefer to lie down. It is painful for them to stand. They display stiffness of the hind legs and an arched back. The disease may affect the cardiac muscles or the muscles that control breathing, leading to death. The second form of the disease causes a poor rate of growth and an unthrifty body condition. It can result in a poor antibody response when sheep are stressed by infections or vaccinations. Prevention involves providing ewes and lambs with adequate amounts of selenium and vitamin E in their diet. Treatment involves feeding a commercially made selenium/vitamin E product.

Diarrhea - Diarrhea in lambs can be caused by dietary changes. It is common as their creep feed intake is increased. Diarrhea is usually the result of the effects of the protein and carbohydrate levels in the creep feed. It can also be caused by ingesting lush grass that is high in moisture, protein, and soluble carbohydrates. The feces becomes unpelleted, which also puts the lambs at a higher risk for fly strike.

Enterotoxemia - This disease is commonly called overeating or pulpy kidney disease. It is common in lambs that have not be vaccinated and are on a high concentrate diet. Losses as high as 40 percent have been reported. While the bacterium that causes the disease, *Clostridium perfringens*, is a normal inhabitant of the intestinal tract, a rapid increase in the numbers of bacteria can be caused by high grain concentrations in the ration. As the bacteria multiply, they release a substance that is toxic to lambs. Symptoms may include depression, abdominal pain, teeth grinding, frothing at the mouth, diarrhea, or convulsions, although death may occur without any obvious symptoms. Early diagnosis is critical to halting outbreaks and preventing further losses. A microscopic examination of the intestines of a freshly dead animal is helpful for diagnosis. The presence of a soft, pulpy kidney is also strongly suggestive of this disease. Treatment is usually ineffective. Prevention is based on good feeding management and a sound vaccination program.

Soremouth - Soremouth is a viral disease that attacks all ages of sheep but is most common in sheep under one year of age. The virus attacks the skin and mucous membranes of the lips and nostrils, forming pustules and finally scabs. The scabs make eating painful, resulting in weight loss. The disease may be prevented by vaccination early in life or when an outbreak occurs. Treating lesions with Nolvasan disinfectant will help reduce the sores. Care should be used in treating sheep because the disease can affect humans, causing sores like blisters on the skin.

Acidosis - Acidosis is also commonly known as grain overload or founder. It commonly occurs in older lambs. Animals usually develop this condition when their diet is changed from roughage or grazing to a diet containing grain, which affects the bacteria in the rumen. Affected animals will exhibit loss of appetite, depression, and loss of consciousness. The condition can lead to death. Treatment involves decreasing the levels of acid in the rumen, which can be accomplished by drenching the animal with bicarbonate of soda or giving it an antacid. Veterinary assistance should be sought for treatment. Normally acidosis can be prevented if the roughage is decreased and the grain increased gradually over a period of time. A 5 to 10 percent change in the grain to roughage ratio every two to three days is recommended.

Polio - Polio is caused by a lack of thiamine (vitamin B1) in the diet. This condition causes the animal to lose its appetite. Often, it will go down on its side and paddle its feet with its head thrown back. If an animal is in this position for very long, death will occur. Early treatment is effective. Treatment involves giving the animal an injection of thiamine hydrochloride, with injections being repeated over several days. Ration management and thiamine injections are the only ways to prevent this disease.

Scours - Scours is normally caused by some form of bacteria. This condition is common in feeder lambs and is associated with the stress of weaning, shipping, changes in feed intake, and crowding. Signs include going off feed, a

yellowish-green odorous diarrhea, depression, and tenderness and irritation of the hindquarters. Treatment with antibiotics is expensive and discouraging because finding the correct antibiotic is difficult. Prevention is the key. Good sanitation pays off in controlling the agent that causes this condition. Producers should avoid stressful conditions and follow a good feed management program. This disease is also transmitted to humans. Care should be taken to wash hands thoroughly after handling sick animals.

Pneumonia - Pneumonia is caused by viruses in conjunction with bacteria, commonly pasteurella bacteria. Sheep go off feed, become gaunt, and breathe rapidly and heavily. Animals seem to hurt with each step if they walk very far. Other symptoms include fever, nasal discharge, loss of appetite, and coughing. Treatment includes antibiotics. A veterinarian needs to be consulted about treatment because very few antibiotics have been cleared for use with sheep. A multi-day treatment with the proper antibiotic is necessary to cure pneumonia. Good sanitation, dry bedding, and good ventilation can help prevent pneumonia.

Copper toxicity - Copper toxicity in sheep occurs primarily when sheep are fed or exposed to cattle or hog feed or to the mineral itself. Sheep are unable to tolerate copper. When consumed over a period of time, excessive copper is stored in the liver. No damage is noticed until a toxic level is reached. At that time, red blood cells are destroyed, causing the death of the sheep. If this condition is suspected, analysis of the feed or examination of the liver of a dead animal can confirm the problem. Prevention involves implementing a good feed management program.

Chlamydiosis - Chlamydiosis, or enzootic abortion (EAE), is a highly contagious infection that results in severe economic losses to the sheep industry in many area of the United States. It most commonly occurs in flocks in the western states but is reported nationwide. It is caused by a group of organisms called chlamydia. This disease is spread through exposure to aborted fetuses or infected afterbirth. The organism enters the bloodstream of the ewe and causes no signs until the ewe becomes pregnant. Chlamydiosis causes abortions; the fetus is usually aborted 60 to 90 days after infection. Laboratory analysis using cultures or sophisticated tissue staining techniques is usually necessary to diagnose the infection. Treatment is ineffective. Prevention involves breaking the infective cycle. Removing infected ewes from the flock, burying aborted fetuses and afterbirth, and thorough cleaning of the spot where the fetus and afterbirth are found is helpful in preventing chlamydiosis. Immunizations are available and will increase the ewe's resistance to infection.

Toxoplasmosis - Toxoplasmosis is an infectious disease that also occurs nationwide and causes severe economic losses. This disease is caused by a microorganism carried by cats. Transmission occurs when sheep feed is contaminated with fecal matter from infected cats. When ewes become infected, the organism invades the placenta and fetus. If this occurs in early pregnancy, the fetus is absorbed by the ewe. If the infection occurs during late gestation, the lamb is often stillborn or born weak. Diagnosis of this disease involves microscopic examination of aborted fetuses or placentas. No effective treatment currently exists for this disease. As with chlamydiosis, prevention involves breaking the cycle of infection.

Brucellosis - Brucellosis is caused by bacteria. This disease is spread through sexual contact between animals. This bacteria causes an infectious swelling that blocks the transfer of sperm from rams. Brucellosis can also affect pregnant ewes. The bacteria can cause abortions, but more commonly results in the birth of small, weak lambs.

Pregnancy toxemia - Commonly referred to as ketosis, this disease occurs in ewes that are almost ready to lamb. Ketosis usually occurs in older ewes carrying multiple lambs or in extremely thin or fat ewes. The basic cause is a diet deficient in energy during late stages of pregnancy when fetal growth is greatest. In the absence of sufficient energy in the diet, the liver is not able to completely convert fat stores into usable energy. Breakdown products called ketones accumulate in the sheep's body. This disease can also be triggered by stress brought on by dogs or predators, bad weather, old age, poor teeth, heavy worm infestations, and other diseases. Early signs of this disease include listlessness, teeth grinding, and labored breathing with frequent urination. Sometimes a ewe with ketosis has an odor to its breath. Changes occur in the brain and kidneys that are responsible for loss of appetite, a depressed attitude, and the eventual death of the ewe. Treatments include intravenous glucose injections. Producers can prevent toxemia by providing proper nutrition for ewes.

Mastitis - Similar to mastitis in cattle, this infection involves an inflammation of the tissue of the udder. Nearly 100 percent of the udder infections involve entry of bacteria through the teat end. Injured or damaged teat ends support the growth of bacteria. Milk from the infected animal appears abnormal, with clots, chunks, or a thickness similar to pus. Diagnosis is made by observing the ewe and examining the udder. Treatment involves the use of an intramammary or injectable antibiotic and occasionally the use of other drugs to reduce inflamation and fever. Lambs of infected ewes may need to be bottle fed during treatment. Good sanitation is important in preventing mastitis. Dirty housing during gestation and dirty lambing areas contribute to contamination of the teats.

Vibriosis - Vibriosis is caused by bacteria. The disease can be transmitted by contaminated feed or water, carrier ewes, birds, or rodents. The bacteria invades the uterus, placenta, and fetus of ewes during the late stages of pregnancy. Vibriosis causes abortions. This condition is hard to detect because the infected ewes show very few symptoms. A brownish, foul-smelling vaginal discharge usually appears following the abortion. A few of the ewes may die from retaining dead fetuses. However, the ewes usually recover completely without treatment and will be immune to the disease. Proper vaccination practices and strict sanitation during and prior to lambing is important for the prevention of this disease. Infected ewes should be isolated from the rest of the flock. The aborted fetuses and membranes should be destroyed.

Leptospirosis - Sheep can become infected with leptospirosis by coming in contact with infected cattle. Leptospirosis causes abortion in sheep. Abortion normally occurs in the last stage of pregnancy. Other symptoms of this disease include fever, anemia, jaundice, and bloody urine. These symptoms are sometimes mild or unapparent, so a producer may not be able to detect leptospirosis until the fetus is aborted. Vaccines are available for this disease. Infected sheep can be treated with antibiotics.

Scrapie - Scrapie is a slow degenerative disease of the central nervous system of sheep. It affects the brain and the tissue of the nervous system. The unknown agent that causes this disease exhibits itself only in sheep with a certain genetic makeup, which plays a role in the length of the incubation period and the expression of the symptoms. Symptoms include tremors of the neck and head, itching, and a lack of coordination. Sudden movement or handling can cause excessive tremors and cause the animal to fall into a convulsion-like state. The major method of prevention is to avoid introducing it into the flock through replacement stock by reviewing the health history of the source flock, checking on unexplained deaths, and purchasing animals from scrapie control program members. No method of treatment exists.

Urinary calculi - Urinary calculi, also referred to as water belly, is a metabolic disease that primarily affects male sheep. Salts that are usually passed out of the body in urine instead form calculi, or stones, that can lodge in kidneys, ureters, the bladder, or the urethra. If calculi form in females, the stones are more easily excreted than in males due to anatomical differences. Castration affects the urethra, so wethers are at the greatest risk for developing this problem. Blockage of the urethra in males causes several symptoms, including retention of urine, abdominal pain, urine dribbling, loss of appetite, a humped appearance, and distention and rupture of the urethra. The condition will cause death if it is untreated. Prevention involves properly balancing calcium and phosphorous at a ratio of 2:1 in the ration, providing an adequate amount of water, and making sure water sources are not high in minerals. Treatment involves snipping off the end of the penis to dislodge the calculi and feeding ammonium chloride to acidify the urine and dissolve the calculi. Surgery may be required for valuable animals.

Fescue toxicosis - Fescue toxicosis, or fescue foot, can cause a reduced rate of gain, lameness, and in extreme cases, loss of extremities, such as hooves, ears, and tails. It also reduces conception rates in exposed ewes. One way to prevent this disease is to feed fescue that is free of the endophytic fungus *Acremonium coenophialum*, which causes the disease. Another is to keep pastures clipped with a mower. Fescue that gets too tall can break and provide a place for the endophyte to enter the plant.

Foot rot - Foot rot is caused by a bacterial infection of the feet. The bacteria live in warm, moist environments and usually enter the foot through an injury. The bacteria attack the portion of the foot under the hoof and sole. The condition may be present in some sheep for long periods of time before it emerges. The feet may develop distorted hoof growth, lameness, and a strong odor in

advanced stages. Prevention includes purchasing sheep from herds that are free of this condition, cleaning and disinfecting trucks and trailers from other sheep farms that enter the operation, and providing a foot bath of a bactericide solution. Treatment involves hoof trimming and the application of a bactericide as a spray or foot bath.

If a sheep displays signs of illness, it should be separated from the flock to try and prevent exposing other sheep. Treatment should begin as soon as possible. Producers should consult a veterinarian for a diagnosis or to determine the best course of treatment.

## Summary

Maintaining good health is vital for producers to meet economic demands and successfully make a living. The producer's knowledge of potential problems and the steps to prevent or treat them is vital to the profit level of the enterprise. If a producer utilizes proper observation, recognizes signs of poor health, and knows how to react to the signs of disease, then many major health problems can be prevented or controlled.

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## *Lesson 6: Flock Health for Sheep*

Sheep producers want to make the highest possible profit on their product. For producers to achieve the highest margin of profit, they must produce sheep that are of high quality, which means that they must be healthy. Developing a flock health plan will help in managing routine preventative measures for maintaining health.

### Regulations Affecting Purchases and Sales

The regulations that affect buying or selling sheep chiefly have to do with the transportation of the animals. When transporting any livestock either within or into the state, regulations set forth by the U.S. Department of Agriculture must be followed. In Missouri, the state laws and federal regulations are the same. Most local regulations align with these laws as well, but local authorities should be contacted to determine if this is the case.

The main requirement for sheep being moved into Missouri from another state is that they be inspected by a licensed, approved veterinarian and issued a Certificate of Veterinary Inspection. However, animals do not have to be inspected if they are going directly to a slaughter facility. Sheep being transported into Missouri must also be accompanied by an entry permit issued by the state. If the sheep come from scabies-infected areas, they must be dipped or treated within ten days of entry.

Within the state of Missouri, transportation of livestock does not require an inspection. However, sheep must be certified as being free of any infectious diseases by a local veterinarian.

### Introducing New Animals into the Flock

Producers should do research to make sure that animals are healthy prior to purchasing them and introducing them into their flock. One way of determining the status of a sheep flock is for the producer's veterinarian to contact the veterinarian associated with the farm from which the livestock will be purchased. They can discuss all the potential risks for animals on both farms so that decisions can be made about what course of action should be taken to minimize these risks. Whenever possible, producers should purchase animals from flocks with a health status that is equal to or better than their own.

Even if the health status of the animals is known, isolation of all new animals is important. Avoiding contact with infected animals is the best way to prevent diseases. Sheep being brought into the flock must be quarantined for at least three to four weeks, but the length of time for isolation is dependant on the individual producer. The producer should take adequate time to achieve certain goals. The most important of these goals is diagnosing and controlling any diseases or parasitic infections in the animals. The animals should also be allowed to adjust both physiologically and nutritionally to their new surroundings. They then have the opportunity to develop immunity to pathogens already present in the flock.

As with other livestock species, after any contact with isolated animals, the producer should shower and change clothes before returning to the main flock. This practice will control the spread of any diseases or parasites that the new animals may be carrying.

### Vaccination Practices

Disease prevention is an ongoing process. It begins with the ewe prior to breeding and is carried on throughout the life of the offspring. It is important to devise a plan that works well and continue with this program. A basic flock health calendar is shown in Figure 6.1. This calendar should be adjusted based on the producer's needs and the advice of a veterinarian.

Devising a vaccination schedule is an important part of a flock health program. Producers should check with a veterinarian prior to beginning a vaccination schedule because some conditions may be more prevalent in a particular area. The vaccination schedule should be tailored to the health problems that may affect the producer's flock. Ewes should be vaccinated for reproductive diseases like leptospirosis, vibriosis, and chlamydiosis six to eight weeks before breeding. Ewes should be given a booster shot for vibriosis 60 to 90 days after breeding. They should be vaccinated for enterotoxemia two to four weeks prior to lambing. All lambs should be vaccinated for enterotoxemia at about four to six weeks of age.

*Figure 6.1 - Sample Flock Health Calendar*

Rams - Six to Eight Weeks Before Breeding
- Test for the Brucella ovis when selecting or purchasing new rams.
- Isolate for at least 30 days and observe daily for health problems.
- Conduct a breeding soundness evaluation.
- Deworm all rams and treat for external parasites; worm again in 17 to 21 days.
- Give vaccinations as required. Seek advice from a local veterinarian.
- Provide adequate energy, protein, salt, minerals, and water so rams are in top physical condition.

Ewes - Six to Eight Weeks Before Breeding
- Conduct a thorough physical examination for general health. Give special attention to teeth, feet, and udder.
- Plan a flushing program two to three weeks prior to breeding.
- Deworm prior to breeding; worm again in 17 to 21 days.
- Vaccinate ewes for previously unvaccinated diseases, especially reproductive diseases.

During Gestation
- Vaccinate any bred replacement ewes.
- Increase energy and protein in the ration.
- Use ultrasound for pregnancy testing.
- Vaccinate for vibriosis 100 days after breeding.
- Deworm two weeks prior to lambing.
- Start a coccidia program two weeks prior to lambing.

Lambing Period
- Clip and treat navel with iodine.
- Observe ewes and lambs for mastitis, scours, and pneumonia. Treat as needed.
- Dock and castrate lambs.

During Growth and Weaning
- Vaccinate lambs with clostridium agents.
- Maintain a nutritional program for ewes and lambs to promote health.
- Monitor ewes for mastitis.
- Sort and cull ewes with poor teeth and excessive thinness.
- Conduct an internal and external parasite control on all sheep (ewes, lambs, rams).

As with other species of livestock, the proper administration of vaccinations is an important consideration. Most vaccinations should be administered in the neck or under the inside of the front leg, in the foreflank area. Shots should generally not be given on the outside of the front or rear leg. Bruising and staining will damage the meat and reduce the value of the animal at slaughter. An exception is the vaccination for enterotoxemia, which should be given in the flank of the rear leg.

Vaccinations will be effective in controlling health problems only if the flock is healthy, stress-free, and well fed. Sheep that are sick, undernourished, or infested with parasites will not respond well to vaccinations.

## Parasite Control

Sheep are at risk for both internal and external parasites. Sheep have a cleft upper lip, which allows them to graze close to the ground and pick up the eggs and larvae of internal parasites. Their thick wool can provide protection for external parasites. To control parasites, producers must establish a plan for keeping their animals healthy.

Examples of internal parasites that can affect sheep include tapeworms, roundworms, and lungworms. Infestations can result in a lower rate of gain, lower feed conversion, malnutrition, and death. Producers can use some management practices to lower the incidence of parasites. Proper sanitation is essential when trying to control parasites in a sheep flock. Another method of control involves creating unfavorable conditions for

parasite growth by keeping areas containing sheep dry. Moisture encourages the development of internal parasites. Making sure animals do not ingest parasites or their eggs is important. Sheep should not graze on contaminated pastures, and lambs should be placed in clean, rested pastures after weaning. The use of anthelmintics is an important tool in controlling internal parasites. The frequency of worming depends on the pasture and environmental conditions of the operation. Most wormers are given to sheep orally by drenching.

Drenching should be done carefully to avoid harming the sheep. Sheep should be adequately restrained for drenching. The use of the proper facilities, such as a chute, will result in less stress for the sheep and the handler. To administer the drench, the sheep's head should be held in a straight line with its body. The muzzle should be tilted slightly upward but not high enough to induce choking. The drench gun should be placed carefully in the side of the mouth. No resistance should be encountered when the nozzle is in the correct location. Rough use of the drench gun may cause pharynx or larynx damage, resulting in serious infection or difficulties in swallowing. If the sheep struggles, it should be allowed to calm down before the liquid is squirted into its mouth. If it is not calm, the sheep may choke and breathe in the liquid, which could result in a fatal case of aspiration pneumonia. The drug should be administered in the back of the sheep's mouth to prevent it from spitting the drug out. The sheep's mouth must be kept closed until it swallows. Each sheep should be marked after treatment.

Examples of external parasites that can affect sheep include sheep ticks, wool maggots from blow flies, lice, head bots, keds, and the mites that cause scabies. They are usually controlled by the use of insecticides, which may be applied as sprays, dips, pour-ons, or dusts.

Producers should always check with a veterinarian before instituting a program for parasite control. The veterinarian can also help determine which anthelmintics would work best for a particular operation.

## Record Keeping

As with any type of livestock operation, the producer should keep complete and accurate health records about his or her sheep flock. They will prove useful when evaluating the animals' performance or when selling stock to other producers. Health records include worming dates and the vaccination record of an animal. The records may also include a history of illnesses the animal has experienced.

## Summary

A successful sheep operation must have a good flock health program. Through consultation with a veterinarian, a producer can develop a flock health plan for vaccinations and parasite treatments that will ensure a high level of production for the operation. Producers should also be aware of the regulations surrounding the purchase and sale of animals and the proper strategies for introducing new animals into a flock.

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## *Lesson 7: Health Problems in Horses*

Horse producers must take the necessary steps to successfully manage parasites and diseases. Horses perform well only if they are healthy and in good condition. Knowing what to do when problems occur and taking steps to prevent future problems is the key to raising healthy horses. Regularly observing horses for signs of poor health serves as a starting point for maintaining herd health.

### Observing Herd Health

Observation of each animal in the herd is one of the most important aspects of health maintenance. By observing the horses regularly, the producer is more likely to recognize a problem when it occurs. Producers should be familiar with the habits of each of their horses to help identify abnormal behavior. Usually horses are observed daily during feeding. Another good time for observation is during grooming or exercise, if these activities are carried out regularly. If a horse is missing from the herd when the producer observes them, she or he should look for the animal to make sure nothing is wrong.

Producers may also want to check equipment and facilities daily. Damage to equipment or facilities could potentially cause injuries to horses. Repairs need to be made promptly to prevent injuries and avoid health problems.

### Indications of Health Problems

Early detection of diseases or injury is an essential part of herd health management. Detecting problems is not always easy, but producers who regularly observe animals should notice signs of illness. These signs include reduced feed consumption or grazing, abnormal feces or urine, lack of movement and spirit, an unusual demeanor (aggressive instead of calm, for example), floppy ears, a rough or dull coat showing signs of balding or rubbing, and dry, hazy eyes.

Abnormal vital signs can be another indicator of health problems in a horse. Important vital signs include the body temperature, respiration rate, and heart rate of the animal. If signs of health problems are observed, producers may try to check the vital signs of the animal. Body temperature, which is taken rectally, may be the easiest for the owner to check. A veterinarian can determine if an animal's respiration or heart rate is abnormally high or low. Average vital signs can be found in Table 7.1.

*Table 7.1 - Normal Vital Signs*

| Vital Sign | Average |
|---|---|
| Temperature | 100.5° Fahrenheit |
| Respiration Rate | 8-16 breaths/min. |
| Heart Rate | 34-45 beats/min. |

### Health Problems

In spite of the best efforts of the producer, health problems will likely arise. Effective treatment of these problems depends on an early and accurate diagnosis followed by an appropriate treatment. Producers should separate animals with infectious diseases from the herd to prevent exposing other horses. A veterinarian should be called immediately to make a diagnosis and provide treatment. Below is a list of some of the health problems associated with horses.

Azoturia - This condition, which is also called Monday morning disease, is a nutritional disorder that develops when a horse is put to work following a period of idleness during which it has received the same level of feeding as when it is working. The horse becomes stiff and sweats and has dark-colored urine. Their muscles become swollen, tense, and paralyzed. Azoturia can be prevented by decreasing the amount of grain fed when the horse is idle. The horse should be exercised during idle periods and started back to work slowly. When symptoms appear, the horse should be stopped from working and allowed to rest in a standing position. It should not be allowed to move. Producers may use blankets to keep the horse warm and dry. Medicine may be necessary depending on the severity of the case, so producers should call a veterinarian for treatment.

Colic - Colic is not a specific disease but rather a disease complex encompassing a wide range of conditions that affect the horse's digestive tract. It usually results from some type of obstruction from gas, fluid, or feed that blocks the flow of feed through the intestine, resulting in abdominal pain. About 20 percent of the cases of colic are caused by the presence of an internal parasite, usually large bloodworms. Colic may also be caused by

nutritional factors. A ration that is too high in energy, sudden changes in feed, feeding a high-fiber ration, or feeding a poor quality ration may cause colic. If horses are allowed to drink large amounts of cold water before being cooled down after heavy exercise, colic may occur. Symptoms include abdominal pain, which is expressed by the horse looking at its flank, getting up and down, kicking at its belly, sweating, and shifting weight. The horse may lie down and roll; rolling should be prevented by haltering the horse, because it may cause a twisted gut and result in the death of the animal. Other signs are an increased pulse and respiration rate, congested mucous membranes, straining, sweating, and bloating. It is better to follow a good management program to prevent colic than to have to treat the condition after it occurs. When colic occurs, it must be treated immediately. If a horse develops colic, the producer should call the veterinarian immediately and try to walk the horse until she or he arrives. In some cases, surgery may be needed.

Distemper - Distemper, or strangles, is caused by bacteria. It spreads quickly from horse to horse, especially where large numbers of animals are together in one place. Contaminated feed, watering troughs and tack, or direct nose to nose contact will spread the disease. Symptoms include high fever, loss of appetite, and depression. A pus-like discharge may come from the horse's nose. The lymph nodes in the lower jaw and throat swell and may break open and discharge pus. A veterinarian may also surgically drain abscesses. Horses may be treated with antibiotics after the abscess breaks or is lanced. Vaccinations may prevent the disease.

Encephalomyelitis - Encephalomyelitis, which is also called sleeping sickness, affects the brain and may be caused by one of several viruses. The viruses are carried by mosquitoes. The symptoms include high fever, depression, lack of coordination, loss of appetite, drowsiness, drooping ears, and circling. The horse may recover or die. Death rates may range from 20 to 90 percent. Vaccinations can prevent the disease; producers should consult a veterinarian to determine which strains of the virus should be vaccinated for in their area. Controlling mosquitoes also helps prevent this disease. No effective treatment exists, although good supportive care may be provided.

Equine infectious anemia (EIA) - This disease, also referred to as swamp fever, is a serious blood disease caused by a virus carried by horse flies and mosquitoes. Symptoms can vary but include high intermittent fever, depression, stiffness, weakness, loss of condition and weight, and swelling. Most affected horses die within two to four weeks, but some may recover. However, they may spread the disease to other horses. No vaccine is available to prevent the disease. A blood test called the Coggins test can detect swamp fever. If a horse tests positive for this disease, the animal should be quarantined and slaughtered, unless it is a nursing foal that may be affected by antibodies from a mare that tests positive. Once it is weaned and is over six months of age, it may test negative for the disease.

Equine influenza - Influenza is caused by viruses. It spreads quickly where large numbers of animals are kept together. Symptoms include high temperature, lack of appetite, coughing, and a watery nasal discharge. Younger horses are more likely to become infected. To prevent the disease, infected animals should be isolated. Vaccines may also be used to create immunity. For treatment, veterinarians may administer antibiotics to prevent secondary infections. The horse should be allowed to rest for three to four weeks.

Fescue toxicosis - Fescue toxicosis, or fescue foot, is caused by a fungus that grows in tall fescue, an important pasture forage in Missouri. The fungus produces toxins that inhibit prolactin, a hormone that is essential in the last months of gestation for udder development and colostrum formation. The toxin can also cause lameness, sloughing off the end of the tail, poor weight gain, and an increase in pulse rate, respiration, and body temperature. It may cause a thickened placenta in broodmares, and foals may be stillborn or die at birth. Mares may not produce milk. No treatment exists for fescue foot. The animals must be removed from fescue pasture immediately when symptoms occur. Hay made from tall fescue should not be fed to pregnant mares or used for bedding. Pregnant mares should be removed from fescue pasture at least three months before foaling. Fungus-resistant varieties of fescue are available for pasture use.

Laminitis - Laminitis, or founder, is a nutritional disorder. Common causes are overeating of concentrates or grass heads, sudden changes in feed, drinking too much water, or standing in a stall for long periods. One symptom is the swelling of the sensitive laminae on one or more feet, leading to lameness; the laminae are the tissues

that lie directly below the horny outer wall of the horse's hoof. Other signs include fever, sweating, and a stiff gate. Distortion of the hoof during growth is common with extreme cases of founder. Care in feeding and exercise helps to prevent the disorder in some cases. Stiff horses require emergency treatment; if the animal is treated within the first 8 to 12 hours of lameness, permanent damage can be avoided. Treatment of the acute form involves applying cold water to the hooves. A veterinarian can provide additional medication for treatment. Chronic cases are treated by trimming the hoof and shoeing the horse.

Heaves - Heaves, also referred to as broken wind or asthma, is a nutritional disorder that affects the respiratory system. It is often caused by feeding moldy or dusty hay. It is more common in horses over five years of age. An affected horse has difficulty in breathing because the air must be forced from the lungs by the abdominal muscles. Other symptoms include a dry cough, nasal discharge, and loss of weight. Care in selecting feed is the best preventative measure; producers should never feed dusty or moldy hay. Changing to a pelleted ration may help treat the condition if the disease has not progressed too far. Putting the horse on pasture may result in some improvement. No effective treatment exists for advanced cases.

Tetanus - Tetanus, or lockjaw, is caused by bacteria. The bacteria usually enters the animal's body through a puncture wound but may enter through other types of wounds. The bacteria produces toxins that cause the horse to become ill. The horse will become nervous and stiff. Muscle spasms and paralysis follow. Death usually occurs in untreated cases. The disease may be prevented through annual vaccinations or by administering the tetanus antitoxin immediately after a known injury. About 30 percent of all infected horses recover with treatment by a veterinarian, which may involve administering muscle relaxants and antitoxins.

Blister beetle poisoning - The presence of blister beetles in alfalfa hay can poison horses. The beetles produce a blistering agent in their blood. This compound is very stable and affects animals that consume the dried remains of the beetle fed in hay. It causes irritation and damage to the lining of the stomach, small intestine, bladder, and urethra. Symptoms of blister beetle poisoning include placing the muzzle in water and playing with the water with the lips and tongue, signs of colic, fever, sweating, stiffness or an exaggerated "goose-step" gait, frequent straining and voiding of urine containing blood. The levels of calcium and magnesium in the blood also drop. Autopsies should be performed on animals that die after consuming hay. Producers can prevent the problem by making sure that hay does not contain blister beetles, either by spraying alfalfa before it is harvested, buying hay only from trusted suppliers, buying hay that was harvested before June or after September, or inspecting hay before feeding it. Horses should be treated with mineral oil. A veterinarian can supply fluids intravenously to prevent dehydration and increase the levels of calcium and magnesium in the blood.

## Summary

The producer's knowledge of potential health problems is vital to the success of the enterprise. If a producer observes the herd regularly and recognizes signs of poor health, major health problems can be prevented or controlled.

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## *Lesson 8: Herd Health for Horses*

Diseases and parasites cost horse owners a lot of money every year because a sick horse will be unproductive and requires treatment. The best way to avoid losses is to devise a herd health plan that will prevent illnesses.

### Regulations Affecting Purchases and Sales

When transporting any livestock that have been bought or sold within or into the state, producers must follow regulations set forth by the U.S. Department of Agriculture. In Missouri, the state laws follow the guidelines set by the federal regulations. Most local regulations align with these laws as well.

The main requirement for horses being transported into the state is that they be inspected by a licensed, accredited veterinarian, who then issues a Certificate of Veterinary Inspection. The certificate must identify and describe all animals listed. Horses must also have an official negative Coggins test for equine infectious anemia (EIA). The test must have been done within the 12 months prior to entry into the state. EIA tests are not required for suckling foals accompanied by their mothers. The animals must be accompanied by a VS Form 10-11, which provides a graphic description of all markings needed for identification. A sample VS Form 10-11 is shown in Figure 8.1.

Horses entering Missouri from a farm of origin to a licensed livestock market must be accompanied by a waybill or owner/shipper statement showing their origin and destination. They do not have to have a Coggins test. However, all animals brought to a Missouri livestock market without the test will have blood samples collected for testing at the market before the sale at the owner's expense. A horse may be sold without the results of the test known but must be quarantined until test results are received.

Within the state of Missouri, horses being sold or traded must have an official certificate indicating a negative EIA test within the 12 months prior to the change of ownership. A completed VS Form 10-11 is also required for identification. As with horses from out of state, horses may be moved within Missouri from a farm of origin to a licensed market without a Coggins test. The same procedures are followed for testing and quarantine of untested animals.

Horses kept at boarding, breeding, or training stables must have tested negative for EIA within the last 12 months. The owner or manager of the horse enterprise is responsible for maintaining proof of current negative tests.

### Introducing New Animals into the Herd

Producers should examine horses for abnormalities and indications of possible health problems prior to purchasing them. In addition to this examination, a producer may request to see an animal's health records to learn about its health history. The producer may also have his or her veterinarian contact the current owner's veterinarian to discuss the horse or the health status of the horses on the farm of origin. As with other types of livestock, producers should ideally purchase animals from herds that have a health status that is equal to or better than their own.

Producers should isolate new horses brought into the herd. Horses should be quarantined for at least three to four weeks, although a producer may choose to isolate them for a longer period. Isolating the horses will enable the producer to deal with any health problems they might have. During the period of isolation, the animals are also allowed to adjust to their new environment.

During the isolation period, producers should be sure not to carry any disease-causing agents from the isolated animals to the main herd. The producer may want to shower and change clothes before returning to the main herd.

### Vaccinations

Another measure for preventing the spread of diseases in a herd is setting up a vaccination schedule for the horses. Producers should consult with a veterinarian prior to beginning a vaccination schedule. No standard vaccination plan exists; programs are tailored to meet the needs of the individual operation based on local health risks, the size of the herd, age, uses, value, and amount of exposure to horses from outside the herd. Once a plan that works is in place, a producer should continue with the established vaccination schedule. However, producers should also review the health status of the herd and make any

*Figure 8.1 - VS Form 10-11*

**Chapter 2—Health Requirements for Movement of Livestock, Poultry and Exotic Animals** **2 CSR 30-2**

U.S. DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
EQUINE INFECTIOUS ANEMIA LABORATORY TEST
*(VS Memorandum 555.0)*

1. ACCESSION NUMBER | 2. DATE

3. NAME AND ADDRESS OF OWNER *(Street, City, State and Zip Code)*
Tel. No. - AC ( ) .....

4. NAME AND ADDRESS WHERE HORSE IS STABLED *(Street, City, State and Zip Code)*
Tel. No. - AC ( ) .....

5. NAME AND ADDRESS OF VETERINARIAN *(Street, City, State and Zip Code. Print name and address legibly for window envelope use.)*

6. MARKET TEST ☐ YES ☐ NO

7. NAME AND ADDRESS OF AUCTION MARKET *(Street, City, State and Zip Code)*
Tel. No. - AC ( ) .....

8. FEDERALLY ACCREDITED VET. ☐ YES ☐ NO

*I hereby certify that the blood specimen submitted with this form was drawn by me from the horse described below on the date indicated*

9. STATE IN WHICH LICENSED

10. SIGNATURE OF VETERINARIAN

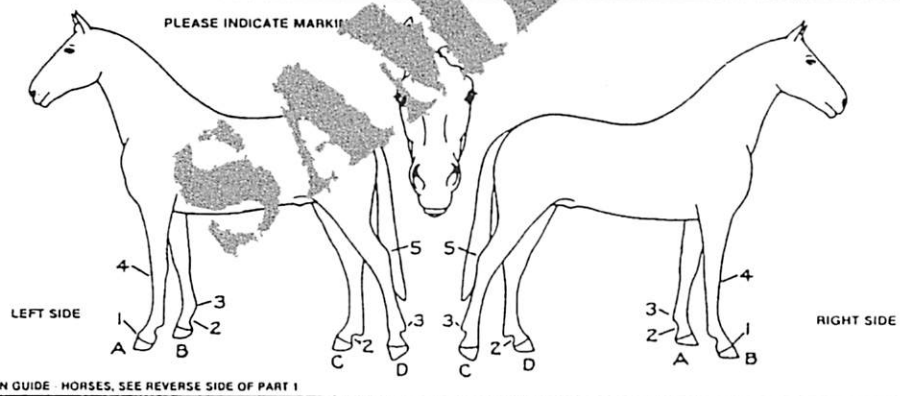
11. TEL. NO. AC ( )

12. DATE SAMPLE DRAWN

13. IDENTIFICATION

| TUBE NO. | OFFICIAL TAG NO. | TATTOO/BRAND NO | NAME OF HORSE | COLOR | REG NO. | BREED | AGE | *SEX |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

PLEASE INDICATE MARKI[illegible]




FOR DESCRIPTION GUIDE HORSES, SEE REVERSE SIDE OF PART 1

14. REASON FOR TESTING *(If other than Equine Infectious Anemia)*

15. DESCRIPTION AND REMARKS *(Left Side)*

A - LEFT OR NEAR FORE LEG
B - RIGHT OR OFF FORE LEG
C - RIGHT OR OFF HIND LEG
D - LEFT OR NEAR HIND LEG

1 - Coronet
2 - Pastern
3 - Fetlock
4 - Knee
5 - Hock

M - Mare
S - Stallion
G - Gelding
N - Neuter

16. DESCRIPTION AND REMARKS *(Right Side)*

FOR LABORATORY USE ONLY

| 17. DATE RECEIVED | 18. DATE REPORTED | 19. TEST RESULT | 20. REMARKS |
|---|---|---|---|
| | | | |
| 21. NAME OF LABORATORY | | 22. SIGNATURE | |

VS FORM 10-11 (APR 90) *Replaces APHIS Form 8011 (JUN 89) which may be used*

PART 1 - VETERINARIAN/SUBMITTER







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necessary changes to the schedule to improve overall herd health.

Producers should vaccinate all horses for tetanus. Foals may be vaccinated at three to four months of age by giving them two doses about four weeks apart. Because horses may wound themselves easily, a booster shot should be given every year to all horses. If a horse receives a wound and has not had a booster in the previous six months, another booster shot may be given. Mares may be vaccinated prior to foaling to pass on immunity to the foal.

Other diseases that producers frequently vaccinate their animals for include encephalomyelitis, influenza, and herpes viruses. Foals are vaccinated for encephalomyelitis at some point between three and six months of age, with two doses given three to four weeks apart. Booster shots are given to all horses before the beginning of mosquito season. Foals should be vaccinated for influenza beginning at three months, with vaccinations repeated at six months. Horses under six years of age that are at risk because of exposure to horses from outside the operation or because of stress should be vaccinated three or four times a year. Older horses or horses that are not often exposed to outside animals may be vaccinated once or twice a year. Foals are vaccinated for herpes viruses at three months by giving two doses four to six weeks apart. Young horses and horses undergoing training should be vaccinated every three to four months, while other horses may be given a booster once a year. Broodmares are vaccinated in the fifth, seventh, and ninth month of pregnancy to prevent the abortions associated with herpes viruses.

Vaccinations must be given properly to provide immunity. Producers should always check the label of the vaccine for directions on administration. Vaccines must be stored properly to be effective. Also, producers should check the date on the vaccine to make sure it is still usable.

## Controlling Parasites

Like other animals, horses may be affected by parasites. Producers must establish a plan for dealing with internal and external parasites to keep their animals healthy.

Examples of internal parasites that commonly affect horses are pinworms, roundworms, bot worms, and bloodworms. Signs of infestation may include anemia, digestive disorders, lack of spirit, dull coat, and reduced growth. Management practices can help control internal parasites. Proper handling of manure can decrease the chances of infestation because many parasites are transferred in feces. Manure should never be spread on horse pastures and should be cleaned up every couple of days in confined areas. Other good management practices include avoiding overstocking pastures, using rotational grazing practices to break the life cycle of the worms, and alternating horses with other livestock on pastures. Also, producers should make sure water supplies are clean and feed the horses in bunks to keep them from ingesting parasites.

Anthelmintics are an important tool in controlling internal parasites. Most producers have their horses wormed four times a year, although it may be done more frequently if necessary. Producers should always check with a veterinarian before instituting a program for parasite control. The veterinarian can help determine which anthelmintics would work best for a particular operation.

External parasites that affect horses include flies, mosquitoes, horse bots, and the mites that cause mange. External parasites are usually controlled by the use of insecticides, such as sprays and foggers. Some management practices can help to control these parasites as well. Good grooming can prevent infestation by horse bots and mites. Good sanitation can reduce fly populations.

## Routine Horse Care Practices

Horse producers should be aware of other routine practices that affect the health and well-being of the animals. Foot and tooth care are an important part of properly managing horses.

Most producers employ a farrier to shoe their horses, which is done every six to eight weeks. However, producers should know how to clean hooves and examine them for problems. Horses kept in a stall or small pen should have their hooves inspected and cleaned daily. A hoof pick can be used to clean the hoof. Stalls that are too moist promote rapid drying of the hoof and erode natural oils and protective films. A hoof dressing containing animal fats like lanolin should be applied regularly if moisture levels are a problem.

Regular examinations may also reveal problems like loose nails or the early stages of laminitis. Each time a horse is ridden, its hooves should be checked for gravel and other foreign objects that have become lodged in the natural depressions in the bottom of the hoof.

Hooves should also be trimmed periodically. Horses kept in stalls or small pens should have their hooves trimmed every four weeks, while horses that are used frequently or kept in pastures should have them trimmed every six weeks. Trimming is done to keep hooves the proper length and shape. Unless the horse's hooves need special attention, most producers should be able to trim the hooves of their horses themselves once they learn the proper procedures. If a horse has problems with its hooves, a farrier should do the trimming.

Horses that are one year of age or older should have their teeth examined by a veterinarian at least once a year. Signs that an examination is necessary include difficulty in chewing, a reluctance to drink cold water, dropping food out of the mouth, excessive amounts of unchewed grain in manure, weight loss, and reluctance to accept a bit. During the examination, the teeth may be floated, or filed down to remove any sharp edges or high spots that can interfere with chewing.

## Record Keeping

As with any type of livestock operation, the producer should keep complete and accurate health records for horses. Health records should include worming dates and the vaccination record of an animal. Vaccination records should indicate the type of vaccine given and the date of administration. Treatment may sometimes be affected by the vaccination history of the animal, so keeping accurate records is important. Health records may also include a history of illnesses the animal has experienced. These records are important for future reference when dealing with health problems or selling stock.

## Summary

Diseases and parasites can be very costly for horse owners. One good way of preventing or reducing disease is to develop a good herd health plan that includes a vaccination schedule and treatment for internal and external parasites. Health plans should be developed in consultation with a veterinarian. Other strategies for reducing health problems include following regulations for the transportation of animals that have been bought and sold and isolating animals before introducing them to the herd. Accurate health records should always be kept for all animals.

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## *Lesson 9: Health Problems in Poultry*

The key to disease control in the poultry industry is prevention. Common methods of preventing diseases include administering vaccinations, purchasing sound stock from reputable breeders, and properly cleaning and disinfecting facilities. All of these management techniques help the poultry producer maintain a sound and highly productive flock. If the manager misses the onset of disease by failing to take the time to closely observe the birds, significant losses are possible due to disease and other health problems.

### Observing Flock Health

Poultry producers should make it a part of their routine to periodically observe the flock. The flock should be observed daily for signs of health problems. If the birds are being raised in large floor units, a good manager will sit down for at least an hour within the unit to observe the birds' behavior. By observing the birds' behavior, the producer can determine which birds are sick or are the cause of other problems, such as cannibalism, egg-eating, and picking, which is pecking at bloody spots on the bodies or at feathers. These conditions can be eliminated if the problem bird is identified and promptly removed. In addition to observing the birds' behavior, the producer should look for bits of egg or blood on their beaks to determine whether they are engaging in these activities. In houses with solid floors, the producer should examine litter conditions.

### Indications of Health Problems

While observing the poultry flock, a producer should look for specific indicators of disease. First, the flock's general appearance should be noted. Healthy birds will appear alert, sound and act normal, and have normal droppings. Signs of an unhealthy flock include listlessness, coughing, squinting, droopy combs, loss of plumage, ruffled plumage, bloody droppings, and diarrhea.

The bird's vital signs can provide another indication of disease. The most commonly measured vital sign is temperature, although a bird's heart rate and respiration rate can be evaluated as well. Normal vital signs are listed in Table 9.1.

*Table 9.1 - Normal Vital Signs*

| Vital Sign | Average |
|---|---|
| Temperature | 106° Fahrenheit |
| Heart Rate | 200 to 400 beats/min. |
| Respiration Rate | 15 to 36 breaths/min. |

Other signs of disease that are not as obvious include a drop in egg production, decreased egg shell quality, and a decrease in feed or water consumption. Changes in any of these factors are indicated through production records. Managers should be sure that records of feed and water consumption are accurate because a drop in feed or water intake can be an early sign of health problems in the flock.

During certain periods of growth, the producer should expect some losses, but abnormally high losses may signal a problem. A higher rate of losses is normal during the first three weeks of production when the chicks or turkey poults are more weak and vulnerable to health problems. If the losses exceed 2 percent of the chicks or 3 percent of the poults, a health problem is likely the cause, and action should be taken immediately to diagnose and treat the problem. After the birds are three weeks of age, losses per month should not exceed 1 percent of either the turkey or chicken flock.

The producer should be familiar with the symptoms of the major poultry diseases and immediately take action if any of the signs of an unhealthy flock become apparent. However, poultry flock managers are not trained to recognize and diagnose every disease that the poultry flock can contract. Therefore, vertically-integrated companies often employ the services of a poultry disease specialist or an avian physiologist to work with their contracted producers. For the specialist to make an accurate diagnosis, he or she must be provided with a few samples of live birds that exhibit the symptoms typical of the rest of the flock.

A sampling of two or three live birds should be gathered for laboratory analysis regularly. How often the birds are gathered for analysis depends largely on the preference of the manager and the disease history of the flock. If a flock has had some history of disease, generally the birds will be tested more regularly. The birds should be tested for the presence of avian diseases and parasites,

especially those that are prevalent in the area. Through random testing, the producer will have a general idea of the condition of the entire flock.

## Health Problems

Many vaccines have been developed to prevent outbreaks in the poultry industry. Hatcheries routinely vaccinate newly hatched chicks and poults with some vaccines. The poultry producer should develop and implement a disease-prevention program for the diseases that affect his or her area. Some poultry diseases are described below.

Marek's disease - Marek's disease is sometimes referred to as range paralysis or acute leukosis. This disease affects many different types of birds but is especially common in chickens. It is caused by a herpesvirus that is shed in sloughed off skin and feather cells. Pullets between the ages of 6 and 16 weeks are most often affected. The chief symptom is paralysis of the legs, but other signs include sudden death, blindness, skin lesions, significant weight loss, and diarrhea. Birds that do recover from the disease may have decreased egg production. While no treatment exists, producers can vaccinate day-old chicks at the hatchery to prevent them from contracting the disease.

Newcastle disease - This disease affects chickens and turkeys. It is caused by several highly contagious viruses that cause different forms of the disease, ranging from mild to deadly. The viruses are spread through the air and by contaminated equipment and clothing. An entire flock may become infected in three or four days. Symptoms include paralysis, a twisted neck, and respiratory problems, such as gasping, snorting, wheezing, coughing, and sneezing. Laying hens may experience a large decrease in egg production or lay poor quality eggs with soft shells. The symptoms are generally less intense in turkeys and may not be noticeable; the chief losses are due to reduced egg production in breeder flocks. No treatment exists for Newcastle disease. Birds may be vaccinated in a variety of ways, including injections and sprays or dusts that treat the entire flock. The vaccinations have to be repeated throughout the birds' lives to continue to protect them from the disease.

Avian influenza - Avian influenza is caused by a virus that is spread in the feces and nasal discharges of infected birds; it is easily transmitted by contaminated people and equipment. This disease affects the respiratory and nervous systems of chickens and turkeys. The chief symptoms include coughing, sneezing, wheezing, and gasping for air. Diarrhea and lack of coordination may also be signs of avian influenza. Laying hens with this disease may show a significant decrease in egg production or lay misshapen eggs. Avian influenza has no effective treatment, although antibiotics may reduce losses from secondary infections. Recovered flocks will continue to transmit the virus and so should be considered infected for life. Vaccinations can help to control the disease.

Fowl pox - The fowl pox is caused by a virus that affects both chickens and turkeys. It is spread by direct and indirect contact between birds and by mosquitos. Blisters around the face and comb and yellow sores in the mouth are symptoms of the disease. For turkeys, another symptom is pale yellow sores in the throat. The growth of young birds with fowl pox is retarded, and layer hens will produce fewer eggs. The disease has no treatment but can be prevented by vaccinations.

Infectious bronchitis - Only chickens are susceptible to the virus that causes infectious bronchitis, which is extremely contagious. When this disease breaks out, the entire flock will become infected. It is spread through the air and on clothing and equipment. Infectious bronchitis is more prevalent in broilers than in laying hens. The symptoms of this respiratory disease are coughing, difficulty in breathing, gasping, rattling, and sneezing. Younger birds will experience retarded growth. Production in laying hens may stop almost entirely, and the eggs they do lay will be small, soft-shelled, and misshapen. No treatment exists, but a number of vaccines are available to help prevent the disease. Producers should select the vaccine that contains the form of the virus that is prevalent in their area. Strict management procedures can also help prevent this disease. Moving entire flocks at once and thoroughly cleansing and sanitizing facilities between batches are important in preventing infectious bronchitis.

Infectious bursal disease - This disease, which is also called gumboro, is caused by a virus. It is an extremely contagious illness that affects young chickens three to six weeks of age. It is found in most areas of concentrated poultry production. Although losses can be high, one of the most problematic aspects of the disease is that it

damages the immune systems of birds that do survive, making them more susceptible to other illnesses. Gumboro is spread by contact between birds, infected litter, and contaminated clothing and equipment. Signs of the disease include sleepiness, unsteady gait, decreases in food and water consumption, and whitish diarrhea. While no specific treatment exists, the disease can be prevented through vaccinations.

Pullorum disease - This disease is caused by a bacterium that affects both chickens and turkeys. Transmittal of this disease occurs in a number of ways, including contaminated clothing and equipment and contaminated facilities. The chief mode of transmission is from a hen to her chicks by the egg, although contaminated chicks may spread the disease between them. Pullorum disease results in large losses in production due to the high death rate among chicks. Young chicks may die without showing any symptoms; the symptoms that do occur include ruffled feathers, difficulty in breathing, chills, droopiness, white diarrhea, and vent pasting. Treatment involves administering different types of antibiotics. However, birds that survive the disease will be carriers, so recovered hens should not be kept to produce eggs. The best form of prevention is to perform blood tests on the breeder flocks and then cull the birds that carry the bacteria. Producers should only purchase chicks or poults from hatcheries that have been certified free of pullorum.

Fowl typhoid - Like pullorum disease, this disease is caused by a bacterium. Methods of transmission are the same as for pullorum, however mechanical transmission is more prevalent with fowl typhoid. Birds can be infected at any age, but the disease primarily occurs in young adults 12 weeks of age and older. Signs of the disease include sudden or sporadic death, listlessness, green or yellow diarrhea, loss of appetite, increased thirst, and pale, anemic appearance of comb and wattles. Birds infected with fowl typhoid are treated with the same drugs as those used for pullorum. Prevention includes purchasing hatching chicks from disease-free flocks as determined by pullorum testing, practicing strict sanitation, providing clean feed and water, and disposing of dead birds per state animal health agency policy.

Colibacillosis - Colibacillosis is caused by a microorganism called *Escherichia coli.* Although this type of bacteria is common, when *E. coli* populations grow too large, the toxins that they produce can cause disease. Because many different strains of E. coli exist, a variety of symptoms is possible, resulting from infections of the respiratory system, digestive system, or blood. Among these symptoms are fever, difficulty in breathing, coughing, and diarrhea. The broad array of symptoms makes it necessary to perform laboratory testing to check for infections. Antibiotics are used to treat colibacillosis, but infections do not also respond well to treatment. Infected birds are generally culled. Producers can prevent the disease through good sanitation and management practices that reduce stress on the birds.

Fowl cholera - Fowl cholera, which is caused by a bacterium, affects all types of poultry. The bacteria is transmitted through the droppings of diseased birds, dead birds, contaminated water supplies, and contaminated equipment or clothing. The disease has two forms, a chronic form in which birds are sick for a long time and an acute form in which they become suddenly and severely sick. Birds may die without showing any symptoms, but others may show a variety of signs. Symptoms of the disease include drowsiness, fever, loss of appetite, rapid weight loss, difficulty in breathing, greenish-yellow droppings, darkening of the head, and sitting with heads turned back over the wings. Treatment for fowl cholera involves the use of sulfa drugs and antibiotics, but birds that do recover remain carriers of the disease, which tends to recur. They should therefore be culled. Good sanitation and vaccinations can help to prevent outbreaks.

Coccidiosis - Coccidiosis is the most costly disease affecting poultry. It is caused by coccidia, a protozoa or microscopic animal. Because several different species of coccidia affect chickens and turkeys, a flock that develops a resistance to one type after an outbreak may be infected by another. Several strains are of major commercial importance; they affect different sections of the gut and cause varying symptoms. The organisms are transmitted in the droppings of infected birds, either directly to other birds or indirectly through contaminated clothing and equipment, insects, and rodents. Symptoms of the disease are weakness, anemia, diarrhea, bloody droppings, droopiness, and decreases in food and water consumption. Egg production will also decrease. Anticoccidial drugs called coccidiostats are added to food and water to treat the disease. Prevention involves good sanitation, especially

keeping litter dry. Vaccinations and coccidiostats may also be used to prevent the disease.

Infectious coryza - Infectious coryza, or roup, is a respiratory disease caused by bacteria. Although the disease primarily affects chickens, it may occur in turkeys, pheasants, and guinea fowl. Chickens become susceptible to the disease at four weeks of age, and susceptibility increases as they age. The disease is transmitted by direct contact, airborne droplets, and drinking water. It is characterized by nasal discharge, sneezing, and swelling of the face around the eyes. Egg production is reduced in laying hens. The all-in, all-out method of management in commercial flocks has helped to eradicate this disease in certain areas. Vaccinations and medications administered in feed and water can be given to prevent this disease. Erythromycin can also be given in feed or water to treat sick birds.

Blackhead - Blackhead is a protozoal disease that affects turkeys, grouse, quail, and occasionally chickens. Turkeys of all ages are susceptible, but the greatest mortality occurs in birds that are about 12 weeks of age. The protozoa is carried through fecal matter and may live in the soil for many years. Symptoms include listlessness, drooping wings, unkempt feathers, sulfur-colored droppings, and a dark head. Strict sanitation must be practiced to help prevent this disease. Medications can be administered in feed and water to prevent or treat this disease.

Enteritis - This disease has three forms, coronaviral enteritis (bluecomb), hemorrhagic enteritis, and ulcerative enteritis. The first two forms are caused by a virus and affect turkeys, while the third form is a bacterial disease that affects both chickens and turkeys. The symptoms of the first form include marked depression, anorexia, diarrhea, dehydration, and weight loss. Mortality may be high in young birds, but the economic losses resulting from the condition of the older birds are also important to the producer. The second form causes intestinal hemorrhaging and is diagnosed by bloody droppings, depression, and death. Symptoms of the third form are sleepiness, whitish watery diarrhea, a humped posture, and loss of appetite. Good sanitation must be practiced to prevent the introduction of these diseases into the flock. Hemorrhagic enteritis may be prevented with vaccinations. Depopulation and complete disinfection techniques must be employed to break the cycle of infection for bluecomb. This practice is best done during the summer months. Houses should be left vacant for about a month. Antibiotics can reduce the number of deaths from bluecomb and ulcerative enteritis.

Dermatitis - Dermatitis is an infectious disease caused by bacteria that is characterized by a sudden onset, a sharp increase in mortality, and a gangrenous condition of the skin over the breast and thighs. It affects chickens and occasionally breaks out in turkeys. Affected chickens show signs of extreme depression, lameness, and prostration. Feather loss and sloughing off of the skin frequently occurs. Birds often die within 8 to 24 hours, and mortality rates may reach 50 to 60 percent. This disease can be controlled by maintaining proper litter conditions, minimizing mechanical injury, and controlling cannibalism. A vaccination program should be implemented to help prevent this disease. Medication may be given in feed to rapidly reduce mortality if the disease does occur.

Laryngotracheitis - This disease, also referred to as gapes, is an acute, highly contagious herpesvirus infection of chickens characterized by severe coughing, gasping, rattling, and extension of the neck. Birds also lose their appetite and become inactive. The mouth may appear to be bloodstained due to tracheal hemorrhaging. Mortality varies but may reach as high as 50 percent in adults. Prevention may be accomplished through vaccinations using a modified strain of the disease. If birds contract the disease, some relief is obtained by keeping them quiet, lowering the dust levels, and using a mild expectorant.

## Summary

The best way to maintain poultry flock health is through prevention. Producers should make observation of the behavior and general condition of the flock a part of their daily routine, looking for indicators of health problems such as listlessness, coughing, ruffled plumage, and diarrhea. They should also keep accurate records of production and feed and water consumption and take random samples of birds to analyze the general health of the flock. Many specific diseases and parasites tend to be a problem in poultry production systems. Fortunately, a variety of vaccinations can help prevent outbreaks.

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## *Lesson 10: Flock Health Management*

With every flock, the poultry producer must invest a large amount of time, labor, and money in the prevention of diseases and other health problems. Proper health practices are essential to ensure that the flock remains healthy. Producers must be sure to follow local, state, and federal regulations when buying and selling birds. They should also follow proper vaccination schedules and establish methods to control internal and external parasites.

### Regulations Affecting the Sale of Birds

The regulations affecting the sale of birds revolve around their transportation. The laws are specifically designed to prevent the spread of pullorum and fowl typhoid. These laws are set by the USDA; the Missouri Department of Agriculture generally follows their guidelines. They have been established with the cooperation of the National Poultry Improvement Association (NPIA) and its Missouri branch, the Missouri Poultry Improvement Association (MPIA).

According to the regulations, all birds and hatching eggs entering the state of Missouri must possess either a Certificate of Veterinary Inspection or a VS Form 9-3. The certificate must be signed by an accredited veterinarian who has found no clinical signs of fowl typhoid or pullorum in birds or no signs of pullorum in the flocks producing hatching eggs. The owner or the shipper of the flock signs the VS Form 9-3, which states that the birds show no signs of illness. All birds must have documentation showing that they have tested negative for pullorum and fowl typhoid within the last 90 days, unless they are a product of a flock that has been certified disease-free by state representatives of the National Poultry Improvement Plan (NPIP). The NPIA devised the NPIP to coordinate government and industry efforts to establish standards for evaluating breeding stock and hatcheries to ensure that they are free from disease.

All birds and hatching eggs entering Missouri must also have an entry permit certifying that they are free of disease. These permits are issued to NPIP participants every year. Other producers must request an entry permit for each shipment.

Official representatives of the NPIP must be provided with the Certificate of Veterinary Inspection or the VS Form 9-3 upon request and are permitted to conduct testing as they see fit. Those flocks diagnosed unhealthy are quarantined. The birds are tested to find the source of disease. If the birds are diseased, they are disposed of in an approved manner.

### Practices for Introducing New Birds

Poultry scientists strongly discourage the introduction of new birds into an already existing flock because of the potential for introducing diseases. Instead, new birds are brought into poultry operations using an all-in, all-out system in which an entire group of birds is introduced at once to a facility that was cleaned and sanitized after the removal of the previous flock.

If flocks of different ages are present, they should be housed separately in facilities that are at least 40 feet apart. When egg prices are high, producers may want to keep the highest-producing, most vigorous laying hens when the rest of the flock is culled after a year of production. However, they should be kept only if separate housing is available. If it is not, a producer should cull the entire flock and completely replace it.

### Vaccination Practices

Another aspect of managing flock health is the administration of vaccinations. Producers should either develop a vaccination schedule designed to prevent diseases that are common in their area or follow the vaccination schedule and procedures outlined by the integrator. Vaccination programs and schedules will vary widely from flock to flock, but the following provide some examples of disease prevention programs.

Broilers - Broilers should be vaccinated for Marek's disease, Newcastle disease, infectious bronchitis, and fowl pox. They should be vaccinated for Marek's disease at one day of age and for Newcastle disease at one to two weeks of age. They may also be vaccinated for infectious bronchitis at this time. The birds will need to be revaccinated for both Marek's disease and Newcastle disease. Broilers may be vaccinated for gumboro at any time before three weeks of age. Broilers should also be vaccinated for fowl pox, but the timing of the vaccination will depend on how frequently the disease occurs in their area. It may vary from one week of age where the disease is common up to sixteen weeks of age.

Replacement pullets - Replacement pullets for egg production or breeding flocks should be vaccinated for Marek's disease, Newcastle disease, infectious bronchitis, fowl pox, and avian encephalomyelitis. They are vaccinated for Marek's disease at the hatchery when they are one day old. If they are not vaccinated for Newcastle disease and infectious bronchitis at hatching, producers must give birds the vaccines for these diseases at one to two weeks of age. The birds are later revaccinated for Newcastle disease and infectious bronchitis. They should be vaccinated for fowl pox, but the timing of the vaccination will vary depending on the incidence of the disease in their area. The birds may be vaccinated for avian encephalomyelitis during the growing stage. They may also be vaccinated for laryngotracheitis after four weeks of age depending on the incidence of the disease in the area. See Table 10.1 for an example of a chicken vaccination schedule.

*Table 10.1 - Sample Vaccination Schedule*

| Age | Disease |
|---|---|
| 7-12 days | Newcastle disease, infectious bronchitis |
| 32-37 days | Newcastle disease |
| 10-12 weeks | Fowl pox |
| 12 -14 weeks | Avian encephalomyelitis |
| 16 weeks | Newcastle disease, infectious bronchitis |
| 18-20 months | Newcastle disease, infectious bronchitis |

Turkeys - Turkeys may receive vaccinations for Newcastle disease, fowl pox, erysipelas, and fowl cholera. The timing of the vaccinations will vary from one poultry operation to another.

The birds should be healthy at the time the vaccine is administered. Vaccinating a sick or parasite-infested bird will only lead to more losses. Birds suffering from coccidiosis should not receive vaccinations; they should be fully recovered and vigorous before being given any type of vaccination. Producers should not vaccinate pullets after 20 weeks of age because it will delay the production of eggs. If layer hens are going to be kept for a second year of production, they will need to be vaccinated again for some diseases.

Vaccinations are more effective if birds are not under stress when the vaccine is administered. The birds respond better if they have not undergone any stress-inducing management practices, such as moving or beak trimming. Ideally, they should not receive more than one vaccination at a time. Multiple vaccinations are more stressful for the birds; vaccines are also more effective if they are administered separately. Still, many poultry producers prefer to give multiple vaccinations or vaccinate during the beak trimming process to save time and labor.

Producers must always follow all directions provided by the manufacturer precisely when administering any type of vaccine. When administering vaccines, producers should check to be sure that the vaccine has not passed its expiration date and that it has been stored at the proper temperature, which is indicated in the manufacturer's directions. Dosages must be exact. If the vaccine requires mixing, the producer must be sure that it is mixed thoroughly.

A new method of vaccination has been introduced and implemented in some poultry production systems. The process involves vaccinating the birds while they are still embryos. On the eighteenth day of incubation, a specialized needle is inserted through the shell to administer a specific dosage of vaccine to the embryo. The process is done relatively quickly and does little damage to the shell and embryo. Two technicians can use a machine to inject 20,000 to 30,000 eggs in as little as an hour. When the chicks hatch, they are already immune to the disease. Embryo vaccinations reduce stress, because the live birds are handled less often. There have also been reports of chicks that are ready for market two days earlier when they have received vaccinations as embryos than those that were vaccinated as newly hatched chicks or poults.

## Control of Internal and External Parasites

In addition to disease, other threats to poultry health exist. Internal and external parasites may infest birds. Predators and scavengers such as rodents and raccoons are a problem in poultry production, even in confinement facilities. Such unwanted visitors are capable of transferring diseases and parasites. When birds are being raised outdoors, wild birds can easily pass on microorganisms and parasites as well.

Internal parasites that infest poultry include roundworms, thread worms, tapeworms, cecal worms, and gapeworms. If birds become infected with internal parasites, the local county Extension agent, a veterinarian, or a poultry specialist should be contacted. They should help in diagnosis and provide recommendations for specific treatments. Various drugs and anthelmintics may be used to treat the different types of parasites.

External parasites that may affect poultry include lice, mites, and fowl ticks. Insecticidal sprays and dusts are used to get rid of these parasites. To control lice and mites, both the birds and the facilities are commonly sprayed with approved insecticides. When spraying poultry, producers must be sure to administer enough spray to penetrate the feathers. The walls, ceilings, and floors of facilities should be sprayed thoroughly, paying attention to cracks and crevices. To eliminate ticks, poultry houses and surrounding areas should be sprayed. The birds are not treated directly for ticks. If the producer chooses to use dusts, insecticidal dusts may be applied to either the birds or the facilities.

It is important that the people who are handling insecticides remember that they are very poisonous. They must always be used properly, according to manufacturer's directions. All insecticides should be kept away from water and feed sources. Some treatments require a specific time to pass after their application before the birds can be used for laying or slaughter. Contract producers should always follow the integrator's guidelines regarding insecticide use.

Although it is not a parasite, the darkling beetle, commonly known as the litter beetle, has long been recognized as a nuisance pest in poultry operations. The beetle is shiny black or dark brown and is especially active at night and when it is warm. It causes damage by leaving the litter and crawling into the walls and insulation. Damaged insulation results in a loss of efficiency in heating and cooling and translates into a higher cost of production. The beetles are also known to transmit pathogens and poultry parasites, such as *Salmonella*, *E. coli*, poultry tapeworms, and coccidia. Prevention involves removing manure and feed spillage as often as possible. Walls should also be prepared properly by using aluminum foil backing on the insulation, taping the ends of the insulation with aluminum tape, sealing cracks and crevices with caulk, and using aluminum sheeting along the barn walls and posts to a height of about one meter. Barns should also be cleaned well and sprayed with a disinfectant between flocks.

### Biosecurity Measures

The best method of controlling disease and parasites in poultry species is prevention. Flocks should be isolated from other birds and animals. Poultry houses should have screens over entrances to prevent the entry of wild birds and animals that carry disease and parasites. These screens should be kept in good repair. Ideally, all the birds on a poultry farm should be the same age, with new groups of birds introduced using an all-in, all-out system. As discussed earlier, if it is necessary to keep flocks of different ages, the flocks should be kept at least 40 feet apart.

Certain guidelines should be followed for visitors to the operation. The number of visitors to the poultry facilities should be strictly limited. Visitors should shower in and out, and the poultry facility should provide them with boots from the site. If the visitors bring their own boots or shoes, they should scrub the soles with disinfectant. Likewise, vehicular traffic should be kept to a minimum on the poultry operation. Delivery trucks should stay as far away from the flock as possible. The poultry farm employees should unload supplies themselves, and the driver should not be allowed to step out of the truck. The truck's tires should be disinfected before it enters the premises.

The facilities should be kept as clean as possible. Outside, trash should not be allowed to accumulate near the poultry houses, nor should feces or litter be stored where it is accessible to wild birds. Inside, the poultry houses should be thoroughly cleaned and disinfected before bringing in a new flock. The equipment should be kept clean, dry, and disinfected. Feed and water receptacles should be cleaned regularly, and birds should only be provided with clean and fresh feed and water. Proper ventilation should be provided to discourage bacterial growth.

### Record Keeping

Health records are necessary for producers who wish to track the overall health of their flock. For vaccinations, the date, method of administration, type of vaccine, vaccine lot number, and source of the vaccine should be recorded. The date and type of treatment for diseases should also be

recorded. For internal and external parasites, the date of application and type of drug or insecticide used should be included in health records.

## Summary

Experts recommend that poultry be kept in groups that are all the same age. If it is necessary or desired to have birds of different ages, they should be kept at a safe distance away from each other. Vaccination schedules should be determined before purchasing any flock of birds. The schedule should be designed with the help of an avian physiologist or poultry disease specialist and prevalent diseases or other health problems of the local area should be taken into consideration. Birds should be vaccinated when they are healthy and free of stress according to the manufacturer's directions. The best method to prevent internal and external parasite infestations is to prevent outbreaks by maintaining clean facilities and equipment and preventing them from entering the poultry production system. Drugs and insecticides are used to treat parasites.

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## *Lesson 1: Facilities and Equipment for Beef Cattle*

Careful planning of the facilities and equipment necessary for any livestock operation is important. For beef cattle, planning for the facilities and equipment based on the type of cattle enterprise is crucial for the success of the operation. The type of facilities and equipment needed will vary with each operation. Careful planning will help make the facilities easier to use and provide a less stressful environment for the livestock. Also, well-planned and well-built facilities can result in a safer environment for the livestock and the producer.

### Factors Affecting Facility Requirements

In determining facility requirements, the producer must first understand the characteristics of a specific operation, focusing on three main factors. The type of enterprise will affect the kinds of facilities required. A cow-calf enterprise can often get by with limited facilities, but a feedlot operation may require very complex facilities. Another factor to consider is the number of animals serviced in the facility at a time. Both factors will determine the size of the facility and to some extent the layout and design. A producer must also determine the herd management tasks that will be necessary. The operation will require facilities that will fit these duties. Understanding these tasks will help in developing the facilities needed for a herd management program.

Besides these factors, some other considerations are important when planning facilities. These additional factors are listed below.

- Location of the facilities on the farm
- Amount of land available
- Space required per animal
- Storage space needed for feed and supplies
- Handling methods employed
- Cost and labor associated with developing and using the facilities
- Opportunity for growth and expansion of the facilities
- Manure disposal

Other factors are important when considering the design of a particular building or facility. They will determine the usefulness of that facility. They include the following.

- Year-round weather conditions
- Flexibility of the facility, allowing it to be used for multiple tasks
- Ease of access to the facility
- Ventilation needs
- Electricity requirements
- Water needs
- Type of floors
- Bedding requirements
- Feed/bedding storage

### Facilities for Beef Cattle Operations

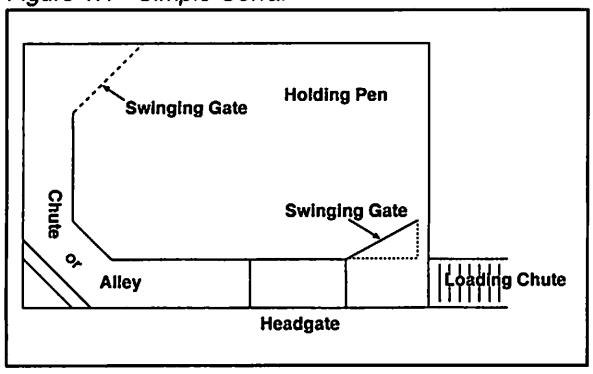
Producers should plan facilities with the following tasks in mind: gathering, sorting, weighing, tagging, vaccinating, worming, castrating, treating sick animals, treating external parasite problems, and monitoring cows, heifers, and bulls during the breeding season. A producer must determine the best facilities to handle all these different activities. Listed below are some conditions that should be considered when developing the necessary facilities for any type of beef cattle operation.

- The facility should be designed with as simple a layout as possible.
- All gates should be near corners.
- The facility should include a short runway to prevent animals from turning around.
- Sorting pens and gates should be open and present animals with a clear view.
- Alleyways should be 15 to 22 inches wide, depending on the age and size of the animal.
- All materials used in the facility should be positioned so that they do not scare the animals and hinder the sorting process.
- All gate and facility latches should be easily operated by humans but not easily opened by livestock movement.
- Sharp corners, drop-offs, and protruding structures like boards should be avoided in the working facility.
- All facilities should be constructed with posts and other obstructions on the outside and a smooth surface on the inside.
- Good quality, sturdy materials should be used to build all facilities and equipment.
- A working chute should be included near the loading facilities so that producers can easily transport animals to and from the facilities.

A few basic facilities may be used for all types of beef enterprises. They include corrals and outside lots, barns, and windbreaks and shelters.

Corrals and outside lots - Corrals or lots are necessary for any type of beef cattle operation. A holding pen, working chute, headgate, and loading facilities are essential parts of a beef cattle corral system. The facility should be constructed using high quality metal or wood materials. The pens should be set up to drain well and reduce the handling stress of livestock. These facilities should be designed to minimize the effort required to handle cattle. Figure 1.1 shows a very simple corral system.

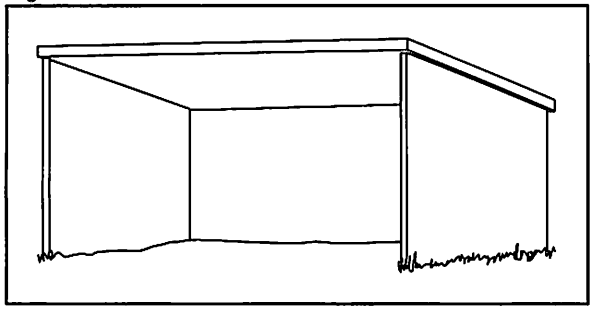
*Figure 1.1 - Simple Corral*




Barns - Barns are used for storage for equipment, feed, and hay housed on the farm. Barns that are open on one side can store equipment, hay, and feeds unaffected by changes in temperature. These barns will protect equipment and feed from precipitation and wind but not from fluctuations in temperature. In order to protect equipment and feed from hot or cold temperatures, a producer may opt to build a closed barn that can be insulated and heated or cooled if necessary. Also, barns can provide shelter for livestock that are calving or recovering from an illness.

Windbreaks and shelters - Windbreaks or shelters may be necessary if cold weather and harsh winters are present. Typical windbreaks consist of a line of trees, stacked hay, plywood wired to steel fence posts, or a building of some sort. If heavy snow and rain is present, a producer should build shelters to provide cattle with additional protection from the elements. An example of an inexpensive pole barn shelter is illustrated in Figure 1.2.

*Figure 1.2 - Shelter for Beef Cattle*



## Facility Requirements for Cow-Calf Herds and Backgrounding

A cow-calf operation generally requires very little in terms of facilities. Cows calve on pasture during the fall and spring. Producers can winter them outside on pasture with a minimum amount of shelter provided by windbreaks or open shelters, as in Figure 1.2 above. Producers frequently move livestock close to the farmstead for monitoring just before calving. A barn may be necessary for shelter during calving in some of the colder regions of the country. However, in most cases calving can occur in the pasture with only minimal shelter.

Cattle in a backgrounding operation also require minimal facilities. These cattle are pastured throughout the winter. Producers may generally provide a windbreak or open pole barn shelter only in very cold or harsh winter situations.

## Facility Requirements for Feedlot Operations

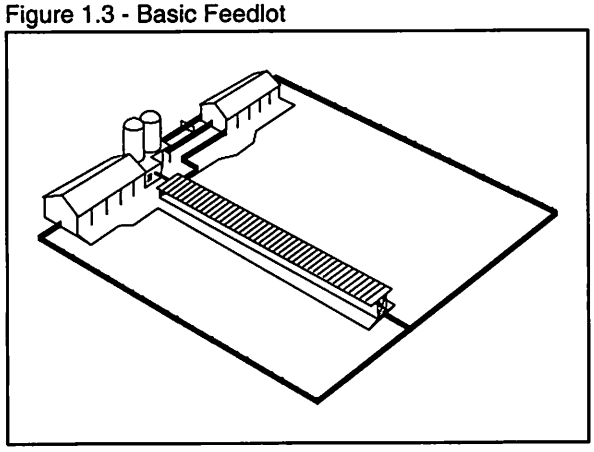
Feedlot facilities are generally more involved and require more planning than the facilities for other types of beef enterprises. Several factors will influence the type of facilities found on a feedlot operation. One of the most important decisions that has to be made when planning for a feedlot is the location. The feedlot must be easily accessible and should allow for easy movement of livestock to pastures and other facilities. Also, the feedlot operator should consider environmental issues, including dust and odor concerns for neighbors of the facility. The operator must consider the wind direction because of the odors and dust generated by large numbers of cattle concentrated in a relatively small area. The feedlot must be well-drained and should not be located near lakes, streams, ponds, or ditches because of the potential for run-off. Feedlot operators must also consider the soil type when deciding on a location. Different soil types affect the types of structures that can be built on the feedlot. For example, sandy soils increase environmental concerns because of the possible contamination of water reserves below the earth's

surface. The size of storage units like silos may also be limited by the type of soil.

Another factor that will dictate feedlot size and type of facilities is the amount of money an operator can afford to spend. Large automated facilities are more expensive than a simple corral system and may cost too much for some feedlot operators. However, if the labor force is limited in the area where the facility will be built, then the operator may have to consider using more automated facilities.

Most feedlots will consist of a basic system of lots on the perimeter of the operation with an office, weigh scales, enclosed veterinary hospital, feed mill, and maintenance buildings in the center of the feedlot. Housing for livestock usually involves providing open pole barn shelters. A basic feedlot system can be seen in Figure 1.3. The feedlot should be designed to provide an opportunity for expansion in the future.

Figure 1.3 - Basic Feedlot



A feedlot operator will have a wide variety of choices when selecting feed storage and handling equipment. A feedlot owner will generally have an on-site feed mill used to formulate rations at an optimum level for production. The systems used for feeding range from basic manual systems to very complex automated systems that weigh and mix the feed based on instructions from a computer. If an automated system is used, then the feedlot operator must consider the need for an adequate power supply to operate the equipment.

## Waste Handling

The removal of manure is an important factor to consider when developing facilities. If animals are pastured, producers do not have to worry as much about the handling of waste because it can decompose naturally as it is spread over the pasture by the herd. However, producers must keep livestock out of water sources to avoid contamination. They should fence in ponds to keep the animals from standing in the water.

If a producer develops a feedlot designed to house a herd of animals year round, she or he must consider how manure will be handled because of the concentrated population of cattle on the feedlot. A producer must implement a process to clean facilities and dispose of manure in a safe manner. Some ways to reduce water pollution from feedlots include reducing clean water entering the lot, runoff control systems, and storage for runoff. The water can be directed away from the lot by placing the feedlot near the top of a slope and using diversion embankments to prevent runoff from a slope from entering the lot. Runoff control systems collect the runoff from the feedlot and direct it away from areas where it can contaminate groundwater. The collected runoff can be stored for later land application; storage facilities include tanks, concrete pits, and lagoons. Before building the facilities, the feedlot operator must carefully consider the soil type and the potential for groundwater contamination to help determine the necessary design. Government regulations may also affect the design of the facilities. The feedlot operator may obtain additional information about how to handle and dispose of manure safely from experts, including Extension specialists.

Producers also need to consider the disposal of animal carcasses. They can hire companies to dispose of dead animals by rendering or placing them in a landfill. However, producers need to make certain that dead animals are picked up away from the facilities and other livestock by setting up a designated pick-up point. This practice prevents the spread of diseases by keeping the truck carrying the dead animals from bringing diseases from other farms onto the operation. If a good location is available on the operation, producers may also bury dead animals. They should be buried in a pit that is deep enough to cover the animal with four to six feet of soil. The site should be isolated, above the water table, and away from water sources. Producers should check to make sure their disposal methods meet local and state regulations for dead animal disposal.

## Sanitation Requirements

Sanitation is very important for both the facilities and equipment used in handling the beef cattle herd. A producer should keep all working facilities and handling equipment clean. Barn floors should be kept clean with regular sweeping. Dust may be controlled by frequent sweeping and water misters. Equipment can be sprayed or dipped into a sanitizing solution.

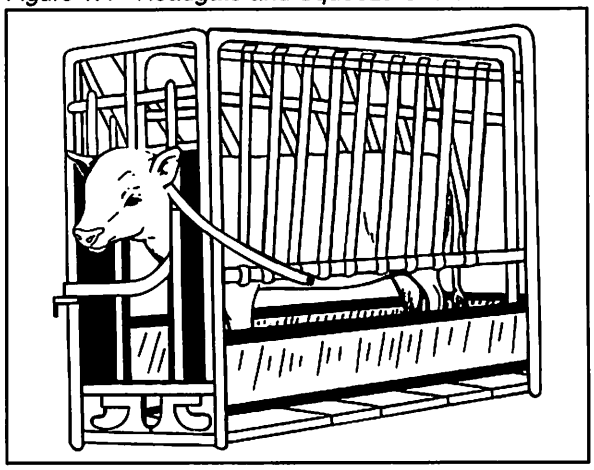
Feedlot operations have some special considerations. If the feedlot has a veterinary section on the grounds, the operator must ensure that healthy livestock do not pass through or near the facility and that all feed, equipment, and medications are sterile before passing from the veterinary unit to the rest of the herd. Also, producers must ensure the sanitation of the feed mill to prevent diseases from being spread through the herd.

## Handling Equipment

Handling equipment is an important part of a beef cattle operation. The lack of this type of equipment can increase the amount of labor necessary to complete basic tasks. The basic equipment used includes a headgate with a squeeze chute and a loading chute. Fencing panels can also be useful when handling cattle.

Headgate and squeeze chute - This equipment is shown in Figure 1.4. The headgate and squeeze chute form the central point where all producers perform basic health care procedures and other management tasks associated with the beef cattle herd. They are designed to thoroughly restrain the animal while producers perform procedures like dehorning, branding, castrating, and vaccinating. A headgate may also be a separate piece of equipment that can be a permanent part of a facility or a portable unit for use in remote locations.

*Figure 1.4 - Headgate and Squeeze Chute*



Loading chute - A loading chute is used to load cattle into a trailer for transport to various destinations. Both sloping and stepped ramps are used in a loading chute. Sloping ramps should be designed to prevent the animals from slipping. The sides of the chute should be solid to keep the animals from seeing out. Loading chutes should be adjustable to allow cattle to be loaded onto trucks of different sizes. The chute should have a walking path for the handlers along its sides.

Fencing panels - Fencing panels can be used to construct pens quickly on the farm. The panels can be stored easily and maneuvered quickly to restructure the pen. They should be made from material that has enough strength to hold cattle.

## Other Equipment

In addition to handling equipment, many other types of equipment may be found on beef cattle operations. Having good equipment saves feed, reduces labor, and increases production. Some of the more common types of equipment are listed below.

Feeders - Beef enterprises may use a number of different kinds of feeders, such as grain troughs, hay bunks, self-feeders, and fence line bunks. Grain troughs should be located in a well-drained area or on concrete. They should be deep enough to keep grain from being spilled. Hay bunks should hold enough hay for several days. Self-feeders should be easy to fill and large enough to hold 10 days to two weeks worth of feed. The needs of the operation will dictate the type of feeder used. For example, a cow-calf producer may simply need a trough and hay bunk to feed livestock, but a feedlot may use fence line bunks because they are easily filled from a feed truck driving along the line of the fence.

Waterers - Cattle need abundant fresh water. Many producers have pastureland with access to a pond or stream that can serve as a water source for cattle. However, if these water sources are not available, a producer must pipe water to a tank or trough. They should be adequate in size and should keep animals from getting in the water.

The waterer should preferably be located in a shady area during the summer. If the area around the waterer will become muddy, it should be surrounded by concrete paving. Automatic waterers with heating elements can be a viable alternative for watering in the winter. Waterers should be easy to clean.

Mineral feeders - Mineral feeders are designed to house mineral supplements for cattle during the winter. Feeders should be located near the water supply. Animals tend to consume more minerals when fresh water is readily available. The feeders should have a cover to provide protection from the weather.

Livestock trailer - A trailer is needed to move livestock from one facility to another. The livestock trailer is generally built by a trailer manufacturer and can come in a variety of sizes and styles depending on the needs of the producer.

Silos or feed bins - Silos or bins may be needed to store feed for the operation. They can be large, complex structures or relatively simple storage units. Some producers may mix their own feed rations and have several bins designed to hold the components of the ration. Other producers simply buy a ration in bulk and store it prior to feeding.

## Records

Producers should keep records for each major piece of equipment on the operation. Their records should include the depreciation on the equipment to maintain an accurate estimation of its value. Producers should also keep a maintenance worksheet for important pieces of equipment. This worksheet should include the date purchased, upgrades, maintenance, and other pertinent information regarding its upkeep.

One of the most important records associated with facilities and equipment is the annual inventory. The inventory should list all the assets of the operation, including the value of buildings and equipment. This inventory will help a producer to keep track of the value of facilities and equipment for insurance and tax purposes. The information is also helpful in management planning.

## Summary

Many different factors affect the design of the facilities and the type of equipment necessary for a beef cattle operation. All cattle producers are ultimately trying to deliver proper management and care to their animals. Well-planned facilities, including barns, corrals and lots, and shelters, will help to ensure the safety and productivity of the animals. The most extensive planning is required for feedlots because they generally have more stringent design needs because of the nature of the enterprise. Proper manure management and good sanitation are a must for any type of cattle operation and should be taken into account in the design of the facilities. In addition to planning for facilities, a producer should carefully consider the types of handling and other equipment needed for the cattle on his or her operation. Good records should be kept relating to both the equipment and facilities on the operation.

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## *Lesson 2: Dairy Facilities and Equipment*

Well-designed dairy facilities increase productivity and profits and reduce the workload and overall energy necessary to maintain a dairy herd. Of particular importance to the dairy farm is the mechanization of the milking parlor, which can greatly reduce the amount of manual labor required.

### Factors Affecting Facility Requirements

A dairy operation requires a large investment in equipment and buildings. Mechanization can decrease the labor necessary to manage the herd but can be a large initial expense. Because of the cost, the producer must plan carefully before building facilities. Several factors affect facility design: (1) management practices, (2) the size and location of the operation, (3) location of the facilities, (4) waste disposal, and (5) electrical requirements.

Understanding the management activities on dairy operations helps producers plan the facilities necessary to maintain a good herd management program. Housing is more elaborate than on beef cattle operations because more management is required. Dairy cows are milked at least twice daily.

The size of the herd affects the type of housing used and the design of the milking parlor. The location of the operation may dictate some facility requirements. For instance, some form of heating is needed during the winter. Fans are required in facilities for the summer.

Choosing a good site for the location of the facilities is important. A well-drained location must be chosen for all dairy facilities. It should provide easy access for vehicles hauling feed, milk, manure, and livestock. Prevailing wind directions need to be considered. Plan to put the dairy housing and milking parlor downwind of the farmhouse and any neighbors.

Another consideration is the electrical requirements for dairy facilities. A continuous supply of electricity is necessary to operate most milking, milk storage equipment, and automated feeding systems. A standby generator needs to be available in case of power failure because the milking schedule should never be interrupted.

Considerations for designing facilities are listed below.

- Amount of money available for construction
- Regulations and laws for the construction of dairy facilities
- Manure handling systems
- Feeding systems
- Type of milking system
- Housing requirements
- Ventilation needs
- Water needs
- Feed/bedding storage
- Future expansion needs

### Facilities for Dairy Operations

Dairy operations have very specific facility needs. Among the facilities necessary are housing for cows, replacement heifers, and calves, a milking parlor, and feed storage structures such as silos and grain bins.

#### *Housing*

The free-stall barn is the most common type of housing in Missouri. A free-stall barn allows the cattle to freely enter and leave the stalls from an alley. The stalls are not wide enough to turn around; this prevents cows from contaminating the front part of the stall. They can mingle in the alleys or lie down in the stalls when they want to rest. The cows are fed in the housing area or in an attached feeding area and moved to milking parlors for milking. Free-stall barns allow easier use of mechanized feeding and better cow disposition due to freedom of movement. They are built with curtain sidewalls, which can be opened in the summer. Manure is removed by either scraping and hauling or flushing to a lagoon.

Calves and replacement animals for the dairy herd are also a consideration. Providing dry, clean, and well-ventilated housing is important. Young calves are housed in portable calf hutches or in a confinement calf barn. A typical calf hutch is 4 feet by 8 feet in size. Hutches can be made or fiberglass types can be purchased. The hutch usually has a fenced area in front for exercise. Calf barns can be either heated or unheated depending on the climate. Generally in a calf barn, cows are housed in separate pens until after calving. Calves are then placed in individual pens until weaning and then grouped together in larger pens. Calf barns can be mechanized for feeding

and manure removal to decrease the labor requirements. Producers often choose to pasture their heifers and provide only basic open sheds.

*Milking Parlors*

Milking parlors are a quick and efficient way to milk cows. They can easily accommodate large herds. Factors to consider when designing a milking parlor include the number of cows milked, milking frequency and total hours of use, number of operators, plans for expansion, and personal preferences. These factors will affect the size, type, and design of the facility. Types of milking parlors include herringbone, side-opening, parallel, and rotary or carousel parlors. These types are shown in Figure 2.1.

Herringbone - Herringbone milking parlors are the most common type. In this system, the cows enter in groups and stand at an angle to the operator pit. The cows stand in elevated stalls to provide easy access to the udder. The cows are on either one or both sides of the operator. Most of the cows are finished at approximately the same time. They are released together so that a new group of cows can enter the parlor.

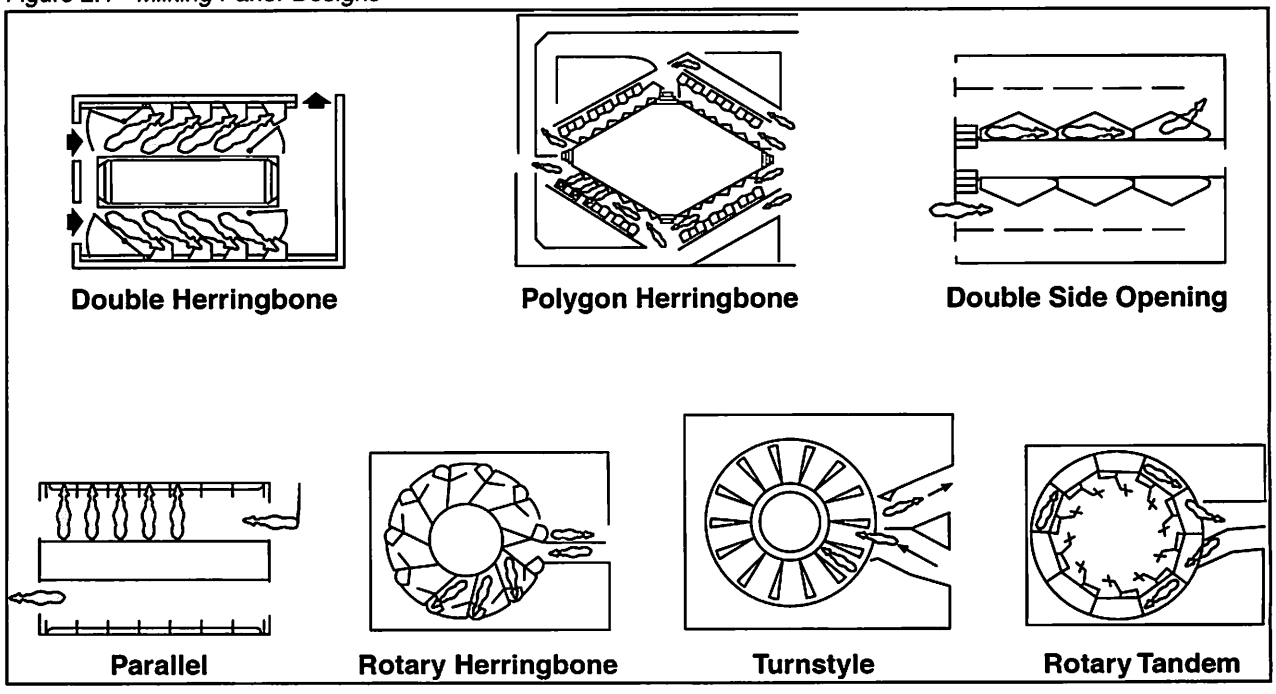
Polygon - Polygon milking parlors use herringbone stalls in a four-sided structure around the operator pit. They are most efficient with large numbers of cows. This system is generally set up in a diamond shape. The operator works around the diamond during the milking process.

Side-opening parlor - This type of milking parlor positions the cows parallel to the operator. Each cow enters and leaves the parlor individually. Side-opening parlors keep slow-milking cows from holding up the movement of a group. One disadvantage of this parlor is that slightly more time is needed to milk the entire herd. An efficient routine is necessary to wash, milk, and release the cows as quickly as possible.

Parallel - Parallel milking parlors line the cows up at a 90-degree angle to the pit. Producers milk the cows from between the hind legs instead of from the side. A shield is put in place to keep the equipment from being contaminated by manure. Advantages of this type of dairy parlor include increased safety for the operator because the cow cannot kick out and reduced kicking off of the milking unit.

Rotary or carousel - Rotary parlors allow a large number of cows to be milked in a limited amount of space. In this type of milking parlor, animals enter one at a time onto a slowly rotating platform. The operators attach the milker and the cows are milked as the platform rotates. Once the platform rotates to the exit, the cows leave the parlor. If the

*Figure 2.1 - Milking Parlor Designs*



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animals have not been milked out completely, they must remain in the parlor for another rotation of the platform. Rotary milking parlors come in different styles, including tandem, herringbone, and turnstile configurations. A disadvantage of rotary parlors is that they are slightly more expensive.

*Feed Storage*

Facilities for storing feeds are an important part of any dairy operation because of the importance of proper feeding to milk production. Producers commonly feed silage to the dairy herd because it can provide good quality forage with many nutrients at a relatively low cost. It is also easily fed using mechanized systems.

Producers must have appropriate facilities for storing silage. Both tower silos and trench, or above-ground bunker silos, may be used. Tower silos are more expensive but provide good protection for the silage and easy feeding using automated systems. The location of the silo should provide easy access for filling and be close to where the animals will be fed. Trench and bunker silos can reduce investment in facilities and expand easily to store greater amounts of feed. Spoilage will be greater, however, and they do not allow for automated feeding. Bunk-type silos are preferred when feeding a large number of cows.

In addition to silos, hay and grain storage facilities should be included on the dairy operation. Hay may be stored in a barn. The best type of grain storage is a round, steel bin set on a concrete foundation. Most dairies will have a commodity storage building with 3 to 7 bays to store by-product feedstuffs.

## Waste Handling

Removal of waste is a crucial part of the dairy operation. Flushing is the most common type of waste handling system on new, large dairies in Missouri. The floors are solid with drains or alleyways for the manure to be removed. Manure is then flushed away directly to the lagoon using recycled lagoon water. Solids are separated and spread on the land. Lagoon wastewater is irrigated or applied to the land with a traveling gun. This system is cost and labor efficient on large dairies. A permit is necessary from the Department of Natural Resources (DNR) to construct a lagoon.

Solid floors may also be used in dairy facilities. If floors are solid, producers must scrape out the manure daily using automatic scrapers or small tractors with blades (skid-steer loaders). The manure is then stored until it can be spread on a field for fertilizer. Dairies will use sawdust, wood chips, or other forms of loose bedding that is mixed with the manure.

Disposal of dead animals is another part of waste handling. Renderers will dispose of dead animals. They may also be placed in a sanitary landfill. Arrangements must be made to have the carcass picked up away from other animals to keep diseases from being spread. The carcass should be taken away within 24 hours of death if possible. If other options are not available, dead animals can be buried in a pit that is deep enough to cover a carcass with at least 4 feet of soil. The pit should be located in an isolated area that will prevent groundwater contamination. Composting is also an alternative. Producers should wear rubber gloves and protective clothing when handling dead animals to reduce contact with disease-causing agents.

## Sanitation Requirements

A sanitation program is necessary to reduce microorganisms that could contaminate milk. In order to market Grade A milk, a dairy producer must obtain a permit through the Missouri State Milk Board. Producers should contact local University Extension agents or the Health Department to determine if sanitation ordinances or standards affect their county or area.

The milking parlor and all the equipment used in the milking process must be thoroughly cleaned after each milking to ensure that milk production occurs under sanitary conditions. Most milking systems have automatic clean-in-place (CIP) washing systems. This allows the equipment to be cleaned without taking it apart by circulating water and cleaning agents through the system. To clean a pipeline milker, the equipment is first rinsed with lukewarm water at 110°F immediately after milking to remove milk residue. The pipeline is then washed using hot water at 165°F with chlorinated detergent or alkali cleaner. The milker is then rinsed with lukewarm water at 110°F with an organic acid to remove mineral residue. Bulk tanks are cleaned using the same cycle as cleaning milking systems.

## Equipment Requirements

Dairy producers use some of the same equipment as discussed for beef cattle operations in Lesson 1 of this unit. Handling equipment such as headgates and squeeze chutes are necessary to perform tasks such as vaccinations and artificial insemination. Loading chutes are needed to load cattle onto trucks for transport. Trailers are used to transport dairy cattle. Feeders and waterers are also necessary, although the type will be dictated by the facilities used for housing cattle. Milking machines are essential to all dairy operations.

Pipeline milker - Pipeline milkers are the most common type of milker in use. The milking unit is attached to the cow's teats and a pulsating vacuum system removes the milk from the udder. Milk flows from the cluster, or claw, through a pipeline to a receiver. From the receiver, the milk is pumped to the bulk tank. Pipeline milkers reduce the amount of labor necessary during the milking process.

Bulk tank - Milk is stored in refrigerated, stainless steel, bulk tanks. The warm milk is rapidly cooled to 38° to 40°F to prevent the growth of bacteria. Tanks must be large enough to store milk from the milking herd for every other day pick up. Large dairies may ship milk daily in 50,000 pound tractor-trailer loads.

## Records

Records need to be kept on all of the facilities and equipment on the dairy operation. Equipment records should include the date purchased, upgrades, and any maintenance work on the equipment. The depreciation cost associated with each piece of equipment should be tracked to provide an accurate record of its value. An accurate, updated inventory needs to be kept showing all of the operation's assets, including the value of all buildings and equipment on the farm.

Milk production records are essential to manage a dairy. Many producers enroll in the Dairy Herd Improvement (DHI) program. In addition, a dairy must keep records on breeding, herd health, and sires used.

## Summary

Starting a dairy enterprise is very expensive. Buildings and equipment are a large part of the required investment. Producers should consider the factors that will affect the design of facilities to increase efficiency and productivity. Some important facilities include housing, milking parlor, and feed storage. When planning these facilities, producers should take the need for waste disposal into account. Among the most important pieces of equipment are milking machines and bulk tanks. Proper sanitation is another vital part of the success of the dairy farm. Producers should keep good records on facilities, equipment, milk production, breeding, herd health, and sires used.

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## *Lesson 3: Facilities and Equipment for Swine*

Swine operations have traditionally been pasture- or pen-oriented production systems. However, in recent years, the trend has moved toward confinement systems. This lesson will discuss some of the factors that affect facility requirements for swine operations.

### Factors Affecting Facility Requirements

When determining the facility requirements for a swine operation, the type of operation will affect facility needs. Swine enterprises may be involved in several different activities, including breeding, farrowing, and finishing, depending on whether the enterprise is a feeder pig, feeder pig finishing, farrow-to-finish, or seedstock operation. These enterprises require different facilities for housing the animals. The purpose of the operation will therefore dictate the types of facilities that are necessary.

Some factors to consider when planning facilities are the location of the facilities on the farm, the amount of land available, the size of the operation, the space required per head, storage requirements for feed and supplies, the handling methods employed by the producer, the cost and labor associated with developing and using the facilities, the opportunity for growth and expansion of the facilities, and waste disposal requirements. Location is particularly important to consider because of the odors associated with swine production. The prevailing winds and the distance from neighboring homes and businesses must be considered before building facilities. Other factors to consider when designing a particular building or facility include the year-round weather conditions, ease of access to the facility, ventilation needs, electricity requirements, water needs, the type of floor, bedding requirements, and feed/bedding storage space.

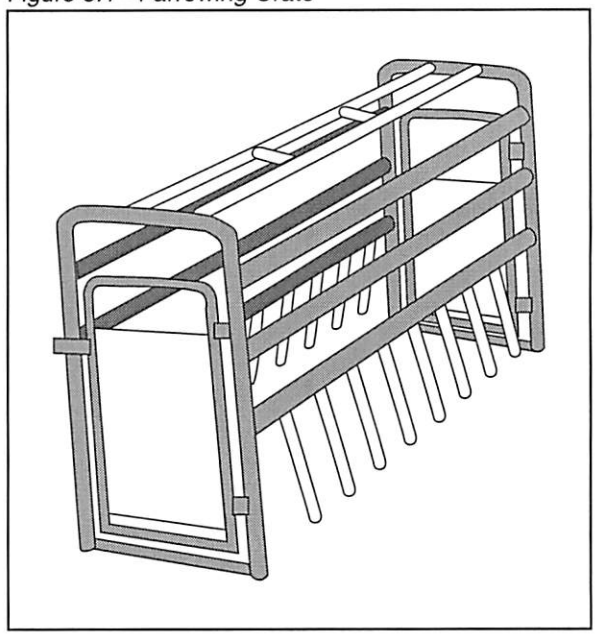
### Facility Options for Farrowing to Finishing

In operations where breeding and farrowing take place, facilities are needed for the breeding herd. Boars are housed in individual crates or pens, while sows and gilts are generally placed in crates, crate/pen systems, or group pens for breeding and gestation. Adequate space should be provided for each animal.

Most of the larger operations today that involve farrowing have a confinement facility built for farrowing purposes. The housing must provide adequate ventilation. The floors should be partially or totally slotted to provide a means for collecting fecal matter and other waste. The housing must also be warm, dry, and free from drafts.

Farrowing in confinement is usually done in pens or in crates. Pens provide more space for the movement of the sow and require more intensive management than do crates. More time is spent cleaning pens and managing the sow during the farrowing process to ensure the safety of the piglets. Guard rails must be used in pens to keep the sow from laying on the pigs. As shown in Figure 3.1, crates are narrow and only provide enough room for the sow to stand or lie down. The crates have a separate area where the pigs sleep when they are not nursing. In a crate system, the sow is less likely to kill her pigs by laying on them. Less labor is required to manage the farrowing process.

*Figure 3.1 - Farrowing Crate*



Automatic feeding and watering systems are generally used in confinement farrowing houses. Confinement producers will usually have facilities for the storage of feeds as well as medical supplies. The feed is often stored in bins next to the facility. The facility may also have a washing unit designed to cleanse the sows before they are put in the farrowing crates.

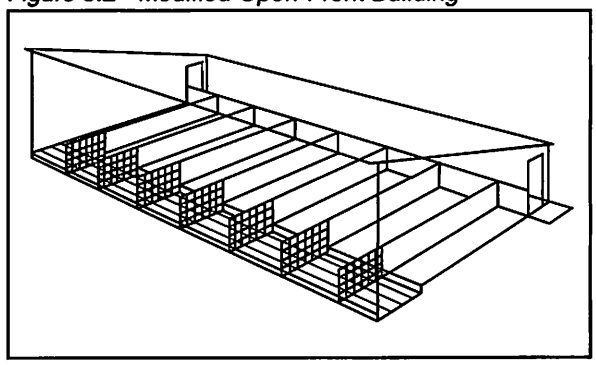
In a confinement system, the nursery is often not a part of the farrowing unit. Instead, the nursery building is separated from the farrowing house to aid in disease prevention. Nursery facilities are generally designed to raise hogs from weaning to about 35 pounds. The offspring are moved from the farrowing crate or pen to the nursery at two to four weeks after farrowing. A pig brooder is often provided in the nursery. A producer will usually provide a heat lamp or some other type of heating in the brooder area to keep the pigs warm. These facilities generally use slotted floors for removal of fecal matter and have mechanized equipment for feeding and watering.

The final phase of pork production is the grow/finish phase. This phase takes the pigs from the nursery weights and completes their growth until they are ready for slaughter at about 250 pounds. Three basic styles of confinement facilities are generally used for finishing swine: open front, modified open front, and enclosed facilities. With each type of facility, producers should be aware of the temperature and humidity levels. They should also carefully manage the number of head per pen to decrease the chances of problems such as tail-biting, slow rates of gain, and cannibalism. It is recommended that pigs be sorted by sex and placed in pens with no more than 25 to 30 animals per pen. If pigs exhibit gaining problems, injuries, or cannibalism, they should be removed and placed in separate pens for treatment or special feeding and handling.

Open front buildings have about half of the pen extending out from the front of the building, and animals may enter and leave the building freely. The facility is designed to protect the animals from wind and inclement weather during the winter and provide ventilation during the summer. Slotted floors or solid inclined floors are usually used. Feeders and waterers are included in each pen. The feeding and watering systems may be automated, depending on the size of the operation. The covered section of the pens is usually divided by solid partitions to reduce winter drafts.

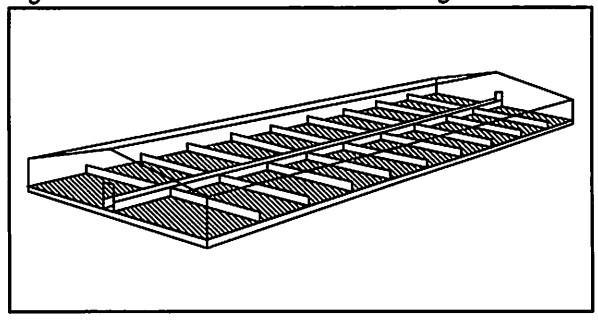
In a modified open front building, pens are covered completely by the roof, and the building has one open side. This type of facility generally has the same requirements as the open-front facility. Figure 3.2 shows an example of a modified open front building.

*Figure 3.2 - Modified Open-Front Building*



Totally enclosed housing is used in many confinement hog operations today. These facilities have no large openings to the outside and typically require heating in the winter and cooling in the summer. The interior is divided into several pens separated by a central service alley. Each pen contains an average of 25 pigs. Manure is generally stored in pits under slotted floors, as illustrated in Figure 3.3; floors may be partially or totally slotted. Producers must make certain to provide adequate ventilation at all times in this system. Producers must also carefully control the moisture and temperature levels to avoid diseases and respiratory problems. Moisture levels may be controlled by using fans to provide ventilation and reduce the humidity. Temperature may be controlled by adding a heating system if the facility is located in a cold climates. In warmer climates, heat may be supplied by the animals' bodies and controlled by raising or lowering exterior wall panels. Some facilities are computer controlled and automatically provide proper heating, cooling, and ventilation to maintain a set temperature and humidity level. Automated feeding and watering systems are frequently used in totally enclosed buildings.

*Figure 3.3 - Slotted Floor Swine Housing*



A new trend in pork production is to place the pigs in wean-to-finish facilities that can be used for finishing the hogs. Pigs are placed in the building at weaning and remain there until slaughter. The facility must be designed to meet the needs of both young pigs and older animals. Ventilation and heating suitable for weaned pigs must be provided, along with enough space to accommodate the pigs as they grow. Feeders and waterers should be usable at all ages. Slotted floors are generally used.

## Waste Handling

The removal of manure is a very important part of any swine operation. Producers should consider the use of slotted floors when building housing facilities for swine. These floors allow for easy removal of manure. The movement of the animals generally works the manure through the slats into a pit placed below the floor. The manure is held in the pit until it is removed by a flushing system and transferred to a holding lagoon. If a pit system is used in an enclosed barn, the producer must maintain adequate ventilation for odor control and to avoid the build up of dangerous gases. Slotted floors are more expensive than solid floors.

The alternative to slotted floors is using solid floors. Scrapers or small tractors with blades are used to remove the manure and bedding from a solid floor. The manure is scraped out of the building and piled up for removal to a field for use as fertilizer. In some facilities, inclined solid floors are used with power washing equipment and flush gutters to remove manure.

The disposal of animal carcasses is another important factor to consider when developing facilities. Facilities should be designed to allow dead animals to be removed easily. Companies can be hired to transport dead animals to a landfill or rendering plant. However, carcasses should be picked up away from buildings or live animals housed on the operation. This practice will keep the truck from contaminating the operation with other diseases. Other options for disposing of dead pigs are burial in pits and composting. Composting involves placing dead animals in bins on a pile of sawdust and covering them with more sawdust. The carcasses break down into compost. If the process is done properly, flies, rodents, diseases, and odors should not be a problem. Composting takes about six months. The compost can then be spread as fertilizer.

## Sanitation Requirements

Producers must consider sanitation requirements when developing a confinement facility. Totally enclosed confinement operations must provide showers and dressing areas for employees and guests entering the operation. Diseases brought onto the operation could seriously affect the entire enterprise because the livestock are housed and maintained in such close quarters. All facilities and equipment must also be kept clean and sanitized to decrease the chances for illness and disease in the herd. Sweeping barn floors, controlling dust with a misting system, and sterilizing equipment are all part of the sanitation requirements in managing a swine facility. Producers should also make certain that all dead or sick animals are removed from or contained within the facility immediately to prevent the spread of disease.

## Handling Equipment

Good livestock handling equipment can make the task of working with swine easier. Holding and crowding pens can help make moving and sorting hogs easier. Appropriately placed cutting and blocking gates should be included in the alleys of the buildings. Cutting gates allow producers to direct pigs into a particular pen, while blocking gates keep other hogs from moving through the alley. Other equipment includes portable or stationary loading chutes, transfer or moving crates that attach to the back of a tractor, and trailers.

## Other Equipment

Feeders and waterers are important pieces of equipment in swine operations. Many different types of feeders and waterers are available. They should be sturdy and able to withstand abuse by the hogs. Feed may be supplied manually or by using automated equipment that augers grain to the feeders. Watering systems may also be completely automated in confinement systems.

Producers should keep some accessory equipment on the farm. These items include tools like weigh scales, ear notchers, castration knives, syringes, and needle teeth clippers. A place should be provided for the storage of these items. The storage area should be located near the area where these items would be used.

## Records

Producers should keep an accurate, updated inventory of all equipment and buildings on the operation. The inventory should list their value. Equipment records should be kept for large and expensive pieces of equipment. They should track the depreciation cost associated with each piece of equipment. A maintenance worksheet should be kept for each piece of equipment listing the date purchased, upgrades, maintenance, and other pertinent information regarding the upkeep of the equipment.

## Summary

Facilities on swine operations include farrowing houses, nurseries, finishing buildings, and breeding houses. When developing these facilities, one of the most important factors for producers to consider is the location of the buildings because one of the major problems for swine facilities is odor. Producers must consider residents living in the area and the direction of prevailing winds in relation to the facility and neighbors. Other important considerations are waste handling and sanitation within the facilities. Good handling equipment, feeders, and waterers are needed for any swine operation. Records should be kept on all equipment and facilities.

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## *Lesson 4: Facilities and Equipment For Sheep*

Experienced sheep producers recognize that well-designed buildings and working facilities reduce the workload and overall time necessary to maintain a flock. With good facilities, a producer can carry out management duties like providing health care in a more timely manner. Good facilities also allow producers to carry out management activities with a reduced risk of injury to themselves and the animals. They also affect the productivity and profit from the sheep operation.

### Factors Affecting Facility Requirements

In order for producers to determine what facilities are needed for an operation, they must consider the type, size, and location of the operation. Producers must first determine what management duties will be done on the farm, which is based on the nature of the enterprise. The type of operation significantly impacts the size and type of facilities a sheep producer may need. A ewe-lamb operation will likely require more facilities than a simple lamb finishing operation. A knowledge of the activities of the enterprise and the time of year they are performed will help producers select and design the facilities needed for a particular enterprise. For example, depending on the location of the operation, early spring lambing may require facilities that provide more protection from cold weather and harsh conditions. The number of sheep to be handled at one time and the number of head to be housed will also affect the design of facilities for sheep operations.

Some other factors are important when planning facilities for the operation and designing individual buildings. These factors are listed below.

- Location of the facilities on the operation
- Amount of land available
- Storage requirements for feed and supplies
- Handling methods employed
- Year-round weather conditions
- Flexibility of the facility
- Ease of access to the facility
- Ventilation needs
- Electricity requirements
- Water needs
- Type of floors
- Bedding requirements and storage
- Cost and labor associated with developing and using the facilities
- Opportunity for growth and expansion of the facilities
- Waste disposal requirements

### Facilities for Sheep Operations

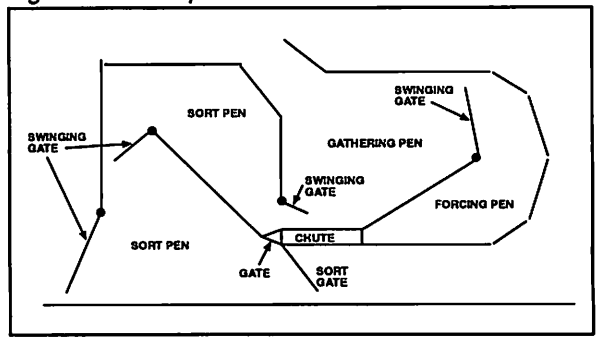
Because sheep are raised on pasture, the facilities needed for sheep operations are relatively simple. They are mainly designed to provide basic shelter and aid in the handling of the flock for management activities.

Windbreaks and shelters - As with beef cattle, sheep can be pastured outside for most of the year. However, producers may provide shelters to supply sheep with protection from the elements during cold, harsh winters. A windbreak may be as simple as a pile of stacked hay. Other producers may wire plywood to steel fence posts or construct an inexpensive open front shed.

Corrals - Corrals should be constructed using high quality metal or wood fences. Pens should be set up to drain moisture after a rain and reduce the handling stress of the livestock. These facilities should also be designed to minimize the effort required to handle sheep.

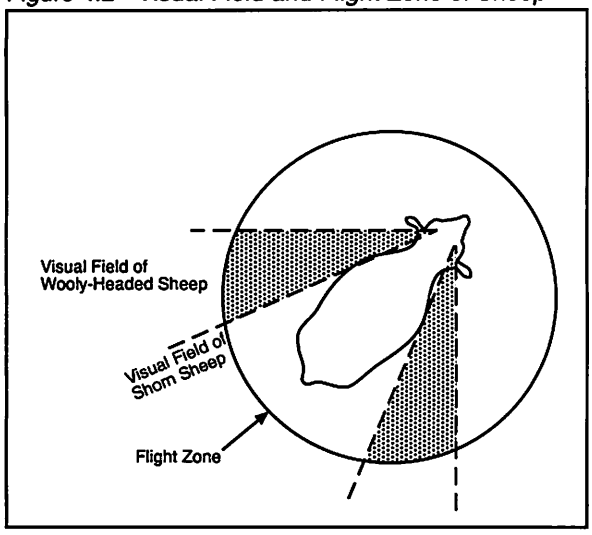
Handling facilities like sorting pens and chutes may be built into the corral system. They may be planned with the following activities in mind: gathering, sorting, weighing, tagging, shearing, trimming, vaccinating, worming, castrating, docking, treating health problems, and monitoring ewes and rams during the breeding season. Handling facilities should be centrally located near a barn or office where all equipment and necessary medications are easily accessible. Figure 4.1 shows a simple handling facility for a small flock.

*Figure 4.1 - Sample Corral for Small Flocks*



The facilities should be constructed to allow for sheep behavior. Sheep have the ability to see behind themselves without turning. As illustrated in Figure 4.2, they have a visual field of 270 to 320 degrees. They also have a flight zone that affects their movement. If a person steps into the circle that forms the edge of the flight zone where the sheep can see him or her, the sheep will move. To encourage the sheep to move forward, a handler should stay within the shaded area shown on the illustration. Moving too far forward will cause the sheep to move back.

*Figure 4.2 - Visual Field and Flight Zone of Sheep*



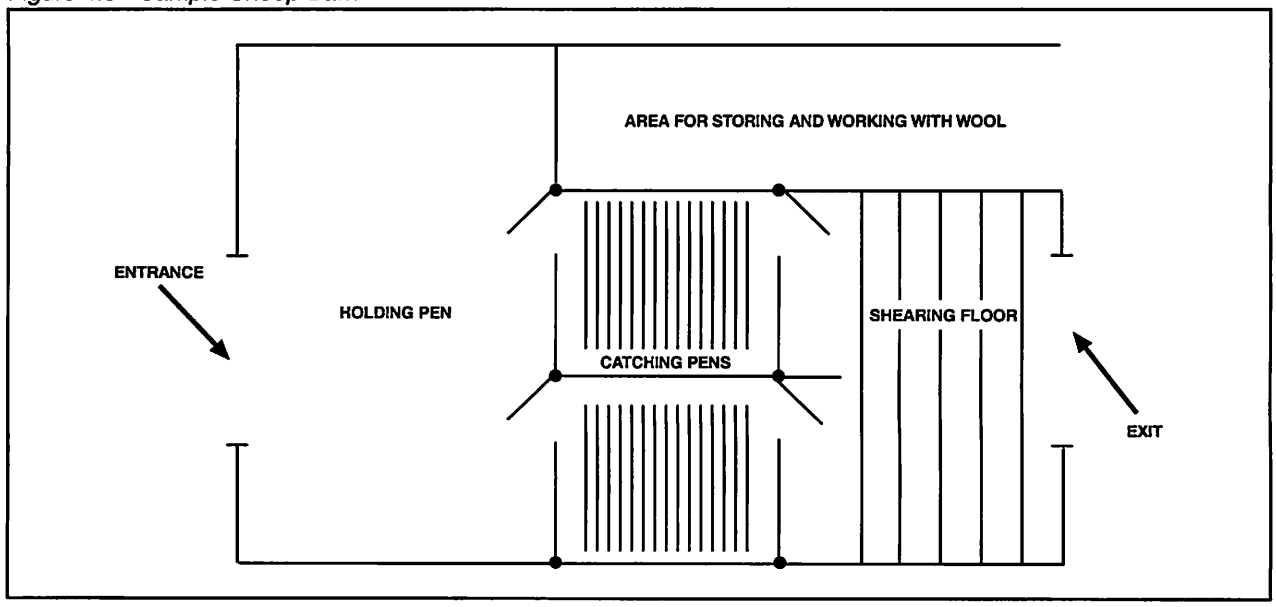

Other tendencies also affect how sheep react to handling. These factors will affect the design of handling facilities. A sheep will:

- move toward freedom or an open space,
- move toward a light or lit area,
- move away from buildings and structures,
- move uphill rather than downhill,
- follow the animals in front of it,
- move toward other sheep,
- move more easily around curves or slight corners,
- move at their own speed.

Barns - Barns for a sheep enterprise may be constructed inexpensively. They may also serve more than one purpose. The barn illustrated in Figure 4.3 could be used for shelter, lambing, and shearing with the addition and movement of panels. It could also include an addition for storing feed and bedding or an office for record keeping activities and storing medications.

Some producers will likely have more elaborate facilities. For instance, in a typical purebred operation, a producer's main goal is to develop the best breeding stock for commercial flocks. A purebred producer invests a great deal of time and money in improving the flock. The flock requires an intensive management program. Purebred producers may invest more in providing the necessary facilities to ensure that their flock is

*Figure 4.3 - Sample Sheep Barn*



managed with as little stress as possible, which will improve productivity.

### Waste Handling

The removal of manure and animal carcasses is an important factor to consider when developing facilities for a sheep operation. If the sheep are pastured, then producers do not have to deal with handling manure because it will naturally break down. However, sheep should be kept out of water sources to avoid contamination.

If a producer has a barn for housing sheep, she or he must consider how waste will be handled. Producers must implement a process to clean facilities and dispose of manure in a safe manner. Some operations may consider using a slotted floor above pits that hold manure and other waste. A confinement sheep operation, for example, may make use of slotted floors to make removing manure easier. However, the expense of including this type of floor is not justified for most operations. They generally use solid floors and manually clean the facility. A tractor and blade may be used to move the manure to a chosen location for storage until it can be spread as fertilizer.

Producers also need to plan for the disposal of carcasses. Dead sheep can be disposed of by rendering, placing them in a sanitary landfill, incineration, or burial. If a company is picking up a dead animal to take it away for disposal, the truck should not be allowed to come too close to healthy animals in order to prevent the transmission of diseases.

### Sanitation Requirements

Good sanitation is an important part of managing the flock. The shearing facility is one key area where good sanitation is essential. If a producer hires someone to come onto the operation and shear the flock, then he or she must ensure that all the items being brought onto the operation are sanitized properly. The producer must make certain that all shearing equipment and any portable facilities brought onto the farm by the shearing crew have been cleaned and sanitized. One of the easiest ways for the flock to develop health problems is by exposure to diseases or parasites brought onto the farm from outside sources. Producers should also keep all other working facilities and handling equipment clean and sanitary. Sweeping barn floors, controlling dust, and sterilizing equipment are all a part of maintaining good sanitation.

### Handling Equipment

Handling equipment is an important part of a sheep operation. As with other types of livestock, portable and stationary loading chutes and trailers are used when transporting sheep. Fencing panels can be used to construct pens and handling areas. The panels are easily stored and can be quickly realigned once they are set in place to change the layout of a pen. Trained dogs can be valuable to sheep operations because they can herd sheep more easily than people can.

Sheep may be handled for management activities using a chute and headgate, but more specialized equipment may be used. A sheep chair is useful for smaller flocks. The chair holds the sheep on its rump, the same position used for shearing. To place the sheep in the chair, it is backed into the webbing that forms the seat and then is tipped backward. A sheep chair may be used for a number of tasks, including treatment for health problems, pregnancy tests, vaccinations, and ear-tagging or tattooing. Tilt tables and turning cradles are used for larger flocks with over 100 ewes. A tilt table turns the sheep on its side, while a turning cradle turns the sheep upside down.

### Other Equipment

In addition to handling equipment, other types of equipment are needed on sheep operations to promote productivity. The size and type of operation will affect the type of equipment that is appropriate for a particular operation.

Several types of feeders are used on sheep operations. Grain troughs, hay bunks, self-feeders, and fence line bunks may all be utilized, depending on the needs of the producer. Feeders should be large enough to hold an adequate amount of feed to meet the needs of the animals.

A sheep operation may have access to a pond or stream that could serve as a water source. However, if natural water sites are not available, a producer must provide waterers for the flock. A tank, trough, or automatic drinking cup can be used for watering sheep. Automatic waterers with heating elements can be a viable alternative for watering in the winter. If possible, waterers should be placed in the shade during the summer.

Producers should consider the safety of the livestock when choosing a waterer. Sheep should be able to climb out if they fall into the waterer.

Mineral and salt feeders should be provided for the flock. Feeders should have a cover to protect the minerals from severe weather. Feeders should be placed near a water source. Animals will be more likely to consume adequate amounts of minerals if fresh water is readily available.

Other useful equipment includes a weigh scale or crate, a dipping tank, a foot bath, and showers or sprayers A weigh scale or weigh crate is used to check the weight of the animals for health care or marketing purposes. Dipping tanks, foot baths, and sprayers can all be used to treat sheep for health problems.

## Records

Producers should keep an accurate, updated inventory of all the facilities and equipment on the farm, in order to track the value of their holdings. In addition to the inventory, sheep producers should keep equipment records. These records are especially important for large, expensive pieces of equipment. For tax purposes, the records should keep track of the depreciation cost for the equipment. They should also include a maintenance worksheet. This worksheet should include the date the piece of equipment was purchased, upgrades, maintenance, and other pertinent information regarding its upkeep.

## Summary

Sheep production is fairly similar to beef production in terms of facility and equipment needs. Sheep producers should consider the needs of the operation when planning for facilities and equipment. Facilities should allow for easy handling of livestock during all management tasks. They should also allow for waste disposal and proper sanitation. The use of good handling and other types of equipment is necessary to improve productivity. Records should be kept for all facilities and equipment.

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## *Lesson 5: Facilities and Equipment For Horses*

A horse producer must plan for the facilities needed for the enterprise when developing a horse operation. A profitable horse operation is normally an efficient one, and it is almost impossible to have an efficient operation without prior planning. In order to plan effectively, the producer must understand the nature of the horse enterprise.

### Factors Affecting Facility Requirements

When determining the facility requirements for a horse enterprise, the producer must first answer several questions relating to the nature of a horse operation. An essential question is the type of operation, which affects the purpose of the facility. A breeding operation that produces high quality purebred show horses for sale to riders or breeders will likely require more elaborate facilities than an operation that produces horses purely for pleasure riding. An operation that is involved in training animals for show or jumping might include special features like an indoor exercise area.

Another important question concerns the amount of capital that is available to invest in the enterprise. Most small horse operations have relatively little money invested. Other horse breeders invest in the top of the line equipment and facilities as well as expensive animals, which requires more capital.

The size of the operation is another consideration. Facilities must be planned with adequate space to accommodate the horses and the needs of the operation. They should also allow for expansion if the operation is likely to grow in the future.

Other factors to consider are ventilation, space, safety of horses and handlers, efficient use of labor, and attractiveness. Buildings for housing horses should have adequate ventilation to supply fresh air to the animals and to the handler when he or she works with the animals. Providing fresh air will reduce dust and odor buildup within the building, reduce the humidity level, and help prevent respiratory problems. Horses require more space than other common farm animals. Facilities must provide plenty of space, or horses may develop bad habits because they are bored with being confined. Buildings should be built with safety in mind because horses may easily injure themselves and their handlers if they are frightened or in pain. For example, doors should be of sufficient width and height. Safeguards against fire should also be incorporated into the structure. Facilities should be designed to allow for effective use of labor to prevent handlers from having to do unnecessary work and promote efficiency. Although it has nothing to do with use and convenience, attractiveness is important in terms of pride in ownership and resale value. If the horse enterprise is involved in raising and selling purebreds, attractive buildings have an enormous amount of advertising value.

### Facilities for Horse Enterprises

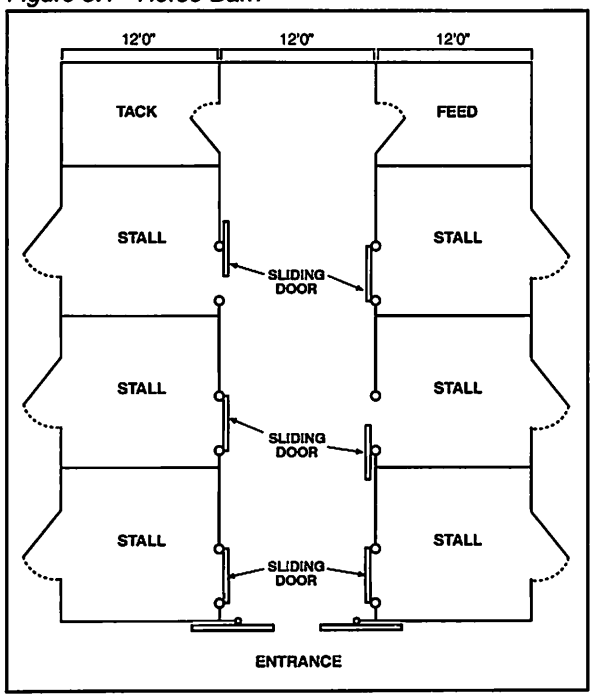
Horses are able to live outdoors without a lot of protection. They generally need only some basic shelter to protect them from extreme weather conditions. The facilities that are included on a horse operation are generally built as much for the convenience of the producer as to meet the needs of the animal.

Shelters - A shelter that protects the horses from the weather may be included in a pasture. The shelter may be enclosed on three sides to provide protection from the wind. It may also consist of a roof to produce shade for the horses.

Corrals or turnout lots - Corrals or turnout lots are necessary for horse operations because horses are generally much healthier when kept outside. Fences should be constructed using wood boards, barbless wire, woven or high tensile wire, metal pipe, or polyvinyl chloride (PVC) boards or pipe. Barbed wire should never be used because it may injure the horses. More sturdy fences are required for large breeds of horses, young horses, and stallions. The pens should be set up to drain well and reduce the handling stress of the horses.

Barns - Horses do not require elaborate or expensive barns. A horse barn should be located in an area with good drainage so that manure and urine can be washed away. It should have interior surfaces that are easily cleaned and sanitized. Barns also must have good ventilation without drafts. They should be well lit. A horse barn should include a storage area for feed, bedding, tack, and other necessary equipment. Figure 5.1 illustrates a simple horse barn designed for a small operation. This design feature a six-stall layout. A more extensive and elaborate facility may be used for a larger operation.

*Figure 5.1 - Horse Barn*




The flooring in a horse barn is generally made of clay or wood. Concrete floors are hard on horses' feet and legs and tend to become slippery when wet. It is easier to provide straw or some other bedding material on a clay or wood floor. Straw or wood shavings provide good bedding for horses. If clay is used for the floor, the top foot of clay should be removed and replaced yearly to decrease the incidence of disease and parasites.

Specialized types of barns may be used for a particular purpose. They may vary somewhat in design and layout. Stallions and foaling mares, for example, require more stall space. Specialized structures used on horse operations include the following.

- Stallion barn
- Breeding shed
- Broodmare/foaling barn
- Boarding stable
- Training stable

Indoor training area - Producers that are involved in boarding and training horses may include an indoor training area on the operation. This area may be a part of the main barn or a separate building. It can be used for exercising, training, or riding. The width and height of the area should be designed taking into account the activity for which it will be used. For instance, if hunters are to be trained inside, ceilings should provide enough room for the horse and rider to jump safely.

## Waste Handling

The removal of waste is a very important part of a horse operation for disease and parasite prevention. As already discussed, most horse facilities are built with wooden or clay floors, which will need to be taken into consideration when planning the method of waste removal. The facility should be designed for easy removal of animal waste from horse stalls. The producer could simply load a small trailer with bedding and manure removed from each stall by hand. The producer could also build the facility so a tractor and blade can be used to drag waste from each stall. Most producers with small horse enterprises have manure removed by hand. Stalls are often cleaned daily.

The removal of dead animal carcasses is another important factor to consider when developing facilities. If a producer develops a barn designed to house horses year round, then he or she must consider how to remove a horse if it dies. Dead animals should be removed from the barn as soon as possible after they are found to help limit the spread of diseases. Carcasses can be disposed of by rendering, placing it in a landfill, or burial. If a dead animal truck is coming to pick up a carcass, the producer should ensure that the truck does not come near the other horses or farm buildings in order to prevent disease transmission. If the horse is buried in a pit, the pit should be deep enough to cover the carcass with at least four feet of soil. The burial site should be in an isolated area where the burial will not contaminate groundwater.

## Sanitation Requirements

Good sanitation is very important for both the facilities and equipment used in the handling and care of horses. It is important for the producer to keep the horse barn and surrounding facilities clean and sanitary to discourage the growth of bacteria and the reproduction of parasites. Stalls should have absorbent bedding to help drain off urine and moisture from manure. The frequent removal of manure and urine-soaked bedding is necessary to keep horse barns sanitary and control flies. Manure should be spread frequently to prevent fly larvae from developing. Sweeping barn floors, cleaning interior surfaces, controlling

dust, and sterilizing equipment used to treat animals should be done on a regular basis. Water and feed troughs should also be cleaned out to remove moldy hay and control diseases and parasitic activity.

## Handling Equipment

Horse operations require good handling equipment to handle the horse safely and prevent injuries. The handling equipment needed includes horse trailers and tack.

When selecting a trailer, two important considerations are the safety of the trailer and the protection of the horse. Trailers should be equipped with brakes, and a safety chain should also be attached to the hitch. These items are required by law in most states. A padded chest bar inside the trailer helps prevent injury to the horse. A rough or uneven floor surface gives better footing for the horse. An enclosed trailer will protect the horse from drafts. A small door in the front of the trailer allows a handler to leave the trailer after leading a horse inside.

Tack is necessary for riding and showing horses. Basic tack consists of a saddle, saddle pad or blanket, bridle, halter, and lead rope. Tack should be made of good quality materials and must fit the horse properly.

The two most common types of saddles are the Western and the English saddle, which are shown in Figure 5.2. The type of saddle used will depend on the style of riding. Western saddles are more durable utility saddles that provide more security for the rider. English saddles allow the rider to communicate with the horse using her or his legs, which is important in jumping or showing horses. When selecting a saddle for a horse, it is important to check the fit by looking at the horse's body, including the length of the horse's back, the shape and size of its withers, the muscling and slope of its shoulders, and the girth of the ribs.

Different types of bridles and bits are available, as illustrated in Figure 5.3. The bit controls the horse's movements, while the bridle holds the bit in the horse's mouth. The type of bit and bridle selected will depend on the riding style. The bit should be appropriate for the style of bridle chosen. When a bridle is not needed, halters are

*Figure 5.2 - English and Western Saddles*

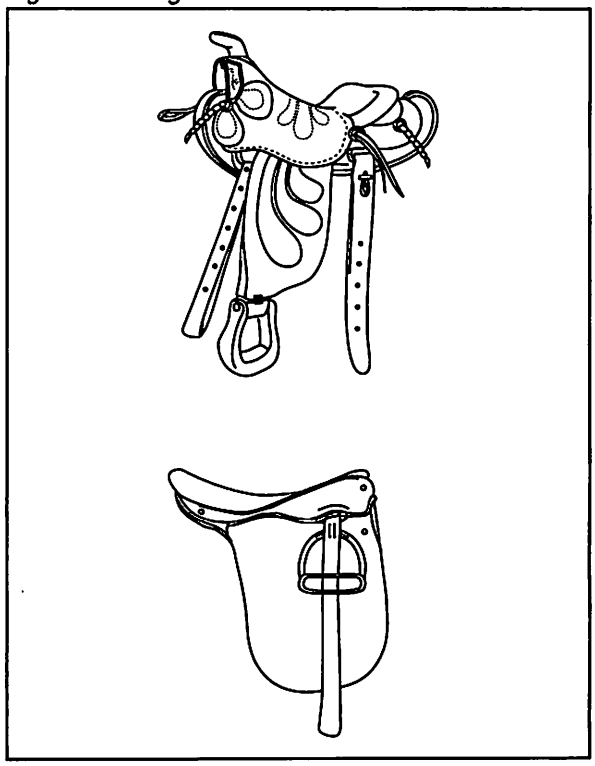
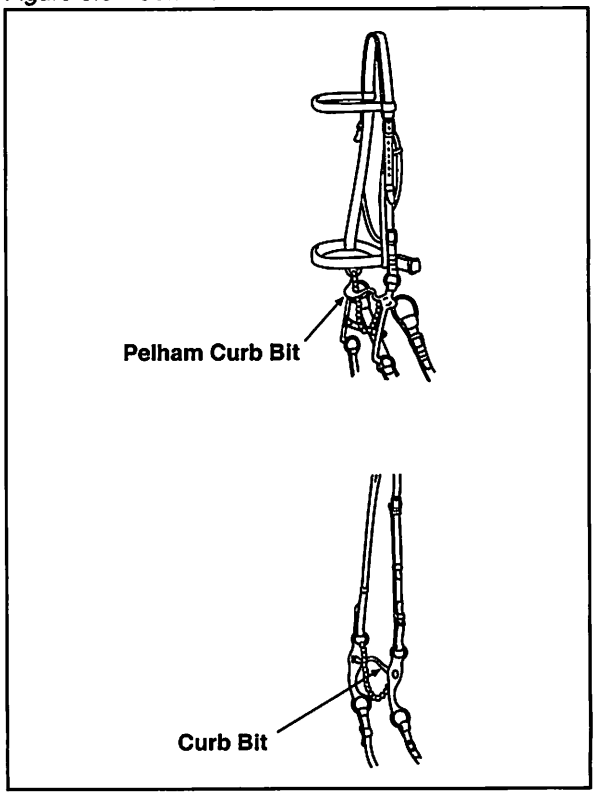


*Figure 5.3 - Common Bridles*



used for tying and leading the horse. They may be made of nylon, leather, or rope.

Tack is expensive and should be given proper care. Leather should be kept clean and oiled. Saddle soap is used to clean the leather. Producers should select an oil that does not rub off on clothing. The oil should keep the leather soft and pliable. Worn or broken parts of the tack must be replaced.

### Other Equipment

In addition to handling equipment, other types of equipment are necessary for horse operations. Among the most important equipment are feeders and salt and mineral feeders. Feeders may include hayracks, mangers, and grain feeders. Hay racks and mangers may be built into stalls. Grain feeders should be removable so that they can be cleaned. If horses are fed outside, a concrete apron should be placed under the feeder to prevent horses from standing in mud or possibly eating dirt if feed should fall on the ground. Wooden salt or mineral feeders are also needed. Salt and minerals should be kept separate by feeding them in different feeders or in one feeder with different compartments.

Waterers are another important type of equipment. They should provide plenty of clean, fresh water. Producers may supply water using a hose or an automatic watering system. A water tank, trough, or automatic waterer is provided to hold the water. The water must be prevented from freezing in cold weather.

Other equipment needs include grooming supplies and hoof care supplies. Horses require daily grooming to keep them healthy and improve their appearance. Grooming equipment includes currycombs, a mane and tail comb, a grooming cloth, brushes, ear clippers, and mane clippers. Regular foot care is also necessary to prevent damage to hooves. Equipment for hoof care includes a wire hoof brush and hoof pick. Some producers may also have their own shoeing equipment if they do not have a professional farrier do the shoeing.

### Records

Both small and large horse enterprises should keep complete records on their facilities and equipment. An updated inventory of the buildings and equipment will allow the producer to track the value of the operation. Producers should also keep records on all of the equipment on the farm, especially large and expensive pieces of equipment like a horse trailer. The records should track the depreciation cost associated with each piece of equipment for tax purposes. They should also include a maintenance worksheet. This worksheet should include the date the equipment was purchased, upgrades, maintenance, and other pertinent information regarding the upkeep of the equipment.

### Summary

Horse facilities and equipment can be very basic in nature. They do not have to be expensive or elaborate, although they may be, depending on the nature of the horse enterprise. At the most basic level, they should provide protection from weather changes and harsh conditions. Facilities included on a horse operation may include shelters, corrals or turnout lots, barns, and inside training areas. Proper waste disposal and sanitation are an important part of caring for horse facilities; they will decrease the chances for disease and parasites and provide an acceptable environment for the animals. Tack is an essential and expensive part of the handling equipment on a horse operation, along with a horse trailer. Other equipment includes feeders, salt and mineral feeders, waterers, grooming supplies, and hoof care supplies. Complete records should be kept for all facilities and equipment on a horse operation.

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## *Lesson 6: Poultry Facilities and Equipment*

The goal of any poultry housing system is to provide the birds with an environment where they are comfortable and free of stress. A healthy environment will discourage disease and facilitate high rates of production.

### Factors Affecting Facility Requirements

To provide good facilities for poultry, as for any other kind of livestock, it is necessary to know how many animals will be housed, how much space they require, and the requirements for production. The four major factors that affect the design of any type of poultry production facility are temperature, moisture, ventilation, and lighting.

Poultry species perform acceptably in temperatures ranging from 35 to 85 degrees Fahrenheit, with optimum temperatures for production at 55 to 70 degrees Fahrenheit for layers and 75 degrees Fahrenheit for broilers. A poultry house should be designed to protect the birds from rapid changes in temperature. The temperature within a poultry house can be greatly affected by factors such as solar radiation, wind, outside temperature, and the heat generated by the birds themselves. Feathers provide some protection from cold temperatures, but egg and meat production are reduced. Poultry have little protection from hot temperatures because they do not have sweat glands. Proper insulation can help poultry houses regulate temperature. Ventilation systems can also help to keep birds cool in the summer.

Relative humidity in poultry houses should be between 50 and 75 percent. However, excessive moisture leads to bacterial growth and an uncomfortable environment for the birds. The moisture in a poultry facility comes from vapor given off by the birds, waterers, droppings, and wet litter. Moisture can be controlled in poultry facilities by increasing air flow through ventilation systems.

Proper ventilation helps to expel moisture and stale air from the building and to regulate temperatures. Considerations in the design of ventilation systems include avoiding drafts and the entrance of cold air. In most poultry houses, electric fans move fresh air through the building, which has inlets to let in fresh air and outlets for the removal of moist, stale air. Natural ventilation from windows may be used in some situations, but it is only acceptable for relatively small houses and smaller flocks.

Lighting is an important aspect of poultry facilities. Lighting systems are crucial to laying house operations because light is used to stimulate hens to lay eggs. Proper lighting is also important for broilers and turkeys, both of which should receive a certain amount of light for optimum growth. The lighting systems used in poultry facilities are automated to switch on and off at specified times. Poultry houses should be equipped with a back-up generator in case of a power outage.

### Facilities for Commercial Egg Layers

Commercial laying hens are generally housed in environmentally controlled laying houses. They may be housed on a slat or wire floor or on litter-covered solid floor, but the majority of laying hens are kept in cages.

The cages contain 2 to 25 birds. The dimensions of the cage should allow each bird at least 54 to 64 square inches of floor space. The number of hens kept in each cage depends on the preference of the producer. The cages are usually placed in a stair-step arrangement of three to five rows of cages. Droppings fall through the cage floor into pits or onto dropping boards placed on top of the bottom cages to prevent droppings from entering those cages. The dropping boards must be scraped off periodically.

In addition to laying houses, commercial laying operations must have a building for handling and storing eggs. These facilities should be clean. They should be kept at the optimum temperature and humidity. Also, an air-tight fumigation cabinet is standard if the producers fumigate the eggs to sanitize them.

### Facilities for Broiler and Turkey Production

Commercial broiler producers generally raise birds in large one-room, environmentally controlled poultry houses. Open houses with windows may also be used. Dimensions range from 24 to 40 feet wide and 200 to 600 feet long. One poultry house can generally hold between 7,200 to 20,000 broilers. They may all be kept in one large pen,

but producers may also divide the room into smaller units with wire fencing. The building should provide .8 to 1 square foot of floor space per bird. Generally solid concrete flooring covered in litter is used in broiler production. Broilers are commonly raised from brooding to market under the same roof, with equipment such as portable feeders, waterers, a heat source, and brooding rings added during the first few weeks of their lives.

Turkeys are raised in confinement systems. Confinement housing for turkeys may either consist of pole-type housing with natural ventilation or more structurally sophisticated, environmentally controlled poultry houses with concrete foundations. Because turkeys require 3 to 5 square feet of space per bird depending on their size and sex, environmentally controlled housing can be quite costly.

### Facilities Needed for Broiler and Turkey Breeders

Broiler breeders are usually kept in confinement housing. They are generally housed on a floor that has wooden or metal slats over two-thirds of the floor; droppings fall through the slats for storage. The rest of the floor consists of an earthen floor covered with litter. This flooring system promotes fertility and clean eggs. Broiler breeders need more space than market birds; they should have approximately 2 feet of space per bird. Divided pens may be needed depending on the mating system used.

Breeding turkeys are kept in confinement housing. Confinement housing are buildings covered with wire on all sides. Three sides of the building are commonly covered with plastic during the winter months to protect the birds from harsh weather conditions. Portable fencing or dividers may be used for breeding purposes. The building should provide 3 to 5½ square feet of space for each bird depending on their sex and size.

In both turkey and broiler breeding operations, egg storage facilities are important. As with commercial layers, the facilities must be clean and provide the optimum temperature and relative humidity for the hatching eggs.

### Facilities Needed for Replacement Pullets

Replacement pullets need to be kept isolated from flocks of laying hens and other birds, so they require separate housing. Generally the housing systems used for pullets are the same as those used for brooding or for a laying flock of hens. Replacement pullets may be started on the floor in a brooder house during the brooding phase. The birds are then moved to a layer house. Replacements are also often reared in cages from the time of hatching.

### Waste Handling Considerations

Manure handling is an important aspect of facility design. In confinement housing on solid floors, clean litter is periodically spread over soiled litter. The litter accumulates as the birds grow. When the birds are sent to market, the manure-laden litter is scraped away with a front-end loader on a tractor or a skid-steer loader. With slat floors, manure falls into a pit for storage; it may later be removed using a tractor or special mechanical equipment. In a cage system, special mechanical equipment may also be used to remove manure from pits.

Manure may be handled in a variety of ways. Some producers may have lagoons for storing manure as it breaks down. Manure may also be stored in pits until it can be spread on fields as a wet or dry fertilizer. Using poultry manure as fertilizer is efficient only if there is sufficient land nearby in need of fertilizer; if not, the cost of transport can outweigh the benefits of supplying manure. Many poultry producers have their manure converted into animal feed. Poultry droppings can be used as a source of energy or protein for beef cattle.

Poultry producers also have to handle the carcasses of dead birds. The proper disposal of dead birds is essential to disease control and prevention on any farm, and local regulations should be followed in any carcass disposal system. Dead birds may be incinerated, placed in disposal pits, or composted.

Incineration - An incinerator can be built on site or purchased. If incineration is done correctly, foul odors, fly problems, and water pollution problems are eliminated.

Disposal pits - Underground disposal pits can also be used. They are generally airtight pits that are 7 feet deep and equipped with a tight lid. Disposal pits should not be used where ground water may become contaminated.

Composting - Dead birds may be turned into compost using specially designed composters. Litter and carcasses are placed in the composter and are allowed to decompose. The remains can then be used for fertilizer.

### Sanitation Requirements

In poultry houses, proper sanitation is accomplished by cleaning and disinfecting the facilities. Producers first spray lightly with disinfectant to settle lingering dust. They then remove all litter and droppings and scrub the walls, floor, and equipment with hot soapy water. The soap is rinsed away, and disinfectant spray is applied according to the manufacturer's directions.

Measures to prevent outside contaminants from entering the facilities are also used by commercial poultry producers. When entering or leaving the poultry facility, visitors and employees must shower in and out, so showers must be provided in the facilities. Boots are disinfected by stepping into a disinfectant solution placed by the door when moving between buildings. Visitors must also sanitize their boots or shoes. When entering the poultry operation, trucks must pass through disinfectant receptacles, which are shallow pools of disinfectant large enough to wet the tires.

### Handling Equipment

In poultry operations, very little handling equipment is needed because the birds are relatively small in size. Managers may use long sticks to round-up turkeys. Another investment a producer may make is the purchase of catching chutes. The chutes are used to capture birds and load them onto trucks. A major advantage of the chutes is that they eliminate the need for handling the birds at all.

### Other Equipment

While poultry do not require much handling equipment, many other types of equipment are used in poultry production. Some of the equipment can be complex, such as the automated systems used to collect eggs from layer hens. A few basic pieces of equipment are listed below.

Waterers - Water can be provided for poultry in troughs, bell-type waterers, nipple waterers, or cup containers. Nipple and cup waterers are frequently used in the cages of layers to minimize cleaning. Waterers need to be designed so that the water cannot be contaminated with litter and droppings. The waterer used should minimize spillage as much as possible to prevent excess moisture in the poultry house.

Feeders - Feeders should be easy to clean and set high enough to avoid contamination from droppings. In a cage system, the feed is usually provided in troughs in front of the hens' cages, often using a mechanized feeder. In broiler and turkey operations, troughs or hanging circle-type feeders are used; feeders may be automated to deliver feed continuously.

Nests - Cage systems for commercial layers require some type of nest in which to lay eggs. One type of nesting system has a sloped bottom so that when the egg is laid it will gently roll into an egg tray or an automatic egg collector. The other type simply holds the egg until it is picked up manually. In this case, some sort of absorbent nesting material is required for the nest. Materials such as oat hulls and wood shavings work well as nesting material.

Broiler and turkey breeders also require nests to collect eggs. Nesting boxes of sufficient size should be provided for the birds. They should be easy to clean. Nesting materials like shavings or sawdust are used for bedding.

Roosts - Poultry producers may want to provide birds with roosts to provide a comfortable perch away from the main flock. For turkeys, roosts are not necessary in confinement.

Warning system - An emergency warning system may be useful for poultry houses and egg storage facilities. The system is designed to sound when it detects fire, abnormal temperatures, and power failures. Some losses may be avoided if a warning system is in place.

### Records

Keeping records on equipment and facilities is an important part of managing poultry operations. An annual inventory should show the type of

equipment and buildings owned by the operation and their value. Information on depreciation is necessary to track the value of property. Copies of insurance policies should be kept in the operation's records. Records of equipment failures and any maintenance performed on the equipment should also be kept.

## Summary

Poultry operations require good facilities to maximize production. Four major considerations for commercial poultry production are temperature, moisture, ventilation, and light. Layer hens are generally housed in confinement systems in cages. Market broilers are raised in complete confinement systems, and turkeys are raised in either range or confinement systems. Broiler breeders are generally raised in confinement, while breeding turkeys are kept on restricted range, in semiconfinement systems, or in strict confinement housing. In all poultry production systems, the birds must have clean feed and water that is easily accessible. Generally the housing, feeding, and watering systems that are used for brooding or for a laying flock of hens are adequate for replacement pullets; they are often grown in cages. Waste management is important for disease prevention; manure and dead birds should be disposed of properly. Good sanitation is necessary in preventing the spread of diseases. Little handling equipment is used in the poultry industry, aside from sticks for driving the birds and catching chutes. Other equipment used are waterers, feeders, nests, roosts, and emergency warning systems. Accurate records should be kept on all facilities and equipment.

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## *Lesson 1: Providing Feedstuffs for Livestock*

Choosing the best feeds for proper nutrition is one of the most important decisions a livestock or poultry manager can make. So many options for feedstuffs exist that choosing what to feed and when can be confusing. The first step in creating a quality feeding program is to locate resources about current nutrition information.

### Information about Animal Nutrition

The National Research Council (NRC), a federally funded research division of the U.S. government, publishes information on the nutrient requirements of a variety of species as well as other information affecting animal nutrition. Publications by the NRC include *Nutrient Requirements of Swine, Vitamins in Animal Nutrition, Grazing Management,* and *Nutrient Requirements of Beef Cattle.* The NRC also makes information available over the Internet.

Information about animal nutrition is also available from University Extension services. Agricultural Extension specialists summarize in various publications the sometimes complex results of research into nutrition so that producers can benefit from their findings. The University of Missouri has published numerous guide sheets that deal with animal nutrition, feed requirements, and feeding guidelines. They can be obtained from local Extension agents and over the Internet.

Livestock feed companies are another source of nutrition information and may have nutritionists on staff to provide assistance.

### Feed Harvesting Options

Because purchasing feeds can become very expensive, producers may raise their own feeds. Producers frequently grow forages for their livestock. Harvesting of forages can be done mechanically or by the animals themselves as they graze.

#### *Mechanical Harvesting*

Hay - Harvesting hay is a very common method of handling forages. The basic steps involved in making hay include harvesting, curing, and then packaging it, usually in the form of bales. The general principal of harvesting hay is to utilize the forage crop as efficiently as possible. The forage will produce little if any feed in the winter months, while production peaks in the spring and early summer. By cutting and preserving hay, the forage can be used during the months when the plant is not productive.

The quality of the hay depends on the harvesting methods used and the stage of growth at harvest. Forages should be cut from the pre-bloom to the early bloom stage to produce high quality hay with the maximum amount of total digestible nutrients. The water content needs to be low, with 15 to 18 percent moisture. If the water content is initially high, it will decrease in storage, causing fluctuations in the nutrient content. In general, crops harvested at their peak have a high moisture content, so it is necessary to cure the hay by allowing it to dry before it is processed further. Harvesting and curing must be done properly to prevent reductions in quality. Shattering the hay during harvesting, or causing it to lose leaves, will reduce quality because the leaves contain most of the nutrients. Bleaching the hay too long in the sunlight will cause it to lose nutrients. During curing, leaching may take place if it rains, which causes water-soluble nutrients to leach out of the cut forage. Foreign matter also reduces the quality of the hay, and as little as possible should be included in the hay bales.

Soilage (green chop) - Soilages are forages that are cut fresh and fed to livestock rather than being cured. An advantage of using green chop is that more of the available nutrients can be utilized by livestock than with other mechanical harvesting options or grazing. The major disadvantage of green chop is that feeding it requires a daily harvest, which may not be the most efficient option for a production facility. However, green chop may be useful if livestock are kept in a dry lot.

Silage - Making silage involves chopping high-moisture crops, packing them to reduce the oxygen content, and storing them in an anaerobic environment in a silo. As the chopped plants ferment, inorganic acids are produced that discourage the growth of microbes. If the silage is not packed or stored properly in the silo, the oxygen present will cause the silage to become inedible.

Silage should have a moisture level of 45 to 70 percent when it is stored. If it is too wet, it will be sour and contain fewer nutrients. Silage that is too dry will likely become moldy.

The temperature during fermentation also has an effect on quality. Temperatures between 80 and 100 degrees Fahrenheit are best. Lower temperatures break down the proteins in the silage and increase the amount of spoilage. Higher temperatures result in a loss of dry matter and crude protein.

Making silage is the most effective method of utilizing feed resources. It can preserve high moisture crops when curing is not a option or when the crop used would be greatly reduced in quality by drying. Although making silage does not improve the nutrient content of the crop, it does reduce the amounts of other compounds that can be toxic to livestock. Livestock find silage very palatable and will eat it readily.

Haylage - Haylage may be thought of as a form of silage. Instead of corn or sorghum being harvested, forages such as alfalfa, clovers, and sudan grasses are harvested at 40 to 45 percent moisture and placed in a silo. The silo could be either an above-ground type or an in-ground bunker. This method of harvesting and feeding materials that would normally be baled as hay has the advantage of decreasing harvesting losses when compared to traditional haying methods. It also reduces waste at feeding time and increases the nutritional value of the feed.

Baleage - Baleage are forages that are baled as large round bales and then immediately wrapped while fresh. The same equipment is used in the baling process with the addition of a piece of wrapping equipment to seal the hay bale. The bale may either be wrapped individually or pushed into a long plastic bag that can contain several bales. The nutrient content of the forage is higher due to an increase in moisture and better retention of the leaves, which are not as easily lost to shattering. Some disadvantages include the problem of disposing of the plastic wrap after feeding and the difficulty of moving the wrapped bales without damaging the plastic covering.

### *Grazing Systems*

Continuous grazing - Continuous grazing allows livestock to harvest forages in a specific pasture without interruption throughout the year. The preferences of the livestock will dictate which plants are left untouched and which are overgrazed. The result is a patchy pasture with some areas abundant in unpalatable and difficult to digest forage and other areas where nutritious plants are overgrazed. If this system is overused, it can result in the disappearance of the most beneficial plants because the majority of beneficial grasses and legumes cannot withstand the rapid defoliation. It also results in nutritious low-growing plants in undergrazed areas being crowded out by taller and less palatable plants.

Intensive grazing - Intensive grazing systems involve dividing a pasture into smaller pastures. These smaller pastures are stocked with animals at a high density. The livestock will rapidly graze a sward to a height of 4 to 12 inches, depending on the species. The animals are then moved to another pasture while the plants in the previously grazed pasture have a chance to grow and establish strong root systems that contribute to future survival.

Intensive grazing has some benefits for feeding. The plants remain at a younger stage of growth and therefore tend to be more easily digested. The growth and survival of valuable plants is favored. The less palatable plants are used more efficiently because the livestock will be less selective about the plants they eat. Livestock preferences do not dictate which plants will be eaten, eliminating the overgrazing and undergrazing of certain plants. Intensive grazing sometimes improves livestock production.

## Storage and Handling Practices for Quality Feedstuffs

The quality of the livestock producer's forage depends greatly on the harvesting, handling, and storage methods employed. Reduced nutrient quality can make it possible for an animal to be eating all it can while starving to death nutritionally. A successful livestock producer knows the nutrient levels in his feeds. This information can be obtained through testing performed by local feed manufacturers or state universities.

Forages are generally harvested as either dry hay or silage. In hay production, it is important to mow and dry the hay in the field to a moisture level that allows stable storage. Conditioning is a forage treatment that allows the moisture content to be quickly reduced, saving time in the haying process. Conditioning usually involves using a machine with rubber and steel rollers that smash or break the plant stems, allowing moisture to evaporate more easily from these broken areas. The skill of the machine operator determines the amount of

forage loss during this process. Typical losses with well-adjusted mower-conditioners vary between 1 and 5 percent of dry matter. Chemical conditioning is a newer process. A chemical drying agent is sprayed on the crop at the time of mowing. The chemical affects the waxy surface of the plant to allow easier moisture removal. Potassium and sodium carbonates are the most commonly used chemicals. The effectiveness of either mechanical or chemical conditioning is determined by the drying conditions. Better drying is obtained on sunny warm days using a thin, wide swath of hay.

The baling and handling of the forage can be accomplished using several methods. Hay may be stored as small rectangular bales or large round bales. Large, high density bales are becoming more popular because they are more efficient to transport and less labor is required. Whatever the method of baling, the handling and storage of the bales plays a large role in the amount and quality of the dry matter and nutrients retained. Typical losses of dry matter range from 2 to 5 percent of the yield. The skill of the baler operator can greatly affect nutrient loss because poor baling techniques can lead to shattering. The time of baling is another important consideration. Hay that is baled with a higher moisture content experiences less baling loss, but moist hay deteriorates more rapidly in storage.

Hay can be either stored inside a shelter or outside with varying amounts of protection from the weather. When protected well, hay is relatively stable during storage with only minor respiration by microorganisms. Respiration reduces forage quality by removing some of the digestible nutrients. Hay stored outside may experience 10 to 15 percent more loss of nutrients than hay stored inside, although storing hay outside will reduce investment in storage structures. Certain management practices may be employed with outside storage to reduce nutrient losses. Setting bales on crushed gravel, old tires, or other material to eliminate contact with the soil improves the preservation of the bottom of the bale. Plastic wrap around the circumference of the bale provides further protection.

Silage can be placed in vertical silos, bunker or horizontal silos, or silage bags. The most important management practice to employ to ensure good quality forage is to make sure the forage is sealed to limit the entry of oxygen when it is stored. Oxygen infiltration will affect the fermentation and respiration of the forage. A bunker silo is sealed by packing the silage with a heavy piece of equipment, such as a large tractor. The top layer will spoil and seal the forage underneath. It is important to fill the bunker as completely and quickly as possible to prevent several "top" layers from developing, which will cause excessive nutrient losses. A sealed upright silo or silage bags make it easier to preserve a seal, keep oxygen out, and ensure quality forage for livestock.

## Enhancing Forage Quality

Some producers treat forages with other materials to help preserve the nutrient content. One substance for preserving high moisture hay and silage is anhydrous ammonia. The use of anhydrous ammonia combined with plastic wrapping is the most popular method of hay preservation. The ammonia prevents heating from aerobic microbial activity by limiting the growth of microbes. It also reduces mold growth and adds non-protein nitrogen, which may be beneficial to livestock. Using ammonia on silage can kill aerobic microorganisms, decreasing storage losses. It can also increase crude protein content and may improve digestibility. The use of anhydrous ammonia presents some safety concerns. Direct exposure to anhydrous ammonia can cause severe burns, blindness, and death. Higher than recommended application rates can be toxic to animals.

Organic acids can be used as preservatives for both hay and silage. Of these acids, propionic acid is the most commonly used. It inhibits the growth of aerobic microbes in moist hay to prevent spoilage. It also reduces surface molding and decreases aerobic spoilage in silage. A disadvantage to the use of propionic acid is that it requires special equipment to spray the acid on the forage. Propionic acid is corrosive to machinery and can cause injuries to producers. Buffered propionic acids that are not as corrosive are available, but they are more expensive.

Enzyme treatments contain a mixture of cellulases, hemicellulases, amylases, and pectinases that are sprayed on silage. The enzymes break down the fiber in forages, reducing the fiber concentration and providing additional sugars to aid in fermentation. Dry matter loss can also be reduced.

The most common additives in the United States are bacterial inoculants. They consist of dried or inactive bacteria that grow and reproduce when sprayed on forage. The inoculants provide a supplement for the natural lactic acid bacteria found on the forage crop. They improve fermentation by increasing the production of lactic acid. They also reduce dry matter loss in silage. The inoculants are more effective on grass and legume silage than on silage from corn or sorghum. One major safety issue when working with inoculants and silage concerns filling the silo. After the silo is filled, carbon dioxide is produced and can replace the oxygen in the silo. The carbon dioxide, combined with nitrogen dioxide produced within the silo, can cause suffocation and death if a producer is exposed. The silo should not be entered for a couple of weeks after filling; then it should only be entered with a forage blower operating for twenty minutes before entry.

## Feed Processing Options

The processing of feeds involves changing a feed's shape or form through various techniques. Feed processing can take place at local feed mills, commercial feed companies, or on the operation. The technology needed for different processing techniques dictates where the feed will be processed. For example, producers generally do not have specialized ovens that are capable of heating grain to a high temperature for popping or the specialized drums used to make pellets. However, some operations may have a small hammer mill on site to grind grain. Feed processing equipment can be costly, but purchasing it may be worthwhile for some producers.

Pelleting - Pelleting consists of heating the feed material with high moisture and then forcing it through holes in a die to produce a compact and nutritious feed pellet. Both grains and forages can be made into pellets.

Pelleted feeds have several advantages. Consumption is increased because pelleting increases the palatability of feeds. Pellets are more easily digested than other feeds. Unhealthy and wasteful dust is reduced. Selectivity is reduced, so less of the feed is wasted. Less storage space is necessary because the feed is more compact. Pellets are easy to use with bulk and automated feeders. They are also useful on the range as they do not blow away as easily as other feeds.

Pellets also have some disadvantages. Pelleted feed is costly, and the quality can be variable. Rations that have a higher fat content are difficult to pellet.

Crumbles are a form of pelleted feed that is common in poultry diets. They are made by breaking or cutting pellets to a specific size.

Cubing - Cubed forages are made by forcing dried hay through holes in a die. The product is rectangular in shape. Hay that has been cubed has less nutrient loss than baled hay. Cubing is efficient when mechanized feeders are used or when the feed is spread on the ground. Less space is necessary to store hay cubes.

Grinding - Grinding is the simplest, most common, and least costly method of feed processing. It involves reducing the size of the feed by compressing it in a hammer mill or burr mill. These mills are able to produce fine particles. Grinding is frequently used for corn, milo, wheat, barley, and oats. Proper management is necessary in cracking concentrates to avoid grinding the feed too finely, which may result in a texture that is less palatable and digestible.

Rolling - Roller mills may be used to crack concentrates. In this process, grain is compressed between two rollers set a desired distance apart to produce a flake. Cattle prefer grain that has been processed by rolling and may gain better on it than if they are fed ground grain. Crimping is a feed processing method similar to rolling; it involves using corrugated rollers to compress the grain.

Heat treatments - Heat treatments include steam rolling, steam flaking, roasting, popping, extruding, and micronizing. Steam rolling consists of exposing air-dried grain to steam for several minutes to increase the moisture content and then rolling the grain. Steam flaking is similar to steam rolling, except the air-dried grain is exposed to steam for a longer period. Roasting involves heating air-dried grain at about 300 degrees Fahrenheit for a specific time to produce a puffed product. To pop grain, air-dried grain is heated at high temperatures for 15 to 30 seconds. Extruding is pushing heated feeds through a die or small holes in a screen to achieve a desired shape. Micronizing involves heating air-dried grain at

temperatures up to 300 degrees Fahrenheit with an infrared generator and then rolling the grain. All of these methods can improve palatability. They can also improve digestibility by affecting the starch in the grain and enhancing the absorption of protein from the feed. However, heat treatments are more costly than other types of feed processing.

## Alternative Feedstuffs

At times, the cost or supply of feedstuffs will dictate that the producer consider using some feeds that she or he does not normally use. If a certain protein source, such as soybean meal, used during feed formulation becomes too expensive per ton or hard to obtain, alternative feeds may need to be considered. Successful livestock producers are constantly evaluating the costs of production and the sources of feed in order to enhance profits. Some of the more common alternative feeds used are as follows.

Distillers' grain - A by-product of the distilling industry, distillers' grain is the spent grain left over after fermenting into alcohol. The grain is dried and sold for feeding. The grains include corn, milo, wheat, or rye.

Brewers' grain - Brewers' grain is a by-product of the beer malting industry. The grain is usually barley, although it may have some corn or rice, depending on the processor. Both dried and wet forms are available for feeding.

Soy hulls - During processing, soybean hulls are removed from the soybean as it is being rolled or flaked. The hulls are usually toasted and finely ground. They contain about 67 percent fiber and 12 percent protein. Soy hulls are a good source of energy.

Wheat midds - Wheat midds are the fine particles of the grain left over from commercial wheat milling. They consist of wheat germ, wheat bran, and some fibrous material. They are a good source of protein and energy.

Corn gluten - Corn gluten is a by-product of the wet corn milling industry, which produces high fructose corn syrup. It may be obtained in dry or wet form. It is relatively high in protein and fiber but low in starch, which was removed to make the syrup.

Whole cotton seed - Cotton seeds are left over after the lint has been removed for the garment industry. They are high in energy, protein, and fiber. However, they are also high in fat.

Rice bran - Rice bran consists of the hulls that are left after the grain has been removed for human consumption. They are blended with some of the germ and are usually finely ground.

Hominy - Hominy is a by-product of the dry milling industry involved in making grits or corn meal. It contains some corn bran, germ, and part of the starchy portion of white or yellow corn kernels.

Most of these feedstuffs are purchased in bulk. Large truckloads of feed need to be unloaded, stored, and moved on the farm, so proper storage facilities and handling equipment must be in place. Most of the commodity storage buildings are metal-roofed buildings with concrete retaining walls that are 5 to 6 feet in height and open sides. They are designed to allow large trucks to dump a load of feed on a concrete apron; front bucket loaders may be used to push the feedstuff into the facility. Other feeds can be moved into a storage facility using an auger. The characteristics of the feedstuff will determine the type of equipment needed. Wet brewers' grains, for example, cannot be augered because they are moist.

When considering the use of any of these alternative feeds, the producer must consider the nutrient value of the feeds as well as the cost per ton. The cheapest ration in cost per ton may not always be the most economical in terms of production. When evaluating alternative feeds, a good means of evaluation and comparison is on the cost per unit of net energy supplied by the alternative feed.

## Factors Influencing the Selection of Feedstuffs

When deciding what to feed livestock, the stage of growth of an animal and its use will affect the amount and types of nutrients required. For example, beef cows nursing calves have higher protein and energy needs than normal, while young pigs require more protein than older pigs. Producers must be sure that the feed supplied meets these needs. They should read labels carefully when purchasing commercial feeds or understand the nutrient content of feeds if they process their own. Producers may need to have

their forages tested to see if they are of sufficient quality to meet nutritional requirements.

Palatability is an important feed characteristic that may affect the choice of feedstuffs. Palatability refers to how eagerly an animal will eat a feed. If a feed is not palatable enough, livestock or poultry may not consume adequate amounts. Factors that affect palatability include its smell, taste, texture, and appearance. This characteristic is most important when feeding production animals.

Climate can also affect feed choices. Hot or cold weather may affect the nutrient requirements of livestock. Dairy cows, for example, require extra energy in temperatures above 77 degrees Fahrenheit because they will decrease feed intake. Climate can also influence the quality and availability of some feedstuffs. Animals may not always be able to obtain the nutrients they need on a pasture. The quality of forages decreases in hot weather, and they are not available in winter.

The facilities, equipment, and amount of land available to an operation can affect feed selection. Some feeds require more space to store than others, so the available storage space may dictate some feed choices. The use of alternative feeds will require special storage facilities and handling equipment. An operation with a particular type of automated feeders will need to use feeds that are easily dispensed from the feeders. If an operation has a limited amount of land, grazing livestock may need additional feed to supplement their nutrient intake.

The cost and availability of a feed are important limiting factors for feed choices. Producers should try to maximize quality while minimizing cost as much as possible. The best quality feed may simply be too costly for an operation. However, the cheapest feed may not be the most economical in terms of the nutrients supplied. When evaluating cost, producers should keep in mind that while a feed or combination of feeds may be more economical at a specific time of the

*Figure 1.1 - Toxic Plants*

| Plant Name | Species Affected |
|---|---|
| Bitterweed | Sheep; cattle and other animals may be affected |
| Bracken fern | Cattle, horses, sheep to a lesser extent |
| Buttercup | All animals; cattle are the most affected |
| Chokecherry | Sheep, sometimes also cattle |
| Cocklebur | Swine; cattle and sheep are affected |
| Copperweed | Cattle, sheep |
| Death camas | Sheep, sometimes also cattle and horses |
| Goosegrass | Cattle, sheep |
| Greasewood | Cattle, sheep |
| Halogeton | Sheep, sometimes cattle |
| Henbane | Cattle, sheep, horses |
| Horsebrush | Sheep |
| Indian hemp | Sheep, cattle, horses |
| Jimmyweed | All species |
| Larkspur | Cattle; rarely affects horses and sheep |
| Laurels | All animals, but especially sheep |
| Locoweed | Cattle, sheep, horses |
| Lupines | Cattle, sheep; sometimes affects other species |
| Milkweed | Cattle, sheep, horses |
| Nightshade | Cattle, sheep, horses, swine |
| Oleander | Most animal species |
| Pine needles | Cattle |
| Poison hemlock | Cattle, sheep, horses |
| Scrub oak | Cattle |
| Skunk cabbage | Cattle, sheep |
| Snakeweed | Cattle, sheep |
| Sneezeweed | Sheep; sometimes affects cattle and horses |
| Wild carrot | Cattle, sheep |
| St. John' s wort | Animals with white skin |
| Timber milk vetch | Cattle; sometimes affects sheep and horses |
| Water hemlock | All animal species |
| White snakeroot | Cattle, horses |

year, it may not be as economical later in the year due to changes in the price of that feed. Also, a feed that is not available locally will likely not be a good choice. If a feed is not easily available, transportation will drive up the costs of the feed. Care should also be taken not to select feeds, especially forages, that contain plants that are toxic to animals. Common poisonous plants in Missouri include milkweeds, chokecherry, larkspur, hemlock, cocklebur, nightshade, and scrub oak. Producers should be able to identify such plants. This knowledge could be obtained by the study of photographs and/or descriptions of the plants, checking with a local agricultural specialist, or sending the plant (with its roots) to a state agricultural college for identification. Most livestock will not consume toxic plants unless desirable forages are not available because of lack of rainfall or overgrazing. A more complete list of poisonous plants and the species they affect are given in Figure 1.1.

The selection of feedstuffs should include an examination for the presence of mycotoxins. Mycotoxins are a group of fungi, such as molds, mildews, rusts, and smuts, that may be present in plants or feeds. Mycotoxins lower resistance to diseases and adversely affect immunization. Aflatoxin is the major nutritional problem related to mycotoxins in the United States. The best method of controlling mycotoxins is to prevent the initial contamination of the feed. Crop rotation and deep plowing prevents some infestation of crops raised on the livestock operation for feeds. Grain cleaning, the use of fungus-free seed, and the application of ammonia have all significantly reduced this problem. Although some blending of affected feedstuffs with clean feed is practiced by producers, it is not permitted in feeds that sold in interstate commerce.

## Summary

Feed is the greatest cost associated with raising livestock and poultry, so feeds should be chosen wisely. A large amount of information on nutritional requirements and feeding options is available from the NRC and University Extension services to aid in selecting feeds for use. Feedstuffs can be harvested and processed in a variety of ways. Forages can be harvested either by mechanical methods that produce hay, soilage, or silage or through grazing systems. When mechanically harvesting forages, attention should be given to proper storage and handling and the possibility of using treatment practices to improve forage quality. Feed processing methods include pelleting, cubing, grinding, rolling, and different types of heat treatments. Some producers may choose to use alternative feedstuffs. When choosing feedstuffs for their livestock, producers should consider the stage of growth and use of an animal, palatability, climate, facilities, equipment, amount of land, cost, and availability.

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## *Lesson 2: Feeding Livestock and Poultry*

Feeds account for one-half to three-fourths of the total costs of production for livestock and poultry species. Choosing the right feeds and feeding options for maintenance and production is therefore crucial to the success of any livestock and poultry operation. Producers should also understand the general guidelines for feeding livestock.

### General Guidelines for Feeding Livestock

The goal of feeding livestock is to meet an animal's nutritional needs for its maintenance and production. If livestock are properly fed, they are more likely to be vigorous and efficient in production. If they are not fed properly, production will decrease, and the animals are more likely to experience costly diseases and parturition problems.

Within an animal's body, feeds are broken down into nutrients, the chemicals that an animal needs to function, maintain itself, and produce. Nutrients include carbohydrates, fats or lipids, proteins, vitamins, minerals, and water. The role of carbohydrates is to provide the energy for the animal to carry out body functions and for growth and production. Fats also provide energy. Proteins supply the building blocks for growth. If excess protein is present in a feed, it will also go toward the production of energy. As production increases, so does the need for protein. Vitamins and minerals are needed in trace amounts for the proper functioning of body systems. Water is required for virtually any bodily process.

All of these nutrients may be provided in a variety of different feeds. It is up to the producer to determine through what feeds the livestock or poultry will obtain these nutrients. The amount of nutrients needed depends on the type of livestock being fed, their stage of growth, the use of the animals, and other factors.

Several measures are used to indicate the energy content of a feed. These measures include total digestible nutrients (TDN), digestible energy (DE), metabolizable energy (ME), and net energy (NE).

TDN - The total digestible nutrients in a feed include digestible protein, digestible crude fiber, and digestible fat, all of which can be converted to energy. TDN is used in determining the energy requirements for ruminants. Because this system of measurement has been in use for years, information on TDN ratios is available for several thousand different feedstuffs.

DE - The digestible energy of a feed is equal to the amount of energy lost through feces subtracted from the feed's gross energy, which is the total amount of energy in the feed. The National Research Council has published the energy requirements for horses in terms of DE values.

ME - If the energy that is lost from urine and gasses is subtracted from the DE, the resulting value is the metabolizable energy. This form of energy measurement is often used in determining feed rations for swine.

NE - Net energy is the amount of energy needed by an animal for maintenance and production. NE is calculated by subtracting the amount of energy lost through heat production as nutrients are metabolized from the ME.

The amount of moisture in a feed influences the percentage of nutrients it contains. Nutrient availability can be measured on either an as-fed or dry matter basis. As-fed measures indicate the nutrient content of feeds with the moisture they normally have when fed to livestock. In contrast, dry matter measurements are used for the material that is left when all the moisture is removed. They indicate the exact amount of nutrients available without being thrown off by the water weight of the feed. The nutrient content of feeds that have a variable moisture content, like silages, is figured on a dry matter basis. To determine the quantity to be fed, the dry matter figures are converted to an as-fed weight based on the dry matter content of the feed.

Feeds are generally classified as either concentrates or roughages. Concentrates are feeds like grains, soybean meal, and by-products that are low in fiber content and high in total digestible nutrients. Concentrates provide fats, carbohydrates, and sometimes protein, so they are a reliable source of energy. Roughages, such as hay, pasture, and silage, are high in fiber and low in total digestible nutrients. They can provide some energy for gain, as well as regulate the pH and moisture balance in the animal's body and satisfy the appetite. Monogastric animals like swine and poultry cannot digest roughages.

To determine what kinds of feeds to provide livestock, a producer must consider the nutrients needed by their livestock. After considering the nutrients required, the available feedstuffs should be evaluated to determine the types and amounts of nutrients the feed provides. The producer can then formulate a diet for the livestock.

Livestock may be fed using either full feeding, free-choice feeding, or limited feeding. In full feeding, the animals are fed as much as they will eat. In a free-choice feeding system, animals have a constant, unlimited supply of feed, and they are allowed to regulate their own intake. Limited feeding involves providing a specific amount of feed on a specific schedule. The amount of feed given maintains weight or growth rather than fattening the animal or increasing its production.

### Feed Additives

Feed additives are products used in animal nutrition that are not nutrients in the usual sense of the word. These items are used to promote feed efficiency and gains by affecting the health or growth of the animal. Feed additives include antibiotics, antibacterials, anthelmintics, hormones, and other compounds. The Food and Drug Administration has strict regulations governing the use of feed additives. Many additives may be used only within specified levels and must be withdrawn within a specified times of the marketing of the animal. Current regulations should be consulted to determine the current approvals for the use of these materials.

Antibiotics and antibacterials are organic in nature and slow or stop the growth of disease-causing organisms. Sometimes they are combined to combat a problem that is not susceptible to either one on an individual basis. More antibiotics are fed to swine than any other species of livestock, accounting for about 40 percent of all usage. Antibiotics are fed to cattle on a regional basis, with little use in arid regions such as the southwestern United States. The growth of the confinement production of livestock has increased the use of antibiotics to combat diseases.

Hormones are substances that are secreted by the endocrine glands into the body fluids and transported to another location in the animal's body where they have specific affects on cell activity. Hormones or hormone-like substances are primarily used when feeding beef cattle. Some common simulated hormone products are Ralgro, Rumensin, and Synoves S and H. They are used as implants or are given in the feed. Hormone additives are not recommended for swine, poultry, and horses. Rumensin is actually fatal in horses.

Anthelmintics are compounds to control stomach and intestinal worms. They may be administered in the water or feed. These compounds should only be used if the presence of worms is suspected. Worms greatly affect the feed efficiency and gains of animals.

Other miscellaneous additives are used for a variety of purposes. They include coccidiostats to prevent disease in poultry, sodium bicarbonate to affect pH levels in the digestive tract, poloxaline to prevent bloat, tranquilizers to reduce stress in the feedlot, and sodium bentonite as a pellet binder for pelleted feeds.

### Feeding Options for Beef Cattle

Because cattle are ruminants, they are able to consume large amounts of roughages and utilize their nutrients. Beef cattle may not need to be fed large quantities of concentrates if they are provided an adequate amount of quality pasture. Generally salt and mineral licks are fed free-choice.

Cow-calf producers generally graze their livestock on pasture. Grazing management is important, so that pasture is not overgrazed or undergrazed and quality plants are available for the cattle. During the winter, grazing is generally supplemented with silage or hay. Concentrates may be supplied for extra energy during flushing or lactation.

Producers may provide extra feed for young calves through creep-feeding. Creep feed may consist of a commercial feed mix, grain, or chopped roughages. The feed is placed in a feeder in an area where the cows cannot reach it. Creep-feeding may be used if cows do not supply enough milk, if calves are to be weaned early or sold at weaning, if they are born in the fall, or if it is economical. It is generally not used if the cows are heavy milkers or if the calves can receive enough nutrients from good pasture or roughages in the winter.

Stocker cattle producers usually raise their cattle on pasture in the summer months and provide hay in the winter. To supplement the roughages,

concentrates may be provided using limited feeding beginning in late summer.

Feeder cattle are pastured or are full fed in a drylot system. In a feedlot, the cattle are full fed. The feed has a high grain content as well as roughages, and a protein supplement may be added to the diet. When cattle are on pasture, concentrates may be fed using either limited or full feeding to supplement the roughages.

### Feeding Options for Dairy Cattle

Dairy cows may be fed using several different methods. In the traditional method, the cows are fed roughages free choice in a barn. Grain and protein concentrates are fed to the cows individually, either in the barn or in the milking parlor; the amount fed is based on the level of milk production. Another method of feeding, challenge or lead feeding, involves feeding higher levels of concentrate early in the lactation period to challenge the cow to reach her maximum potential for milk production. When the level of production drops, the amount of concentrate fed is decreased. Finally, cows may be fed complete rations, also called total mixed rations. The cows are grouped by production level and are fed a complete ration that combines the roughages and concentrates necessary to meet all the nutritional needs of the cows.

Dairy cows may also be fed on pasture. When using traditional feeding or challenge feeding, pasture can be used to supplement the roughages supplied in the barn. Using a rotational grazing system is preferable to continuous grazing because it maintains a high-quality pasture.

Dairy calves should receive colostrum for the first three days after calving. They are then fed milk replacer once or twice a day until complete weaning. Calves should be fed a calf starter containing grains free choice for the first three or four months. Forages may be fed free choice beginning at eight to ten weeks of age.

Replacement heifers may be fed free choice on pastures. Grain and stored forages may be needed to supplement the nutrients provided by the pasture to achieve the desired rate of gain of 1.7 pounds per day.

### Feeding Options for Swine

Commercial swine production systems tend to use automated feeding systems. Market hogs and pregnant sows kept in confinement are generally fed a concentrate-rich feed twice a day. Lactating sows are fed concentrates using automated feeders or hand-feeding a few times a day.

Baby pigs may be nursed until weaning with no other feed supplements. Producers may supplement the sow's milk by placing pans of creep feed in the pen. For pigs not receiving enough milk or early weaned pigs, the producer should provide a commercial prestarter, while pigs weaned after three weeks of age receive a starter feed. Prestarters have a higher protein content than starter feeds.

### Feeding Options for Sheep

Sheep can survive and produce well on quality pasture with a mineral supplement and salt lick fed free-choice. Management intensive grazing may be used when pasturing sheep. Supplemental roughages or concentrates needed for production may be provided in troughs on the pasture.

Lambs may be creep-fed while nursing to help stimulate rumen development. They will begin to eat coarsely ground or crushed grain from a trough as early as ten days of age. Creep-feeding is necessary with an early weaning program.

Market lambs may either be fed out in a drylot or on a pasture. If they are in a feedlot, they may be fed using either self-feeding or hand-feeding. Lambs fed on pasture should receive supplemental feed for finishing.

### Feeding Options for Horses

Horses need a large amount of pasture. Typically a minimum of two acres of quality legume-grass pasture should be provided for each animal. Rotational grazing can increase the carrying capacity of the pasture. Continuous grazing can cause problems with overgrazing. Calcium and phosphorous mineral supplements and salt should be provided free-choice.

Mature and less active horses may need only the amount of energy provided by pasture or hay. Other animals need supplemental concentrates. Concentrates should not be fed free-choice

because horses will overeat. Instead, they should be fed by hand using a limited feeding system. It is better to feed them regularly several times a day rather than only once.

Foals begin to eat feeds at ten days to three weeks of age. If they are on high quality pasture, the foals can get all their nutrients from roughages. Otherwise the owner should begin creep-feeding concentrates at four to six weeks of age.

## Feeding Options for Poultry

Automated feeders and waterers are standard in the commercial poultry industry. Hand-feeding is generally inefficient, except when brooder rings do not permit the use of automatic feeding systems. In this situation, the young birds will need to be hand fed, and extra care is necessary to be sure that they have a constant supply of feed.

Poultry are generally full fed a complete feed; whole grains should never be added to a complete ration. Commercial egg-production systems feed their hens using an all-mash, mash and grain, or cafeteria system. An all-mash system is a mixture of a nutritionally complete ground feed that works very well with automated feeders. A mash and grain system is when grain and a mash mixture are provided separately. The cafeteria system allows the birds to mix their own ration. A quarter of the feeders hold a 26 to 32 percent protein supplement, and the other feeders contain grain. Cafeteria systems are not typically used in commercial operations. In contrast to laying hens, most broilers are fed complete mixed feeds in the form of crumbles or pellets.

## Water Quality and Quantity Requirements for Livestock and Poultry Species

Water is the single most important nutrient for all animals. Animals take in water by drinking it and by consuming it in the feed they eat. Water requirements fluctuate with changes in the body due to the stage and level of production. Forexample, a horse that is worked hard on a regular basis will lose water in the form of sweat and will require more water than an idle horse. A lactating dairy cow loses about 87 pounds of water for every 100 pounds of milk she produces. Water needs also increase with increasing temperatures, high-protein diets, and high salt intake. Table 2.1 indicates the average intake of water by livestock and poultry species.

*Table 2.1 - Water Requirements*

| Species | Gallons/day |
|---|---|
| Beef animal | 8-12 |
| Dairy cow | |
| Lactating | 35-45 |
| Dry | 20-30 |
| Swine | |
| Finishing | 3-5 |
| Nursery | 1 |
| Sow and litter | 8 |
| Gestating sow | 6 |
| Sheep | 2 |
| Horse | 10-12 |
| Chickens | |
| Layers/breeding hens | 50 per 1000 birds |
| Broilers (at 28 weeks) | 100 per 1000 birds |
| Pullets (at 20 weeks) | 46 per 1000 birds |
| Turkeys (at 28 weeks) | 200 per 1000 birds |

Water quality is important to the health of livestock and poultry as well as to production because animals tend to consume less water if the quality is undesirable. Water should contain less than 2,500 mg/l of dissolved solids, such as salts, nitrates, fluorine and other heavy metals. The water should also be free of pathogenic microorganisms, algae, protozoa, hydrocarbons, pesticides, industrial chemicals, and other hazardous materials. The resistance of livestock to these contaminates varies.

## Records

Accurate feeding records are important. Diseases are commonly flagged by a decrease in consumption, so records about feed intake are important, especially in confinement systems that utilize automated feeders. Feed conversion records should be kept to track the feed cost compared to the pounds of gain. Any medication or supplements added to feed should be recorded to avoid missing or doubling dosages.

## Conclusion

The goal of feeding livestock is to meet the nutritional requirements of the animal for maintenance and production. Nutrient classes include carbohydrates, fats, proteins, vitamins,

minerals, and water. Producers must determine whether feeds meet the nutrient requirements of their animals, which can be done by looking at measures like total digestible nutrients, digestable energy, metabolizing energy, and net energy. The nutrient content can be estimated on a dry matter or as-fed basis. Various feeding options may be used to supply nutrients to the different species of livestock and poultry. Of all the nutrients, the most important is water. Animals should be provided an adequate quantity of high-quality water at all times. Feed intake and medications and supplements provided in feeds should be recorded.

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## *Lesson 1: Beef Cattle Management from Birth to Market*

Raising beef cattle from birth to market involves certain management considerations. Some tasks are performed on calves at birth and some as they grow. Important management decisions involve selecting an age for weaning and developing feeding programs appropriate for market cattle.

### Management Practices for Calves

After a calf is born and breathing on its own, the producer should make certain the calf is warm, clean, and dry. In most instances, the cow will clean the calf by licking it. If the calf is born in cold weather, the producer may aid the cow by drying the calf with a cloth. The calf should not be allowed to become chilled, and the producer should supply a warm environment until it is on its feet. Most cows will seek shelter if they are in a range or pasture setting. However, if calving takes place during the winter, the producer should provide shelter. Shelter may be supplied by using large hay bales to form a windbreak or moving the cow into a barn for calving.

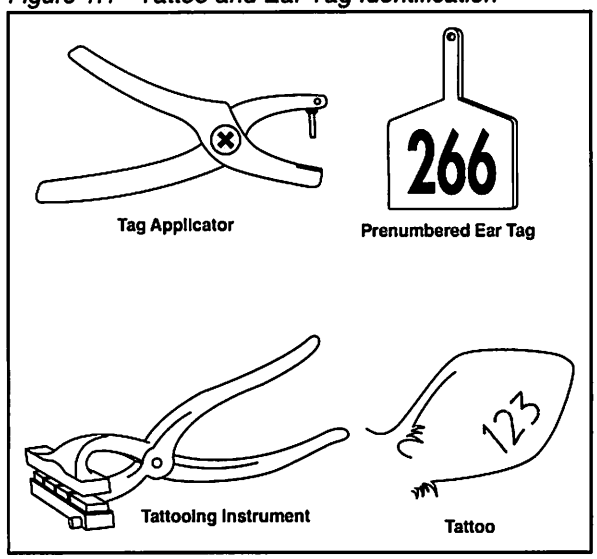
The producer should treat the navel cord. Treating the navel cord should be done as soon after birth as possible to prevent infections. The navel cord should be dipped or sprayed with a 2 percent iodine solution.

The calf will need to nurse shortly after birth to receive colostrum, which contains antibodies and nutrients like vitamin A and E that the calf requires. A weak calf may have problems with the nursing process and so may need some help. The producer may need to physically put its head up to the udder of the mother. Optionally, the calf can be fed using a nippled bottle filled with frozen colostrum that has been thawed and warmed or may be fed through a stomach tube inserted down the esophagus if necessary.

Producers should always separate the cows with calves from pregnant cows. Cows and calves should be put in another area where ample supplies of water and feed are available. Plenty of feed should be available for a new mother because she requires more feed to produce milk for the calf.

The calf is generally identified with an ear tag or tattoo applied at birth or a brand applied just before weaning. Figure 1.1 shows a sample ear tag and tattoo along with tools used to apply them.

*Figure 1.1 - Tattoo and Ear Tag Identification*




Ear tags should be made of flexible plastic with the numbers already printed on them. They are easy to apply; a special set of pliers is used to attach the tags. It is best to put the tag toward the end of the ear between the ribs. This placement allows it to be flexible and makes it easier to read. Producers sometimes put a tag in each ear so that the animal may still be identified if a tag is lost.

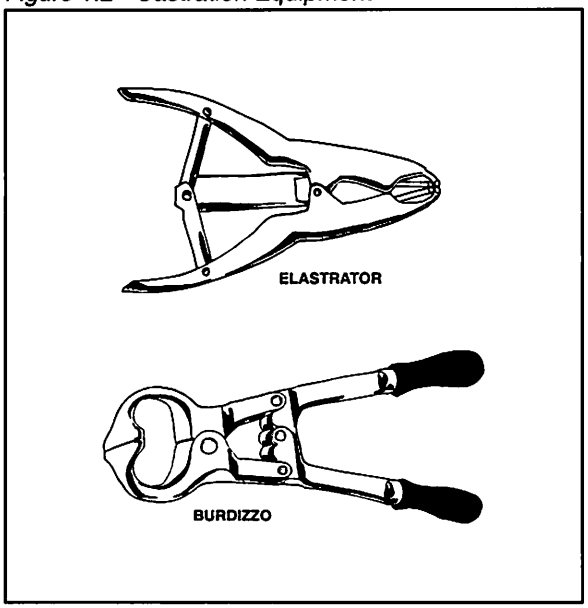
Tags may sometimes be torn from the ears, so some producers may choose to use tattoos for identification. When tattooing a calf, the producer should first make sure the ear is clean by removing any dirt or wax. After choosing the tattoo number desired, it is advisable to check the marking on a piece of cardboard. The instrument is placed so the tattoo is near the center of the inside ear, avoiding the ribs and blood vessels. After removing the pliers, the producer rubs the tattoo ink into the puncture holes until the bleeding stops. Some producers may choose to ensure identification by tattooing both ears. When tattooing, the producer should clean and disinfect the pliers before tattooing the next calf.

Branding is another method of identification. Brands are applied just before weaning. Some western states require cattle on rangeland to be branded. The brands are recorded by county or state governments. Brands in Missouri may be registered with the Missouri Department of

Agriculture. Two major methods of branding are used today. The older form is the use of a hot iron. Freeze branding is becoming more widely used. This form of branding uses an extremely cold iron applied to the animal hide.

Male calves are generally castrated. Producers may choose to castrate a young male calf following birth. Calves that are going into a feedlot can be castrated at any time between birth and four months of age. Typically, producers will castrate, dehorn, and brand the animals about three months after birth. Castration may be accomplished by a surgical method using a knife or scalpel or by applying pressure using a burdizzo (clamp) or elastrator (rubber band), both of which are pictured in Figure 1.2. The most common method of castration involves the use of a knife or scalpel. After the procedure, disinfectants should be used to reduce the possibility of fly or screw worm infestation. Proper restraint of the calf is important during castration. When mechanical handling facilities are available, the calf may be secured on a tilting or working table in a squeeze chute. More producers are choosing not to castrate male beef animals. Some research shows that bull calves gain faster than steers, weigh 5 to 10 percent more at weaning, and produce a carcass with leaner, more muscular meat.

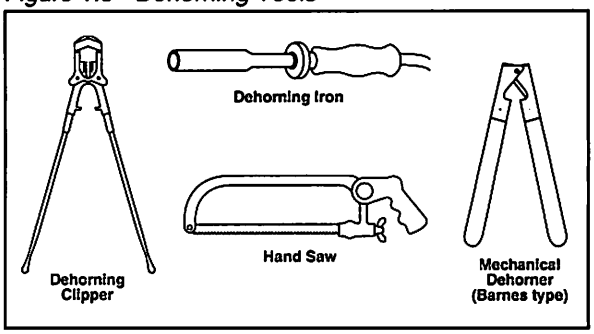
*Figure 1.2 - Castration Equipment*




Normally dehorning will take place at the same time as castration. Calves should be dehorned when they are young because handling the calf is easier and it experiences less stress. Cattle are dehorned for four main reasons. Horned cattle often bring less money when sold. Less space is needed in feedlots and trucks. Cattle are less likely to bruise one another, causing economic loss to the carcass. Dehorned cattle also cause less damage to facilities.

Several methods are used to dehorn cattle or calves, some of which are illustrated in Figure 1.3. Chemical methods are used on calves that are less than two weeks of age. A caustic stick is a substance applied to the horn that acts like an acid and eventually eliminates the horn. Care should be taken to prevent the substance from touching the skin by applying petroleum jelly around the horn. The chemical should be dry before the calf returns to the mother. The producer should keep the calf out of the rain for several days after applying the chemical. When horns are past the button stage but the calf is still less than 60 days of age, a spoon, gouge, or mechanical dehorning tube may be used. A dehorning tube works like a hinge and basically digs out the horn. Hot irons may be used for calves that are 4 to 5 months old to provide a fast, almost bloodless method of horn removal. The horns of older cattle will require clippers or saws for removal. Bleeding is a major problem with older cattle. Arteries may be pulled out after the horn is cut or then cauterized with a hot iron. If bleeding persists, the producer should call a veterinarian.

*Figure 1.3 - Dehorning Tools*




## Determining Weaning Age

Weaning involves removing the calf from the cow and putting the calf where it cannot see the cow. They should not be placed together again once the calf has been removed. Weaned calves should be supplied with plenty of feed and water.

While a number of calves are born in the 40- to 60-day calving period from the first calf to the last calf born, calves are generally weaned at the same time. The younger calves will not be at the same growth level as animals born at the beginning of the calving period. Calves born early in the cycle will therefore wean at a heavier weight than later calves. Producers will usually wean all of the calves once the youngest animals reach 205 days. However, the weaning age will depend on market conditions and the growth of the animals during the early phases.

Several factors affect the weaning weight of calves. An important factor is the amount of forage available to the calf and the cow. The cow needs forages to produce milk for the calf. Also, after three months of age, the calf will begin to feed on forages along with the milk from the cow. Some other factors that affect weaning weights include the weather conditions, supplemental feeds, and disease resistance.

## Feeding Programs for Market Cattle

Beef production can be divided into three phases of production: cow-calf, stocker or yearling, and feedlot. Appropriate feeding programs should be used during all phases of production. One producer may be responsible for feeding cattle through all of these phases, or cattle may be shipped to different enterprises for each stage.

A cow-calf producer generally raises calves from birth to weaning at around 450 to 650 pounds. While the calves are nursing, the lactating cow will need about 50 percent more roughage than when she is dry. Producers must also approximately double the amount of protein fed daily. When the calves are about 4 weeks old, the producer can begin creep feeding grain. The creep feeder should be placed in the shade, if possible, near where the cows rest. They should also be close to waterers. Creep feed may be purchased from a commercial manufacturer or blended by the producer. The feed should be high in protein and energy and fortified with vitamins and minerals. Molasses should be added to increase the palatability of the feed.

The stocker-yearling producer then raises the animal to a weight of 600 to 850 pounds. The feeding period for backgrounding is generally from 120 to 150 days in length, with the calves gaining about 1.5 to 2.0 pounds per day. They primarily are fed roughages such as grass pasture or hay. Supplemental grain is fed to provide proteins, minerals, and vitamins and increase the rate of gain. Calves that have been backgrounded, or pre-conditioned, are more suited to enter the feedlot than those that have not been fed in this manner. The stocker feeding program should prepare the cattle to make maximum use of the ration received during finishing.

Finally, the feedlot operator grows the animal to a desirable slaughter weight between 900 and 1,300 pounds. The feedlot operator uses a high-energy ration to finish the cattle to a desirable slaughter weight. They are typically fed high levels of grains and alternative feedstuffs and low levels of roughages. The amount of roughage fed varies throughout the finishing period; beginning finishing rations have higher levels of roughages than the ration fed at the end of the finishing period. Corn and grain sorghums are the most commonly used grains. The roughages generally consist of hay or silage. Rations should also contain protein supplements, vitamin A, vitamin E, and minerals, including sodium, phosphorus, and calcium. The animals generally reach slaughter weight at 15 to 24 months of age. During the feeding process, animals may receive hormones through growth implants placed under the skin in the ear. This process tends to increase gain by approximately 8 to 12 percent.

## Records

Records are a vital part of the success of any cattle operation. During each of the phases of the beef production discussed in this lesson, information should be recorded by the producer. This information will help the producer evaluate the enterprise to determine if improvements may be made to increase profits. Records may include information concerning percent calf crop dropped, percent calf crop weaned, weaning weights (205-day weights), the amount and analysis of feed given to the animals during the growth stage, age in days and weight at marketing, pounds of feed to produce a pound of beef, and death rates.

## Summary

Producers should manage calves appropriately after calving in order to produce animals that will be productive later in life. Routine management practices include indentifying calves, castrating, and dehorning. Weaning, which generally takes

place at or after 205 days of age, should also be handled appropriately. Feeding cattle using well-developed feeding programs is also important for productivity. Accurate records must be kept during all phases of the production process to aid in evaluating an enterprise's productivity and profits.

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## *Lesson 2: Management of Beef Replacement Stock*

In some ways, raising replacement stock is similar to raising cattle for market. They require many of the same management practices for calving and weaning. However, some special management considerations do affect the production of replacement animals.

### Raising Replacement Heifers

Replacement heifers are raised the same as the calves raised for market. They are calved and managed in the same way until weaning when they are about 205 days old, or about seven months of age. When selecting replacement females, the objective is to identify heifers that have certain characteristics. They should conceive early in the breeding season, calve easily, give a flow of milk consistent with the feed supply, wean a heavy calf, and make a desirable genetic contribution to the calf's postweaning growth and carcass merit.

About 15 to 20 percent of the cows from a breeding herd are removed from the herd each year because of death, breeding failure, or aging. About 30 to 40 percent of the heifers are saved each year to replace those cows. More heifers are saved than are needed to allow for death losses and later culling because of problems or poor performance.

Producers may evaluate the chosen heifers as weanlings and as yearlings to determine whether they should be added to the herd. Using Expected Progeny Differences (EPD) of the sires and dams and the performance records of the heifers is the best way to decide which heifers to keep. Another consideration is a heifer's pelvic area measurement that is used to determine the heifer's calving ability. Only those heifers in the top 50 percent in weaning weight should be considered. Age and weight at maturity should also be considered. Heifers reach sexual maturity at about twelve to fourteen months of age, when they have attained about 65 percent of their mature weight. Heifers of the English breeds should weigh 550 to 625 pounds. Larger breeds and crossbred heifers of large breeds should weigh 675 to 750 pounds. Producers often select the most productive heifers after the first pregnancy check. Heifer conception rates are lower than for cows, so selecting heifers that conceive easily will help ensure a good calf crop.

Prior to sexual maturity, the producer should make sure bull calves are removed from the herd to avoid early mating. Heifers that are bred too early may have their growth retarded and their productive life shortened.

Breeding may take place shortly after reaching puberty. The timing of breeding should be based on weight and not on age. Heifers should be at least twelve months old and weigh around 700 pounds at breeding. Most commercial cattle producers breed heifers to calve at two years of age.

Heifers should be separated into different age groups and kept separate from older cows. The nutritional requirements of cows differ from those of heifers. Bred heifers will have different nutrient requirements than younger heifers. Separating them will allow them to be fed appropriately.

### Replacement Bulls

As with cows, herd bulls will need to be replaced periodically. Replacement bull calves are calved and raised with the rest of the herd until weaning. When they are weaned at six to eight months of age, the bulls are separated from the rest of the calves. Between weaning and three years of age, bulls should be separated by age because younger bulls have different nutrient requirements.

Bulls require relatively simple management. They are typically placed on a feed ration and pasture for growth until they are about two years of age, depending on their size and weight. They should receive plenty of exercise to avoid problems with infertility and feet and leg defects. The performance records of bulls should be checked to monitor their development. The bull's semen should be tested to check fertility. Producers should also check for the bull's feet and legs periodically to make sure they are sound because problems could affect breeding. Replacement bulls are ready to use for breeding around sixteen to eighteen months of age.

### Feeding Programs for Replacement Stock

The feeding program for replacement heifers will have a large effect on their productivity as breeding stock, so it is important to feed heifers

appropriately. Heifers may be raised on good pasture during the summer. Mineral supplements should also be provided. If the pasture is poor, producers should feed three to five pounds of grain per animal per day. Feed for heifers must be palatable; rations should have good quality feed instead of coarse, poor quality feeds. Heifers being raised in cold regions require high energy feeds to maintain body heat. Nutrient needs increase 1 percent for each degree below freezing. Winter rations should also contain adequate protein for growth. Heifers should gain around 1 pound per day between weaning and the first breeding and about 1.25 pounds per day between weaning and calving.

Growing replacement heifers should be given more feed than cattle being fed for market. They require the extra feed to grow and develop before calving. Growing heifers should not be overfed, however, because overweight heifers have calving problems and decreased milk production.

Heifers should be flushed two to three weeks before the beginning of the breeding season. They should gain around two pounds per day. Heifers may be flushed by either feeding extra grain or turning them onto lush pasture.

Proper feeding is also important for replacement bulls. After replacements are weaned, they are placed on high-energy rations for about five months to discover which bulls gain best. The bulls with the best rate of gain may be used in the herd or kept for sale. Overfeeding should always be avoided because it affects the quality of the sperm and causes infertility. Young bulls should gain about 2.5 pounds a day from weaning to fifteen months of age and 2 pounds a day from fifteen months to three years old. Before the bull is a year old, the ration should consist of at least 50 percent concentrate. More roughage may be added to the ration after the first year to complete the bull's growth.

## Records

Records for both replacement heifers and bulls will help the producer make a final determination about whether to keep or cull a certain animal. Records related to performance are useful, including weaning weight (205-day weight), rate of gain after weaning, yearling weight (365-day weight), and feed efficiency, which is the pounds of feed required to generate 100 pounds of gain. Producers should also keep records on early breeding characteristics such as frame size, scrotal circumference, pelvic area measurement, semen test results, other body traits, and EPD scores.

## Summary

Raising replacement beef animals is much the same as raising market cattle until after weaning. After that time special feeding and handling is required for proper management. Producers should keep records on performance data and breeding characteristics relative to each replacement animal.

## Credits

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## *Lesson 3: Management of Beef Cows and Bulls*

Maintaining a healthy and productive breeding herd is the key to success when raising beef cattle. Producers must manage their cows and bulls wisely for them to be productive. Certain management practices should be followed to maintain their productivity.

### Management Practices for Cows

Managing the cow is probably the most vital part of being successful in a beef cattle operation. Without the cow, a beef production enterprise cannot survive. Thus, a producer must implement good management practices when managing a breeding herd in order to achieve the goal of a 100 percent calf crop.

The breeding and calving seasons are important times in the herd. The producer must determine when cows will be bred, which then will dictate when calving will occur. Producers may choose to use either a spring calving or a fall calving program. The cows calve in a 40- to 60-day period in either the spring or fall. Breeding must be done within a restricted period of no more than three months in order to have the cows calve during the chosen season. Breeding within this limited period allows the producer to maintain a short calving season and a uniform calf crop. For spring calving, breeding may begin in June, and the cows are expected to calve around March. Breeding for fall calving begins in late winter, around February, and calving should occur around late October. Most producers choose to have their cattle calve in the spring, with the goal of having the start of the calving season fall 45 to 60 days before pasture season begins and forages become available.

One of the major factors to consider when planning breeding and calving is what type of facilities the producer has available. Producers should also consider weather conditions, feed supply and pricing, pasture availability, equipment needs, and labor issues. Both spring and fall calving have certain advantages.

Advantages of spring calving include the following.

- Cows are bred when they are in good condition and should have higher conception rates, yielding a higher calf crop.
- Calves should be in good shape in the fall for sale as feeder calves.
- Calves do not have to be wintered.
- It is cheaper to feed a dry cow than a cow with a calf through the winter.
- Spring calves use less grain and the maximum amount of pasture.

Fall calving has the following advantages.

- Cows are in better condition in calving.
- Cows give more milk for a longer time.
- Calves make better use of pasture during the summer.
- Calves do not have to deal with flies, screw worms, and heat when they are small.
- After weaning in the spring, calves are ready to go directly onto pasture.

The gestation period of a cow is typically around 283 days in length. During pregnancy, cows need relatively little care, other than proper feeding. Shelter is necessary only during bad weather. The cows should be pastured to permit them to receive plenty of exercise. Lack of exercise can increase the likelihood of difficulty during calving.

### Management Practice for Bulls

Bulls should be separated from the rest of the herd until the producer is ready for the breeding season to begin. They should be pastured to allow them to exercise and keep them in good condition. One bull needs at least two acres of pasture.

Prior to the breeding season, the bull should be checked to make sure it is ready for breeding. The bull's semen should be checked for fertility. The bull should receive a full physical exam to check for soundness before the breeding season. The slightest problem, such as a nagging foot injury, can cause decreases in performance. Foot examination and care is especially important because a good foot care program can improve reproductive efficiency. Producers may need to trim the bull's hooves. If the hooves are trimmed properly, the bull will stand squarely and walk properly with each leg directly under its weight. Foot trimming and reproductive checks should be performed one to two months before the breeding season begins.

Once the breeding season arrives, the producer should turn the bull in with the cows. The producer should monitor the performance of the bull to make certain he is actively pursuing the cows and that he is breeding the herd. Each bull should breed approximately 25 cows during the breeding season when using natural mating. The bull should remain with the cows throughout the breeding season. Once the season has ended, the bull should be removed from the cow herd.

### Feeding Programs for Breeding Stock

Feeding programs are very important for keeping both bulls and cows in the proper condition for reproduction. Feeding programs differ according to the region of the country. Producers should understand the weather conditions and other factors that may affect the feeding needs of cattle in their area.

Cows are generally pastured with supplemental feeding provided during winter months. Supplemental feeding involves providing mineral and protein blocks or range cubes to provide the nutrients needed for growth and maintenance. Dry roughages and silage are often supplied to supplement poor quality pasture, although grain may also be provided if the roughages do not provide sufficient nutrients. If the roughages or pasture are of poor quality, vitamin A should be added to the ration to aid in maintenance and metabolism. Cows should be in good condition during gestation. They should not lose over 10 percent of their body condition during the winter if they are calving in the spring. However, cows should not be allowed to become too fat because being overweight will increase calving problems.

Cows are generally provided with supplemental feed at specific times during the reproductive cycle. Cows are flushed to improve fertility rates by providing supplemental feed consisting of either grain or lush pasture for two or three weeks prior to the breeding season. Additional feed is also provided during the final weeks of the gestation period to help prepare for birth and milk production. After calving takes place, the cow is fed supplemental nutrients for several weeks to help keep milk production high for sufficient calf growth. The cow requires 50 percent more energy, while protein, calcium, and phosphorous needs nearly double during lactation.

Bulls are typically fed in the same manner as the cow herd during all phases of the year. They are pastured for most of the year, and supplemental feed is provided during the winter. Additional concentrate is needed about six weeks prior to the breeding season to increase productivity. Bulls should not be either too fat or too thin once the breeding season begins because either condition can decrease fertility. Bulls tend to lose weight during the breeding season and are typically fed extra rations through the breeding period to keep them in condition.

### Records

Records for breeding animals are important in determining performance levels and whether they should be culled from the herd. The producer should record the occurrence of calving problems, birth weight, weaning weight, yearling weight, and rate of gain for each calf from a cow or bull. Conception and calving rates should also be kept for each cow and bull. This information can help the producer decide whether a cow or bull is productive.

### Summary

Cows and bulls require good management to be productive. Proper exercise and feeding are especially important in keeping breeding stock in good condition and maintaining high conception rates. Records are an important part of developing a quality herd. The producer should keep accurate performance and growth records to be able to analyze the quality of the breeding stock.

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## *Lesson 4: Management Practices for Dairy Cattle*

This lesson describes many of the general management practices that should be performed on the dairy animal from birth until it is mature. Several of these practices are quite different from those of other livestock enterprises because dairy cattle are raised for milk, not for meat.

### Management Practices for Dairy Calves

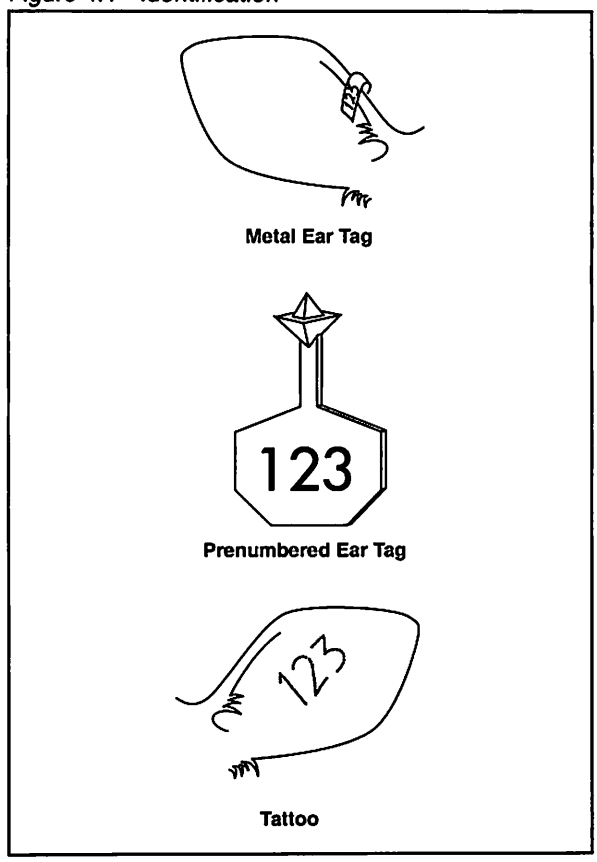
Certain management practices help to ensure that the newborn calf will be strong and healthy. Usually the cow will lick the calf clean shortly after birth. If not, the producer should wipe the calf with a cloth, towel, or clean burlap bag. Efforts must be made to keep the calf from becoming chilled in bad weather. The naval cord should also be dipped in a 7 percent iodine solution to prevent infection. If the navel cord is bleeding, it should be tied off with a strip of sterile cotton or linen cord. An injection of vitamin A, D, and E are recommended a few hours after birth. It is recommended that the calf consume 2 to 4 quarts of high-quality colostrum immediately after birth and 4 quarts within 12 hours of birth.

Identification of animals is important in dairy records management. The calf should be marked for permanent identification before it is removed from the mother. A freeze brand, ear tag, or tattoo, as shown in Figure 4.1, may serve as identification. Breed associations may require a photograph and sketch to document color patterns.

Dehorning should take place after ten days of age but before the calf becomes too big to handle and leaves the nursery barn. Dehorning can be done using a variety of methods. Using an electrically heated iron is the most common method. Other methods include using a caustic potash stick, dehorning tube, or mechanical saws or clippers. All equipment should be cleaned and disinfected before use and between calves. Calves should be isolated for a few days after dehorning to observe them for problems. Prolonged bleeding is the most common problem. Protect the dehorned area from flies by spraying it with an approved fly spray.

The next procedure is to remove any extra teats from the heifers. Sometimes a fifth teat will be present at birth, usually to the rear of the normal four. To remove the teat, the calf is placed on its side, and the area is washed and disinfected. The producer then stretches the extra teat and holds it firmly while cutting it off with a pair of curved, sharp, disinfected scissors. Iodine solution is applied to the area. If bleeding persists, a clean cotton cloth is pressed over the area momentarily. If flies are in season, the area is treated with an appropriate repellant.

*Figure 4.1 - Identification*




### Management Practices for Weaning

With most livestock species, weaning takes place a considerable time after the young is born. One major difference in dairy enterprises from other types of livestock operations is that the calf is removed from its mother as soon as possible after its birth, often before the next milking in the parlor. The calf is placed in a nursery within 1 hour after birth and is fed frozen colostrum that has been thawed in warm water, warmed, and placed in a bottle. Colostrum may be fed through a stomach tube inserted down the esophagus if necessary. After the calf has received enough colostrum, it is

placed on a milk replacer formula or regular milk from the milking herd.

Most calves are placed in individual hutches the first day after birth. Calves are encouraged to consume a coarse-textured grain such as rolled oats and corn. They can be weaned from milk at 8 weeks or when they are consuming at least 1 1/2 pounds of grain per day. Following weaning, the calves are moved to pens in groups of 6 to 8.

### Management Practices for Replacement Heifers

About 30 percent of the dairy herd must be replaced each year. The producer has the choice of raising replacements or buying them. The advantages of raising replacements are reduced costs, greater control over selection, less chance of bringing disease into the herd, employing labor and facilities otherwise unused, and increased income from sale of extra heifers. Approximately 50 percent of the newborn calves will be male. They can be sold for veal or beef along with extra heifers.

Replacement heifers are placed into production based on their age and size. Heifers should be 14 to 15 months of age and reached at least 50 to 55 percent of their mature weight before breeding. For example, if the mature cow of a particular dairy breed will weigh 1,000 pounds at maturity, a heifer should not be bred until she weighs at least 550 pounds.

If bulls are kept on the dairy operation, heifer calves should be separated from bull calves before six months of age to prevent indiscriminate breeding. There should be no more than three months difference in the ages of replacement animals. Any greater age difference will increase the labor required to feed the different rations needed to suit the size of the animals. Establish a monthly worming program for replacement heifers by six months. Replacement heifers may be acclimated to milking procedures before calving. This process involves herding the heifers through the holding pens, placing them in the milking stalls, letting them get used to the milking equipment, and releasing them through the normal exit.

### Management Practices for Lactating Cows

Dairy cows are placed in the fresh cow group almost immediately after calving. During the lactation period, several management practices are necessary.

Lactating dairy cows require proper rations for maximum production. The rations fed must be designed to meet the animal's nutritional needs during production. The quality and quantity of the ration is very important. Feed the cow all she wants to consume of a high quality ration. This is about 3 to 1 of her body weight as dry matter.

Another management decision concerns milking practices. Producers must decide whether they will milk their cows two or three times a day. Milking cows three times per day will increase milk production from 6 to 20 percent over milking twice a day. However, milking three times a day involves additional costs, especially labor costs. A regular milking routine is recommended. For example, if the cows are placed on a milking schedule in which they are milked twice, they may be milked at 5:00 a.m. and again at 5:00 p.m.

Good management practices during lactation will reduce the possibility of off-flavors in milk. Proper ventilation in the barn can affect the taste of the milk. Cows that breathe unclean, cowy, or barn odors may change the taste of the milk.

The milking equipment may also affect the flavor. Foreign deposits in the milking equipment can cause off-flavors. Clean, properly sanitized equipment can help reduce problems. Feeds that are moldy or contain certain weeds should not be given to the cows. To limit the effects of exposure, remove the cows from the pasture two to four hours before milking and feed silage only after milking. These practices allow time for the objectionable feed odor to pass through the cow's system.

Milk let-down is controlled by the hormone oxytocin. Gentle handling during herding and gentle washing and drying of teats can stimulate proper milk let-down. A regular milking routine also promotes milk let-down.

Promoting the comfort of the cow is an important aspect of proper management. A contented cow produces more milk. If the dairy cow is properly cared for in terms of handling, feeding, and housing, milk production can be maximized during the lactation cycle. Cows need to rest 10 hours per day.

## Milking Practices

Certain practices are followed with milking procedures to achieve maximum production and ensure the milk is of good quality. Good quality milk must be kept free of dirt and other sediment. It will have a low bacteria and somatic cell count (SCC) and no chemical contamination from sanitizing agents and other sources.

Proper milking will help to prevent mastitis. Nearly 40 percent of all dairy cows have some form of mastitis, which causes yearly losses of about $225 per cow. Three main factors that contribute to the development of mastitis are dirty or poorly adjusted milking equipment, poor milking practices, and injuries to the teats and udder.

Sanitation for operators during milking is necessary to prevent transmitting bacteria to the cow's udder. Sanitary practices are especially important in preventing mastitis. Operators should wash their hands with a sanitizing soap before milking and after handling any infected cows. They also need to wear rubber gloves and dip them in a sanitizing solution between cows.

The cow's teats need to be cleaned before milking. Operators pre-wash extremely dirty teats and udder using a hose or bucket of warm water containing a detergent. The teats are then washed with warm water containing a sanitizing agent like chlorine or iodine. Use disposable paper towels or a washable cloth to dry the teats and udder.

After cleaning, the teats need to be striped before attaching the milking machine. This invokes squirting two or three squirts of milk from each quarter. This will eliminate the first milk, which is usually high in bacteria. Stripping also stimulates milk let-down.

The milking machine should be attached within one minute after stimulating milk let-down. It is important to be gentle when attaching the teat cups to avoid injury. Most cows will milk out in three to six minutes. Milking times vary from cow to cow.

When the milk flow decreases and the lower part of the udder appears flabby, shut off the vacuum and remove milking machine gently. All four teat cups should be removed at the same time. Improper removal may cause milk droplets to hit against the teat end. If these droplets contain bacteria, they may infect the quarter with mastitis. Leaving the machine on too long can injure the cow's teats. Most parlors use automatic detachment devices that remove the milker unit when the cow is finished.

After milking, the teats should be dipped using a formulated teat dip used for this purpose. The use of a teat dip will help reduce mastitis infections. At least two-thirds of the teat should be dipped into the solution as soon as possible after the milking machine is removed.

## Management Practices for Dry Cows

Dry cows are those cows not producing milk. A cow needs a dry period between lactation cycles to allow its body to rest and recover from milk production. Good management between lactation will increase production during the next lactation cycle, thereby increasing profits.

The dairy cow is bred while being milked and carries a calf 1/2 to 3/4 of the lactation period. Accurate records are needed to determine when calving will take place. Because the lactation period begins with calving, the cow is allowed a dry period of 45 to 60 days based on the projected calving date.

Cows should not be too thin at the end of lactation. USDA research shows that body fat is replaced more efficiently during late lactation than during the dry period. Therefore, before removing the cow from milking, the cow should be conditioned providing some extra feed during the last 2 to 3 months of lactation.

Stop milking unless the cow is producing 80 to 100 pounds per day at the time to dry off. A dairy cow may be dried off simply by not milking her. This method is recommended because leaving milk in the udder will stop its secretion. During the drying-off period, the cow should not be fed grain or silage for two or three days. A regular ration of good quality hay and water should be sufficient. Routine treatment for mastitis with a dry cow treatment product is recommended at the drying off. The producer should observe the udder for two to three weeks for signs of mastitis.

Dry cows are separated from the milking herd and allowed plenty of exercise. Dry cows should not be overfed. Cows that get too fat will have problems calving and may develop milk fever. It is recommended to treat dry cows for internal

parasites at this time. Other vaccinations should be done at this time also.

### Management Practices for Dairy Sires

Most dairy operations use artificial insemination (AI) for breeding. Dairy producers have found that AI greatly improves herd genetics. Because cows are seen daily by the producer, it is easier to observe when the cow is in heat and insemination can be done. Other advantages of AI, such as improved genetic selection and not having to house and feed a bull, make AI a natural fit in the dairy operations.

If a bull is kept on the dairy farm, the following management factors need to be considered. Dairy bulls tend to be more aggressive than the males of other livestock species. Producers should avoid purchasing bulls with bad tempers. A ring should be placed in the nose of young dairy bulls. As the bull grows, the ring is replaced with a larger one. A dairy bull is more easily controlled with a chain attached to the ring than with just a halter. If semen is collected from the bull, special housing and pens are necessary for safe handling. Producers should consult a dairy extension specialist about the design and construction of the facilities.

### Records

The dairy enterprise is probably the most record intensive livestock enterprise. Many management decisions are based on the analysis of records, so it is important to keep complete records. A dairy farmer needs many different types of records, including production records for individual cows and for the herd, feed consumption records, and breeding and calving records. These records are used to make decisions about management practices such as feeding and culling.

Dairy producers are usually enrolled in a Dairy Herd Improvement Association (DHIA) record program. As discussed in Unit III, DHIA employees travel to farms to help producers with testing, collecting data, and analyzing data. They can help producers to manage their operations by providing many types of information for each cow, including the cumulative pounds of milk, fat, and protein produced during the production period, the percentage of fat and protein in the milk, and recommendations for the amount of grain-concentrate to be fed. This information provides valuable assistance in sire and dairy cow selection, culling low producing cows, improving feeding programs, and maintaining herd health. Figures 4.2 and 4.3 on pages 13 and 14 provides an example of some of the information provided by DHIA records. Useful information within the DHIA record is monthly individual somatic cell count (SCC).

### Summary

The dairy enterprise differs greatly from most livestock enterprises, although as with any livestock operation, young animals require proper care so that they remain healthy and become productive animals. Success of the dairy enterprise is determined largely by the management of the cow during lactation, but proper management of replacement heifers, dry cows, and dairy sires is also necessary. A set of complete and accurate records aids in proper management.

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*Figure 4.2 - DHIA Record (Side 1)*

# HERD SUMMARY DHI-202

| HERD CODE AND TYPE OF RECORD | | | SCHED USING DAY | DATE TESTED | | |
|---|---|---|---|---|---|---|
| ST | CO | HERD NO | | MO | DAY | YEAR |
| 43 | 09 | 0006 | | 12 | 23 | 99 |
| DHIRAPCS | | | STRING 1 | | | |

PAGE 1

UNIV. OF MO FOREMOST DAIRY
RESEARCH FARM
COLUMBIA MO 65201
NON-TRADITIONAL

## REPRODUCTIVE SUMMARY OF CURRENT BREEDING HERD

| BR. OF HERD | TOTAL COWS IN BREEDING HERD |
|---|---|
| H | 70 |

| VOLUNTARY WAITING PERIOD (VWP) |
|---|
| 60 |

| | COWS WITH NO SERVICE DATES OR DIAG. OPEN | | |
|---|---|---|---|
| | OPEN VWP TO 100 DAYS | OPEN OVER 100 DAYS | NUMBER DIAG. OPEN |
| NUMBER COWS | 2 | 7 | |
| % OF BREEDING HERD | 3 | 10 | |

| COWS BRED BUT NOT DIAG. PREG. | | | | DAYS TO 1ST SERVICE |
|---|---|---|---|---|
| DAYS OPEN AT LAST SERVICE | | | | |
| FEWER THAN VWP | VWP TO 100 DAYS | OPEN 100 TO 129 DAYS | OPEN OVER 129 DAYS | |
| 15 | 17 | 3 | 26 | |
| 21 | 24 | 4 | 38 | 75 |

## PRODUCTION, INCOME, & FEED COST SUMMARY

| DESCRIPTION | DAILY AVERAGE PER COW ON TEST DAY | | ROLLING YEARLY HERD AVERAGES | |
|---|---|---|---|---|
| TOTAL COWS | 194 | | 186.0 | |
| COWS IN MILK | NUMBER | % | NUMBER | % |
| | 159 | 82 | 158.1 | 85 |
| MILK LBS. (ALL COWS) | 52.5 | | 21,066 | |
| FAT LBS. (ALL COWS) | 2.12 | | 742 | |
| FAT PERCENT | 4.0 | | 3.5 | |
| PROTEIN LBS. (ALL COWS) | 1.76 | | 687 | |
| PROTEIN PERCENT | 3.4 | | 3.3 | |
| MILK LBS. (MILKING COWS) | 64.2 | | | |
| | MILKING COWS | ALL COWS | | |
| SILAGE | LBS. CONSUMED | | LBS CONSUMED | %ENE |
| OTHER SUCCULENTS OR BLENDED RATIONS | LBS. CONSUMED | | LBS CONSUMED | %ENE |
| DRY FORAGE | LBS. CONSUMED | | LBS CONSUMED | %ENE |
| OTHER FEEDS | LBS. CONSUMED | | LBS CONSUMED | %ENE |
| PASTURE | PASTURE (YES OR NO) | | DAYS | %ENE |
| CONCENTRATES | LBS. CONSUMED | | LBS CONSUMED | %ENE |
| VALUE OF PRODUCT $ | 10.20 | 8.25 | 3,055 | |
| COST OF CONCENTRATES $ | | | | |
| TOTAL FEED COST $ | | | | |
| INCOME OVER FEED COST $ | | | | |
| FEED COST PER CWT. MILK $ | | | | |
| MILK BLEND PRICE | PER CWT | %FAT %PROT | PER CWT | %FAT %PROT |

## REPRODUCTIVE SUMMARY OF TOTAL HERD

| | DAYS OPEN AT 1ST SERVICE | | | AVG. DAYS TO 1ST SERVICE | SERVICES PER PREGNANCY | | PROJECTED MINIMUM | |
|---|---|---|---|---|---|---|---|---|
| | NUMBER FEWER THAN VWP | NUMBER FROM VWP TO 100 DAYS | NUMBER OVER 100 DAYS | | PREG. COWS | ALL COWS | CALVING INTERVAL | DAYS OPEN |
| 1ST LACT | 16 | 23 | 15 | 96 | 2.4 | 2.7 | 14.1 | 149 |
| 2ND LACT | 4 | 32 | 10 | 100 | 2.0 | 3.4 | 14.5 | 160 |
| 3+ LACTS | 10 | 31 | 5 | 79 | 2.4 | 3.7 | 14.7 | 166 |
| ALL LACTS | 30 | 86 | 30 | 92 | 2.3 | 3.2 | 14.4 | 158 |
| % OF ALL 1ST SERVICES | 21 | 59 | 20 | | CURRENT CALVING INTERVAL | ACTUAL CALVING INTERVAL | 13.7 | |

| SERVICE OR HEAT INTERVALS | |
|---|---|
| INTERVAL LENGTH | NUMBER INTERVALS |
| LESS THAN 18 | 5 |
| 18-24 | 28 |
| 36-48 | 48 |
| OTHER | 122 |

| SERVICES FOR PAST 12 MONTHS | | | |
|---|---|---|---|
| SERVICE NUMBER | NUMBER SERVICE | % SUCCESSFUL | SERVICE SIRE PTA $ |
| 1ST | 165 | 43 | +258 |
| 2ND | 90 | 36 | +281 |
| 3RD+ | 115 | 43 | +233 |
| TOTAL | 394 | 39 | +256 |

| ABORTIONS | THIS MONTH | PAST YEAR |
|---|---|---|
| ACTUAL | | 1 |
| APPARENT | 3 | 14 |

## BIRTH SUMMARY

| DAM'S LACT NUM. | OFFSPRING BORN | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | MALES | | FEMALES | | CALVING DIFFICULTY SCORE | | | | | |
| | ALIVE | DEAD | ALIVE | DEAD | 1 | 2 | 3 | 4 | 5 | % 4+5 |
| 1 | | | | | | | | | | 12 |
| 2+ | | | | | | | | | | 5 |
| TOTAL | | | | | | | | | | 7 |

## YEARLY REPRODUCTIVE SUMMARY

| DATE OF TEST | % HEATS OBS. | NUMBER SERVICES | % SUCC-ESS-FUL | NUMBER CONFIRM PREG. | NUMBER CALVING | TOTAL PREGNANT COWS |
|---|---|---|---|---|---|---|
| MONTH DROPPED | 47 | 31 | 48 | 5 | 16 | 75 |
| 1-23-99 | 36 | 27 | 33 | 5 | 27 | 55 |
| 2-24-99 | 74 | 50 | 38 | 20 | 12 | 63 |
| 3-24-99 | 46 | 32 | 47 | 32 | 17 | 86 |
| 4-22-99 | 63 | 36 | 39 | 10 | 14 | 84 |
| 5-25-99 | 68 | 51 | 51 | 15 | 10 | 87 |
| 6-29-99 | 50 | 37 | 43 | 15 | 11 | 93 |
| 7-20-99 | 62 | 16 | 13 | 23 | 9 | 109 |
| 8-26-99 | 54 | 36 | 11 | 7 | 6 | 107 |
| 9-27-99 | 58 | 42 | 36 | 3 | 38 | 91 |
| 10-26-99 | 37 | 20 | 50 | 11 | 11 | 94 |
| 11-26-99 | 55 | 47 | | 13 | 26 | 88 |
| 12-23-99 | 74 | 45 | | 14 | 11 | 90 |
| AVERAGES | 56 | 37 | 39 | 14 | 16 | 87 |
| TOTALS | | 439 | | | 192 | |

## COWS TO BE MILKING, DRY, CALVING, BY MONTH

| MONTH | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG |
|---|---|---|---|---|---|---|---|---|
| * MILKING | 155 | 155 | 171 | 163 | 151 | 139 | 116 | 109 |
| DRY | 35 | 31 | 9 | 13 | 22 | 30 | 54 | 58 |
| COWS TO CALVE | 12 | 19 | 15 | 2 | 4 | 14 | 10 | 28 |
| HEIFERS TO CALVE | | | | | | | | |

* ASSUMES 2.5% PER MONTH CULLING RATE.

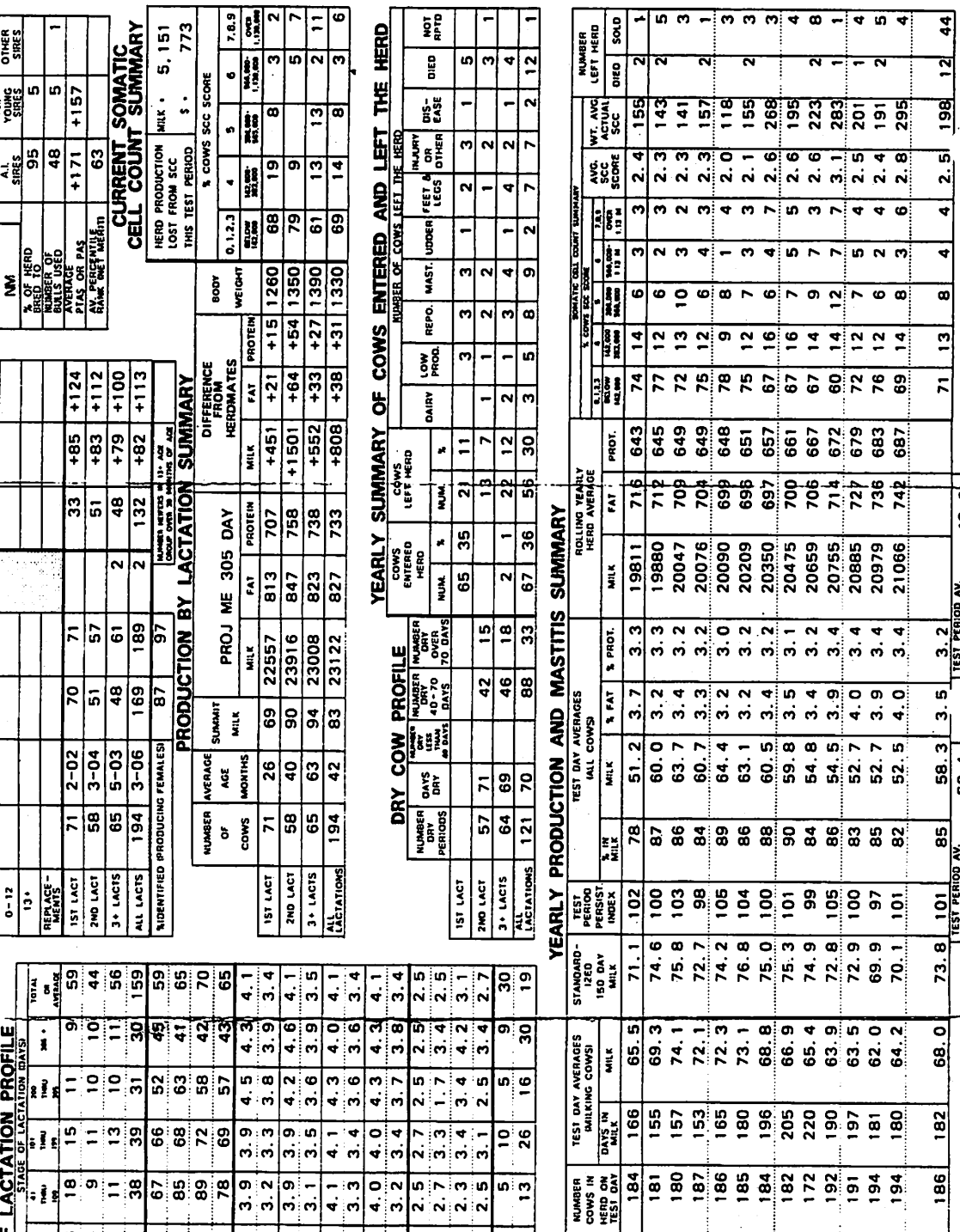
## MISCELLANEOUS HERD INFORMATION

| SHIPPED-TEST DAY COMPARISON | TEST DAY | YEARLY AVERAGE |
|---|---|---|
| SUM OF TEST DAY WTS (LBS) | 10097 | 10683 |
| REPORTED AV. DAILY BULK TANK WTS (LBS) | | |
| % DEVIATION | | |

| ASSOC. | SAMPLES RECV AT LAB | | ORPC MAILED | |
|---|---|---|---|---|
| SUPV. | MO. | DAY | MO. | DAY |
| 15 | 12 | 24 | 12 | 27 |

| | MILKING TIMES | WDH | SPL |
|---|---|---|---|
| 1ST OR PRIOR AP | 4:30 AM | Y | N |
| 2ND | 4:00 PM | Y | Y |
| 3RD | | | |

REMARKS:



HERDCODE 43-09-0006 | DATE TESTED 12-23-99 | BREED H | STRING 1

STAGE OF LACTATION PROFILE

| | | STAGE OF LACTATION (DAYS) 1 THRU 45 | 46 THRU 100 | 101 THRU 200 | 201 THRU 305 | 306 + | TOTAL OR AVERAGE |
|---|---|---|---|---|---|---|---|
| NUMBER MILKING | 1ST LACT | 6 | 18 | 15 | 11 | 9 | 59 |
| | 2ND LACT | 4 | 9 | 11 | 10 | 10 | 44 |
| | 3+ LACTS | 11 | 11 | 13 | 10 | 11 | 56 |
| | ALL LACTS | 21 | 38 | 39 | 31 | 30 | 159 |
| AVERAGE DAILY MILK PRODUCTION | 1ST LACT | 52 | 67 | 66 | 52 | 45 | 59 |
| | 2ND LACT | 82 | 85 | 68 | 63 | 41 | 65 |
| | 3+ LACTS | 85 | 89 | 72 | 58 | 42 | 70 |
| | ALL LACTS | 75 | 78 | 69 | 57 | 43 | 65 |
| % FAT & PROT | 1ST LACT FAT % | 4.5 | 3.9 | 3.9 | 4.5 | 4.3 | 4.1 |
| | 1ST LACT PROT % | 3.2 | 3.2 | 3.3 | 3.8 | 3.9 | 3.4 |
| | 2ND LACT FAT % | 4.0 | 3.9 | 3.9 | 4.2 | 4.6 | 4.1 |
| | 2ND LACT PROT % | 2.9 | 3.1 | 3.5 | 3.6 | 3.9 | 3.5 |
| | 3+ LACTS FAT % | 4.0 | 4.1 | 4.1 | 4.3 | 4.0 | 4.1 |
| | 3+ LACTS PROT % | 3.2 | 3.3 | 3.4 | 3.6 | 3.6 | 3.4 |
| | ALL LACTS FAT % | 4.2 | 4.0 | 4.0 | 4.3 | 4.3 | 4.1 |
| | ALL LACTS PROT % | 3.1 | 3.2 | 3.4 | 3.7 | 3.8 | 3.4 |
| SCC SCR | 1ST LACT | 2.2 | 2.5 | 2.7 | 2.5 | 2.5 | 2.5 |
| | 2ND LACT | 1.3 | 2.7 | 3.3 | 1.7 | 3.4 | 2.5 |
| | 3+ LACTS | 2.0 | 2.3 | 3.4 | 3.4 | 4.2 | 3.1 |
| | ALL LACTS | 1.8 | 2.5 | 3.1 | 2.5 | 3.4 | 2.7 |
| SCC SCORE 3.9 | NUMBER | 1 | 5 | 10 | 5 | 9 | 30 |
| | PERCENT | 5 | 13 | 26 | 16 | 30 | 19 |

IDENTIFICATION AND GENETIC SUMMARY

| AGE GROUP | NUMBER ANIMALS | AVG. AGE YR-MO | NUM. IDENTIFIED BY SIRE | NUM. IDENTIFIED BY DAM | NUMBER ID CHANGES | NO. ANIMALS WITH PTAS / PAS | AVERAGE PTAS / PAS ANIMAL | AVERAGE PTAS / PAS SIRE |
|---|---|---|---|---|---|---|---|---|
| 0-12 | | | | | | | | |
| 13+ | | | | | | | | |
| REPLACE-MENTS | | | | | | | | |
| 1ST LACT | 71 | 2-02 | 70 | 71 | | 33 | +85 | +124 |
| 2ND LACT | 58 | 3-04 | 51 | 57 | | 51 | +83 | +112 |
| 3+ LACTS | 65 | 5-03 | 48 | 61 | 2 | 48 | +79 | +100 |
| ALL LACTS | 194 | 3-06 | 169 | 189 | 2 | 132 | +82 | +113 |
| %IDENTIFIED (PRODUCING FEMALES) | | | 87 | 97 | | | | |

NUMBER HEIFERS 13+ AGE GROUP OVER 24 MONTHS OF AGE

HERD PTA $ OPTION: NM

| | PROVEN A.I. SIRES | A.I. YOUNG SIRES | ALL OTHER SIRES |
|---|---|---|---|
| % OF HERD BRED TO | 95 | 5 | |
| NUMBER OF BULLS USED | 48 | 5 | 1 |
| AVERAGE PTAS OR PAS | +171 | +157 | |
| AV. PERCENTILE RANK ONET MERIT | 63 | | |

CURRENT SOMATIC CELL COUNT SUMMARY

HERD PRODUCTION LOST FROM SCC: MILK • 5,151; $ • 773 THIS TEST PERIOD

| | % COWS SCC SCORE 0,1,2,3 (BELOW 142,000) | 4 (142,000-284,000) | 5 (284,000-568,000) | 6 (568,000-1,136,000) | 7,8,9 (OVER 1,136,000) |
|---|---|---|---|---|---|
| | | 19 | 8 | 3 | 2 |
| | | 9 | | 5 | 7 |
| | | 13 | 13 | 2 | 11 |
| | | 14 | 8 | 3 | 6 |

PRODUCTION BY LACTATION SUMMARY

| | NUMBER OF COWS | AVERAGE AGE MONTHS | SUMMIT MILK | PROJ ME 305 DAY MILK | PROJ ME 305 DAY FAT | PROJ ME 305 DAY PROTEIN | DIFFERENCE FROM HERDMATES MILK | DIFFERENCE FROM HERDMATES FAT | DIFFERENCE FROM HERDMATES PROTEIN | BODY WEIGHT |
|---|---|---|---|---|---|---|---|---|---|---|
| 1ST LACT | 71 | 26 | 69 | 22557 | 813 | 707 | +451 | +21 | +15 | 1260 |
| 2ND LACT | 58 | 40 | 90 | 23916 | 847 | 758 | +1501 | +64 | +54 | 1350 |
| 3+ LACTS | 65 | 63 | 94 | 23008 | 823 | 738 | +552 | +33 | +27 | 1390 |
| ALL LACTATIONS | 194 | 42 | 83 | 23122 | 827 | 733 | +808 | +38 | +31 | 1330 |

DRY COW PROFILE

| | NUMBER DRY PERIODS | DAYS DRY | NUMBER DRY LESS THAN 40 DAYS | NUMBER DRY 40 TO 70 DAYS | NUMBER DRY OVER 70 DAYS |
|---|---|---|---|---|---|
| 1ST LACT | | | | | |
| 2ND LACT | 57 | 71 | | 42 | 15 |
| 3+ LACTS | 64 | 69 | | 46 | 18 |
| ALL LACTATIONS | 121 | 70 | | 88 | 33 |

YEARLY SUMMARY OF COWS ENTERED AND LEFT THE HERD

| | COWS ENTERED HERD NUM. | COWS ENTERED HERD % | COWS LEFT HERD NUM. | COWS LEFT HERD % | NUMBER OF COWS LEFT THE HERD: DAIRY | LOW PROD. | REPO. | MAST. | UDDER | FEET & LEGS | INJURY OR OTHER | DIS-EASE | DIED | NOT RPTD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1ST LACT | 65 | 35 | 21 | 11 | | 3 | 3 | 3 | 1 | 2 | 3 | 1 | 5 | |
| 2ND LACT | | | 13 | 7 | 1 | 1 | 2 | 2 | | 1 | 2 | | 3 | 1 |
| 3+ LACTS | 2 | 1 | 22 | 12 | 2 | 1 | 3 | 4 | 1 | 4 | 2 | 1 | 4 | |
| ALL LACTATIONS | 67 | 36 | 56 | 30 | 3 | 5 | 8 | 9 | 2 | 7 | 7 | 2 | 12 | 1 |

YEARLY PRODUCTION AND MASTITIS SUMMARY

| DATE OF TEST | DAYS IN TEST PERIOD | NUMBER COWS IN HERD ON TEST DAY | TEST DAY AVERAGES (MILKING COWS) DAYS IN MILK | TEST DAY AVERAGES (MILKING COWS) MILK | STANDARD-IZED 150 DAY MILK | TEST PERIOD PERSIST INDEX | TEST DAY AVERAGES (ALL COWS) % IN MILK | TEST DAY AVERAGES (ALL COWS) MILK | TEST DAY AVERAGES (ALL COWS) % FAT | TEST DAY AVERAGES (ALL COWS) % PROT. | ROLLING YEARLY HERD AVERAGE MILK | ROLLING YEARLY HERD AVERAGE FAT | ROLLING YEARLY HERD AVERAGE PROT. | % COWS SCC SCORE 0,1,2,3 (BELOW 142,000) | % COWS SCC SCORE 4 (142,000-284,000) | % COWS SCC SCORE 5 (284,000-568,000) | % COWS SCC SCORE 6 (568,000-1,136,000) | % COWS SCC SCORE 7,8,9 (OVER 1,136,000) | AVG. SCC SCORE | WT. AVG ACTUAL SCC | NUMBER LEFT HERD DIED | NUMBER LEFT HERD SOLD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MONTH DROPPED | 28 | 184 | 166 | 65.5 | 71.1 | 102 | 78 | 51.2 | 3.7 | 3.3 | 19811 | 716 | 643 | 74 | 14 | 6 | 3 | 3 | 2.4 | 155 | 2 | 1 |
| 1-23-99 | 30 | 181 | 155 | 69.3 | 74.6 | 100 | 87 | 60.0 | 3.2 | 3.3 | 19880 | 712 | 645 | 77 | 12 | 6 | 2 | 3 | 2.3 | 143 | 2 | 5 |
| 2-24-99 | 32 | 180 | 157 | 74.1 | 75.8 | 103 | 86 | 63.7 | 3.4 | 3.2 | 20047 | 709 | 649 | 72 | 13 | 10 | 3 | 2 | 2.3 | 141 | | 3 |
| 3-24-99 | 28 | 187 | 153 | 72.1 | 72.7 | 98 | 84 | 60.7 | 3.3 | 3.2 | 20076 | 704 | 649 | 75 | 12 | 6 | 4 | 3 | 2.3 | 157 | 2 | 1 |
| 4-22-99 | 29 | 186 | 165 | 72.3 | 74.2 | 105 | 89 | 64.4 | 3.2 | 3.0 | 20090 | 699 | 648 | 78 | 9 | 8 | 1 | 4 | 2.0 | 118 | | 3 |
| 5-25-99 | 33 | 185 | 180 | 73.1 | 76.8 | 104 | 86 | 63.1 | 3.2 | 3.2 | 20209 | 696 | 651 | 75 | 12 | 7 | 3 | 3 | 2.1 | 155 | 2 | 3 |
| 6-29-99 | 35 | 184 | 196 | 68.8 | 75.0 | 100 | 88 | 60.5 | 3.4 | 3.2 | 20350 | 697 | 657 | 67 | 16 | 6 | 4 | 7 | 2.6 | 268 | | 3 |
| 7-20-99 | 21 | 182 | 205 | 66.9 | 75.3 | 101 | 90 | 59.8 | 3.5 | 3.1 | 20475 | 700 | 661 | 67 | 16 | 7 | 5 | 5 | 2.6 | 195 | | 4 |
| 8-26-99 | 37 | 172 | 220 | 65.4 | 74.9 | 99 | 84 | 54.8 | 3.4 | 3.2 | 20659 | 706 | 667 | 67 | 14 | 9 | 7 | 3 | 2.6 | 223 | 2 | 8 |
| 9-27-99 | 32 | 192 | 190 | 63.9 | 72.8 | 105 | 86 | 54.5 | 3.9 | 3.4 | 20755 | 714 | 672 | 60 | 14 | 12 | 7 | 7 | 3.1 | 283 | 1 | 1 |
| 10-26-99 | 29 | 191 | 197 | 63.5 | 72.9 | 100 | 83 | 52.7 | 4.0 | 3.4 | 20885 | 727 | 679 | 72 | 12 | 7 | 5 | 4 | 2.5 | 201 | 1 | 4 |
| 11-26-99 | 31 | 194 | 181 | 62.0 | 69.9 | 97 | 85 | 52.7 | 3.9 | 3.4 | 20979 | 736 | 683 | 76 | 12 | 6 | 2 | 4 | 2.4 | 191 | 2 | 5 |
| 12-23-99 | 27 | 194 | 180 | 64.2 | 70.1 | 101 | 82 | 52.5 | 4.0 | 3.4 | 21066 | 742 | 687 | 69 | 14 | 8 | 3 | 6 | 2.8 | 295 | | 4 |
| AVERAGES | 30 | 186 | 182 | 68.0 | 73.8 | 101 | 85 | 58.3 | 3.5 | 3.2 | | | | 71 | 13 | 8 | 4 | 4 | 2.5 | 198 | 12 | 44 |

TEST PERIOD AV. MILK LBS. ADDED: 53.1

TEST PERIOD AV. MILK LBS. DROPPED: 49.6

Figure 4.3 - DHIA Record (Side 2)

## *Lesson 5: Managing Swine from Birth to Market*

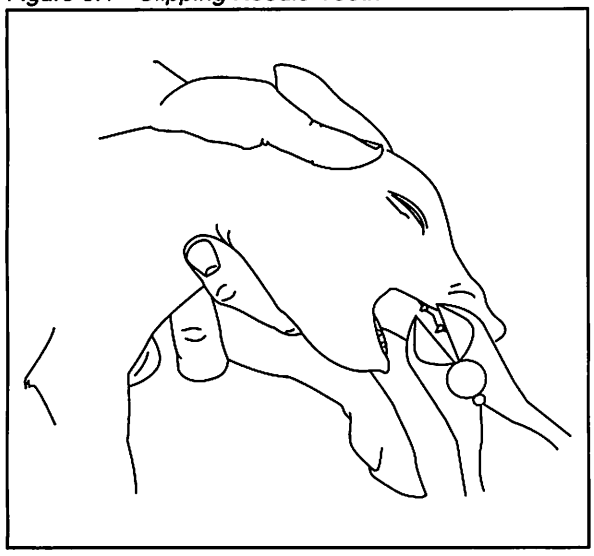
Pork producers must be good managers of their pigs. Pigs require proper management from farrowing until they are marketed. If they are not managed well, they will not be as profitable at slaughter.

### Management Practices for Baby Pigs

Several important management practices are performed in the period between farrowing and weaning. At farrowing, the navel cord should be clipped with side-cutting pliers. The cord should be cut approximately one inch from the body and treated with a tincture of iodine solution. Because bacteria may enter the body of a newborn through the navel cord, this practice is an essential part of maintaining the health of young pigs.

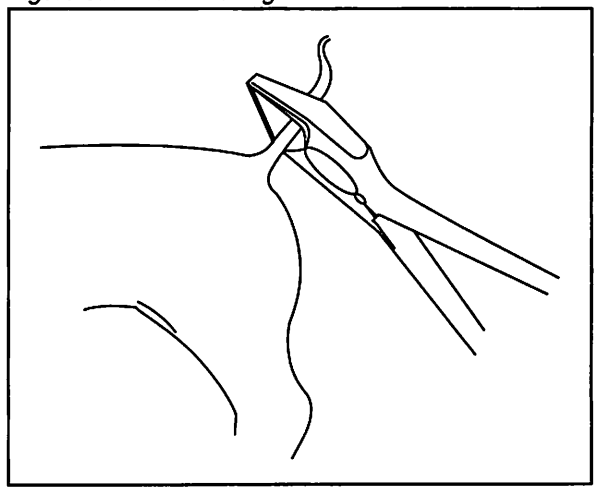
Clipping the needle teeth is another process done immediately after birth. The producer may use side-cutting pliers to clip the teeth at the gum line, as shown in Figure 5.1. The pliers should be disinfected after clipping the teeth of each pig. Care should be taken not to cut the gum. If the pigs are over two days old, the producer should clip one-third to one-half of the teeth. The practice of clipping needle teeth in pigs lessens the chance that the pigs will bite and cause irritation to the sow's teats, which could lead to the sow refusing to nurse.

*Figure 5.1 - Clipping Needle Teeth*



Tail docking is cutting off the pig's tail one-fourth to one-half inch from the body, as shown in Figure 5.2. Docking should be done when pigs are one to three days old. Side-cutting pliers are used for docking. Producers should disinfect the stub of the tail with iodine spray and disinfect the pliers after each use. Tail docking helps to prevent tail biting among pigs in confinement. Producers of feeder pigs should always dock the pigs' tails. Tails should not be docked when pigs have scours.

*Figure 5.2 - Tail Docking*



Producers can prevent pigs from developing anemia by giving them iron injections or an oral dose of iron when pigs are two to four days old. Injections consisting of 100 to 150 milligrams should be given in the neck or shoulder and never in the ham. The injections may cause carcass staining and some loss of value when marketing occurs. Iron should be given carefully because overdoses may cause shock in the pigs. The dose is repeated at two weeks of age, either by giving an injection or adding iron to the feed or water. Producers can also supply iron by placing a couple of shovels of fresh sod in the pen.

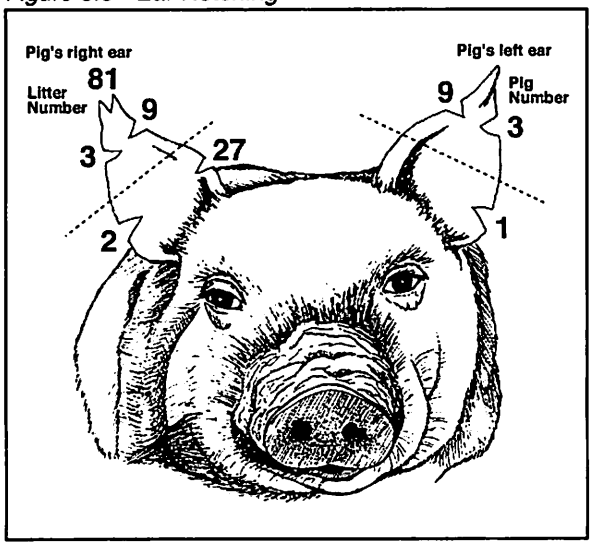
During the first couple of weeks, pigs should be watched closely for scours. Oral drugs usually are more effective than injections in preventing scours. Medication dissolved in water can be used when the pigs become a little older. Good sanitation plays a major role in preventing scours. If scours becomes a serious problem, producers should contact a veterinarian.

Male pigs raised for slaughter must be castrated. Castration is best done when the pigs are young because the pigs experience less stress and the

job is easier for the producer. Producers should castrate boars before they are two weeks old. Knives used for castration must be clean, sharp, and disinfected. Pig holders can be used to hold pigs so that one person working alone can castrate a pig. Other processes, such as vaccinations, should not be done at the same time as castration because it places too much stress on the pig.

Producers should ear notch each pig in the litter to identify each animal. Identification is necessary for the producer to keep accurate records. Most producers use a tool similar to a pair of pliers that removes a v-shaped notch from the ear. The universal ear notching code of 1-3-9-27-81 is used by most producers, with notches in a pig's left ear representing the individual pig number and the notch in its right ear representing the litter number of the pig. Note that the pig's right and left are the same as yours if you are standing in back of the pig. Figure 5.3 shows the way the notches are cut into the ears to indicate the number.

*Figure 5.3 - Ear Notching*




Another important practice for producers is equalizing the litter sizes of farrowing sows. Producers should move pigs from large litters to smaller litters to make the litter sizes about equal. The move must be done during the first couple of days after farrowing, but the producer should make certain that the pigs have nursed to receive colostrum before placing them in a new litter. The larger pigs in the litter are generally the ones moved between litters. Producers should make sure that the sow has the teat capacity to nurse more pigs when adding them to a litter.

## Determining Weaning Age

Pigs are generally weaned between five and eight weeks of age. They should weigh at least twelve pounds when they are weaned. The producer should try to provide a constant environment during the transition period, avoiding large temperature or climate changes.

A trend exists toward weaning pigs at an earlier age. Early weaning occurs at four weeks of age. Weaning at this age requires that the pigs are eating feed rations and getting the appropriate levels of nutrients for growth. It requires a great deal of management to be successful. Producers using early weaning must make certain that the animals are consuming a considerable amount of feed at the time of separation from the mother.

When pigs are weaned, they should be put in pens of no more than 30 pigs. They are grouped according to size. Some producers may also group the pigs by sex at weaning because research indicates that growth can be improved by feeding the sexes separately.

## Feeding Programs for Market Swine

Swine production involves two general feeding phases: farrowing and grow/finish. The farrowing phase is from birth to approximately 40 pounds. The grow/finish phase takes the animal from weaning to market at 240 to 250 pounds. Feeding good rations is an important management task a producer must master to be successful.

The producer should get young pigs started on feed as soon as possible. About a quarter of all pigs lost before weaning are lost because of poor feeding. By the time the pigs are three to four weeks of age, they should be eating well to receive the necessary nutrients. A creep feeding area should be set up with a good quality creep feed available at all times. Producers should provide commercial pelleted creep feeds. A crumbled variety is available for the very young. They should contain sugar because the sweetness of the feed encourages them to eat. The feed should also be medicated with broad-spectrum drugs for parasite control. Research indicates this practice may reduce death losses prior to weaning and increase average daily gain by about 14 percent.

Phase feeding may also be used to more accurately meet the changing nutritional needs of

young pigs. Phase feeding is feeding a special diet based on the nutritional requirements of pigs at different ages and weights. The beginning diets are usually high in protein and amino acids because weaning is a critical time for muscle growth. As the pigs grow, the levels of protein and other nutrients are reduced as their nutrient needs decrease.

In confinement, hogs are grouped by weight and/or sex into pens with no more than 50 to 60 head. Grouping by weight may help prevent larger hogs from keeping smaller animals from the feeding area. Grouping by sex allows gilts to be given feeds that are higher in amino acids than the feed given to boars; amino acids are necessary for improved growth rate and feed efficiency. Amino acid requirements are also higher for lean, fast-growing pigs and in the summer. During the grow/finish phase, hogs are mostly fed a corn ration with a protein supplement like soybean oil meal. Other grains and protein supplements may be fed depending on their quality and price at that time, as long as they provide the amino acids required for proper swine nutrition.

Feed accounts for about 50 to 70 percent of the cost of swine production. Reducing wasted feed is therefore important in maintaining efficiency. Feeders need to be properly adjusted to prevent waste. Producers should check the feeder adjustments one or two times a week to make sure neither too much nor too little feed is supplied. Pelleted rations create less waste and dust, but are more expensive. Rodents should also be controlled to aid in using feed efficiently.

## Records

Records are a vital part of the success of any swine operation. It is important that the producer keep accurate records to track the progress of each group of hogs in a commercial operation and evaluate whether any aspect of the operation should be changed to increase profits. The producer should keep records on birth weights, weaning weights, the amount and type of feed given to market animals, rate of gain, feed efficiency, weight at marketing, and death rates.

## Summary

Swine producers should be knowledgeable and experienced in the management practices necessary to raise pigs from birth to market. These practices include castration, tail docking, clipping needle teeth, and ear notching. Producers must also wean their pigs appropriately. A successful producer must know proper ration formulation and feeding techniques to ensure the maximum rate of gain and feed efficiency. Only through accurate records can an assessment be made of the success of the management of market animals.

## Credits

Blakely, James, and David H. Bade. *The Science Of Animal Husbandry.* 6th ed. Englewood Cliffs, N.J.: Prentice-Hall, 1994.

Ensminger, M. E., and R. O. Parker. *Swine Science.* 6th ed. Danville, Ill.: Interstate, 1997.

Gillespie, James R. *Modern Livestock and Poultry Production.* 5th ed. Albany: Delmar, 1997.

Putnum, Paul A. *Handbook Of Animal Science.* San Diego: Academic Press, 1991.

## *Lesson 6: Management of Swine Breeding Stock*

Managing replacement gilts and boars is a key to success in running a feeder pig or farrow-to-finish swine operation. Without properly managed breeding stock, the production enterprise cannot survive. To manage effectively and efficiently, producers must be knowledgeable about the appropriate management practices for gilts and boars.

### Management of Sows and Replacement Gilts

Managing gilts and sows is a vital part of successful production. For maximum efficiency in reproduction, a high level of management is required for the breeding herd. Good management of gilts and sows will increase profits by increasing the number of pigs available for market.

The selection of good replacement gilts is important. Under normal conditions, 15 to 30 percent of the sows will be culled at each farrowing. Replacement gilts should be selected for reproductive and carcass traits.

Pork producers may raise their own replacement animals or purchase them from other producers. Producers may choose to purchase replacement gilts to bring animals of greater genetic value into the herd. If a producer raises his or her own replacement gilts, the operation must have adequate resources for raising the animals, including breeding stock, facilities, and labor.

Producers who raise their own replacement gilts should separate them from the market hogs when they weigh about 150 to 200 pounds so that they may be fed a less fattening ration in preparation for breeding. An indication of a gilt's ability to reproduce is beginning the estrous cycle at an early age of about four and half to six months. Gilts are ready for breeding at about seven to eight months of age and should weigh 230 to 250 pounds at breeding. To ensure that gilts are ready to breed by this time, producers should pen them near a boar when they reach five and a half months of age. The gilts should be bred during the second heat period to increase conception rates. They should vaccinated and wormed prior to breeding to be sure that they are healthy and ready for breeding. The presence of internal parasites decreases the nutrients available to the gilts for finishing their final growth and preparing for breeding and gestation.

An important sow management decision is determining how often the sow will be farrowed. In multiple farrowing, breeding is scheduled so litters arrive throughout the year rather than having sows farrow once or twice during the year. Large confinement operations with environmentally controlled buildings use multiple farrowing because the facilities provide protection from harsh weather conditions. Multiple farrowing entails more planning and close attention to detail. However, it has several advantages. It distributes the workload throughout the year rather than concentrating it in one or two periods during the year. Also, multiple farrowing produces a more stable market for hogs and a more constant supply for packers.

Proper care of bred gilts and sows is necessary to prevent losses during pregnancy. An important aspect of caring for pregnant animals is designing a good feeding program, which will be discussed later in this lesson. Another important factor during the summer is avoiding heat stress. Temperatures above 85 degrees Fahrenheit can reduce embryo survival rates and result in stillborn pigs. Good ventilation and evaporative cooling or dripper systems are needed for sows kept in confinement housing.

Sows should enter heat within seven days after weaning and may then be rebred. By weaning litters at the same time, a producer can synchronize estrus in a group of sows. If a sow does not conceive after 28 days, she should be culled from the herd.

### Management of Herd Boars and Replacement Boars

Like gilts, replacement boars may be purchased or raised on the operation. Most replacements are purchased to bring new genetic material into the herd. Newly purchased boars should be isolated in clean, comfortable facilities, preferably for 60 days, before introduction into the herd. During the isolation period, they should be tested for certain diseases, including pseudorabies, TGE, and brucellosis. Replacement boars that are raised on the operation are raised with the rest of the hogs until they reach 150 to 200 pounds. The boars

should be kept in pens or crates away from the breeding herd to keep them from becoming sexually active too early.

All boars should be tested for reproductive soundness and test mated at seven to eight months of age. Test mating is done to observe if they have any problems when mating. One of every ten young boars has a breeding problem, other than sperm motility, that requires it to be culled. The producer should observe test matings, looking for aggressiveness, desire to mate, and problems with the mating process.

Replacement boars should be housed appropriately. They may be put in pens together. They should not be penned with older breeding stock because older boars tend to fight younger animals and may cause injury. Boars may also be kept in individual crates to avoid fighting and competing for feed. Boars should be able to exercise to ensure that they are in good condition.

Young boars are ready for mating at eight months of age. Their semen should be tested to check for fertility. Producers should control how many matings take place. A young boar should mate only once a day and no more than five times a week. Young boars should be hand-mated when first put into service. If necessary, they should be put in fence line contact with gilts and sows in the breeding herd to increase the desire to mate.

Either hand mating or pen mating may be used with older replacement boars and mature boars. Hand mating allows the producer to control the use of the boar and record the exact breeding date. The boars and sows also experience less stress. However, more labor and facilities are necessary. The recommended number of services for a mature boar in a hand mating system is two per day, with a maximum of seven services per week. Pen mating requires fewer resources, but the farrowing rate may be lower. When using pen mating, producers should provide plenty of boar power. Groups of eight to ten sows should be penned with a mature boar, while four to six sows may be penned with boars less than one year of age. Producers should consider rotating boars among groups of sows to prevent the possibility that a group may not be bred because of a problem with the boar. With either hand mating or pen mating, producers should monitor the performance of the boar and make sure that ample opportunity is given for mating sows.

As with young boars, mature boars should be separated from the breeding herd prior to the breeding season. They may be housed in individual crates or pens. If they are kept in pens, they should be penned with stock of equal size because larger boars may fight with or intimidate smaller boars and reduce their breeding potential. The crates or pens should provide sufficient room for boars to receive plenty of exercise. Before the breeding season, the boar's semen should be checked for fertility. The boar should also go through a full physical exam to check for soundness.

As with sows, boars will experience heat stress in temperatures over 85 degrees Fahrenheit. The quality of their semen may be reduced. They will have a reduction in fertility rates for five weeks after exposure to high temperatures. Females will have decreased conception rates and smaller litters. Boars must be kept cool and comfortable in the summer. Boars kept in confinement housing should be cooled using evaporative cooling systems or dripping systems.

### Feeding Programs for Breeding Stock

Proper feeding is important for swine breeding stock. Poor nutrition will affect conception rates and the condition of the offspring. Producers must therefore formulate appropriate feeding programs for their replacement animals, boars, and sows.

Replacement gilts should be in ideal condition when the breeding season begins. Gilts should gain about a pound per day until they are ready for breeding. They should receive about five pounds of feed per day through the second estrus period.

One way to increase reproductive efficiency is to flush replacement gilts prior to breeding. Following this practice can result in larger litter sizes from gilts. The producer should increase the ration to six to eight pounds about ten to fourteen days prior to breeding. Producers may also flush sows that have been on a restricted diet prior to breeding. However, sows that are in good condition receive little to no benefit from flushing.

The quality and quantity of proteins, minerals, and vitamins is important for gestating sows and gilts. If gilts are still growing, they must receive enough of these nutrients for both continued growth and the development of the offspring. The need for these nutrients also increases during the last

month of the gestation period when the majority of the growth of the young pigs takes place. Reserves should also be stored in the body for use during the lactation period after farrowing because the demand for milk may be greater than can be provided by the lactating sow's diet.

Bred gilts and sows should be placed on a limited feeding program to prevent them from getting too fat. Overfeeding may result in stillbirths, the birth of weak pigs, and farrowing difficulties. Although gains vary somewhat with individuals and breeds, bred gilts should gain 70 to 100 pounds during gestation, while mature sows should gain about 70 pounds during gestation. About four to six pounds of feed should be given to each animal per day. In addition to avoiding overfeeding, producers should make sure that bred gilts and sows are receiving sufficient feed because they will become extremely thin during lactation if they are too thin at farrowing. Feeding an extra pound or two of feed to each animal during the last ten days of gestation has been shown to increase pig survival and litter size at weaning.

The farrowing ration should be bulky. Wheat bran, ground oats, or alfalfa meal can be substituted for grain in the ration. These feeds can prevent constipation in sows at farrowing.

Five to seven days after farrowing, sows may be given free access to feed. Lactating sows should be provided with a plenty of feed. Provide 1 pound of feed per pig lactating plus 6 pounds of maintenance feed for the sow. For example, a sow with a litter of 10 pigs would require 16 pounds of feed per day. The feed should consist of concentrates that are rich in amino acids, minerals, and vitamins, particularly the B vitamins.

The feed requirements for the herd boar are similar to those for a mature sow of equal weight. Young boars should be fed about five to six pounds of a balanced 14 percent crude protein ration per day, while mature boars will need about five to seven pounds. More feed should be given when the boar is in service during the breeding season.

Boars should be kept in vigorous condition. If the boar is too fat or too thin, the amount of feed should be changed. Producers tend to overfeed boars, which results in sluggishness and decreased desire to mate. If the ration is deficient of required nutrients over a long period, the boar can become temporarily or permanently sterile.

## Records

Keeping records for the breeding herd is as important as keeping records for market swine. Producers should keep records for replacement stock whether they are raising them for their own operations or for sale to other producers. Producers should keep records on performance data such as birth weight, weaning weight, feed efficiency, and rate of gain for each animal. Records concerning early breeding characteristics, such as frame size and scrotal development, may also be useful in helping to decide which animals will be the best herd replacements. The records kept for mature sows and boars should include information related to feeding in order to monitor nutritional requirements. Records about litter size and survival and farrowing difficulty should be kept to evaluate the reproductive performance of sows, while records about the frequency of boar services can aid in the evaluation of boars.

## Summary

Managing the breeding herd is an important aspect of success in swine operations. Replacement animals as well as mature boars and gilts must be managed appropriately if they are to be productive. Devising a good feeding program for breeding stock is especially important because animals must be kept in good condition and should not be too fat or too thin. Records are necessary for the selection of replacement animals; producer should keep accurate performance and growth statistics in order to analyze the potential for productivity. Records should also be kept for mature sows and boars.

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## *Lesson 7: Sheep Management from Birth to Market*

Sheep require proper management to be productive and bring a good price when marketed. Care of newborn lambs is important because losses often occur at this stage, however, wise management of sheep is necessary until they are marketed.

### Management of Newborn Lambs

The bonding process between the ewe and lamb is critical to the lamb's survival after its birth. Bonding can be disrupted by several factors, including the presence of animals such as dogs or other ewes, an abnormal amount of human activity, crowding, or illness of the ewe. Producers can provide aid in the bonding process by penning the ewe in close proximity with her lamb. The lamb should be placed near the ewe's nose so she can identify it as her own and lick it clean. If the ewe does not respond, the producer can assist by rubbing the lamb with the birth fluids.

Grafting involves placing a lamb with another ewe who delivered a single lamb. An orphan lamb is rubbed with the fluids from the birth and placed at the ewe's nose. Often the ewe will accept the orphan as her own and care for it if she can detect her fluids on the lamb. The producer can then avoid the extra work of bottle feeding the lamb.

In cold weather, hypothermia can be a problem. A dry lamb can endure colder temperatures, but a wet lamb is vulnerable to chilly weather. If a ewe is too tired to clean her lamb, the producer should do it for her using clean towels. The producer should be sure to keep the lamb where the ewe can see it so she will recognize it as hers.

The lamb must nurse to receive colostrum from the ewe. The producer may need to help the lamb because nursing on colostrum within the first two hours after birth is crucial. The waxy plugs at the ends of the ewe's teats may need to be unplugged after birth. This task is done by gently stripping the teats. If the plug is not removed, the lamb may not be strong enough to suck it out to nurse. Producers should also guide lambs that have trouble finding the teats.

The producer should cut the umbilical cord if it is broken off at a point longer than 2 inches. If the cord is too long, the ewe will attempt to chew it off, which can harm the lamb. The cord can be snipped off with clean scissors. The remaining navel cord should be dipped in a 7 percent iodine solution. The container can be held against the lamb's belly with the lamb tilted back to submerge the cord and the surrounding area. The producer should be careful not to drench the lamb in too much iodine solution, because the ewe may reject the lamb if its scent is hidden by the lingering odor of iodine solution. The umbilical cord should be dipped as soon as possible after birth to prevent bacteria from entering the area. After 12 hours, many producers choose to dip the navel of the lamb again for extra protection.

Identification of the lamb can be accomplished using ear tagging. Ear tags should be of an appropriate size to avoid snagging on brush or fences. Tagging should be done with sanitary applicators. The producer should place the tag in the lamb's ear in a way that will prevent it from being torn out easily. This identification is necessary to keep records about ownership, selection, and drug treatments.

Castration and tail docking are important procedures that should be done at an early age. The benefits of these procedures outweigh the stress on the lamb, if the procedures are carried out carefully and efficiently by a skilled person. These processes may be done after the lamb is a few days old but before it reaches six to seven weeks of age. Performing the procedures on a younger animal could interfere with bonding, while they are much more painful and produce more of a setback in the growth of the lamb as it ages. For both practices, the producer should make sure that equipment is sanitary and that a sanitizing agent is applied to the affected area of the lamb.

Castration can be performed using one of several methods. Producers may apply rubber bands to the scrotum using an elastrator and crush the spermatic cord with an emasculator or burdizzo, or cut the scrotum open and surgically remove the testicles. The process is performed to prevent indiscriminate breeding, which will control the genetics of offspring and regulate lambing seasons. It also helps reduce injuries by eliminating aggressive behavior in young males and aids in pelt removal and carcass quality at slaughter.

Tail docking is performed to reduce the possibility of soiling the lamb's tail with urine or feces, which

could lead to the development of fly striking problems. Fly striking involves the fly landing on an exposed area of the body and actually biting the animal, leading to maggot infestation. Docking is done using hot iron cautery, an elastrator and rubber bands, or an emasculator and surgical instruments. An emasculator is a clamp-like device that is used to pinch the tail, breaking the bone and crimping blood vessels. The tail is then cut with a scalpel on the opposite side of the emasculator from the animal's body. After releasing the emasculator, little blood loss occurs. Figure 7.1 shows some of the tools used for docking and castration and their use.

## Weaning

Weaning occurs at different ages depending on the management system being used. Weaning may successfully occur at an early age if the lamb is consuming enough nutrients through creep feeding to meet its growth and maintenance requirements. Early weaning may be accomplished around nine weeks of age if the lamb weighs about 40 pounds. Early weaning can be beneficial for the ewe as well as the lamb. If the ewe does not have to produce milk, she requires fewer nutrients, which can reduce management costs. Late weaning occurs at approximately 12 weeks.

An important management consideration for weaning is leaving the lambs in their current environment and removing the ewes. Lambs will adapt better to the weaning process if they remain in familiar surroundings for feeding.

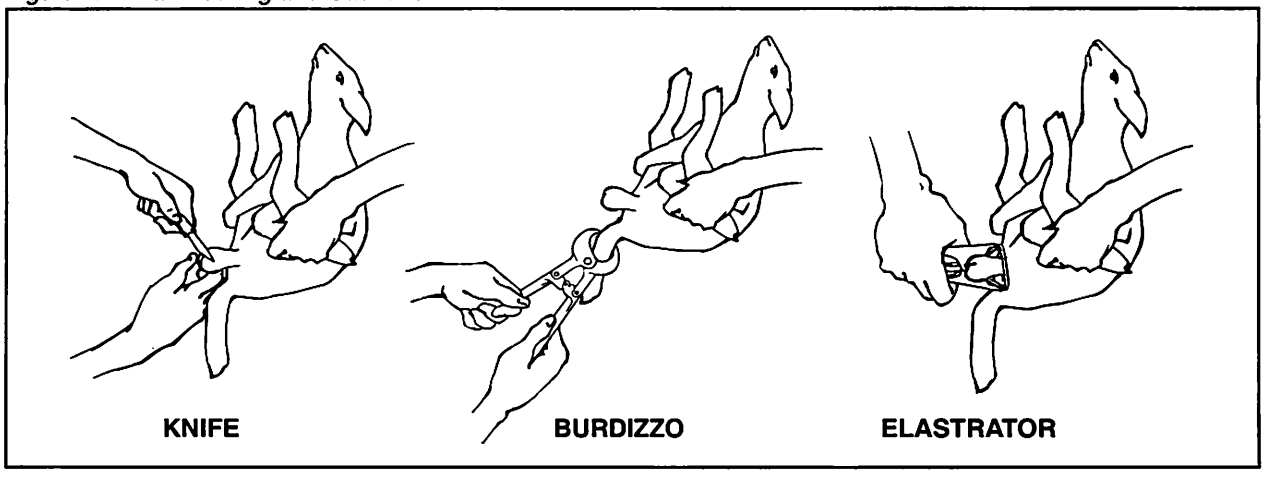
## Feeding Programs for Market Sheep

The feeding of the lamb for market can vary with the production system selected by the producer. Lambs may be produced on pasture or in confinement on dry lots. The feeding program is tailored to the style of production. Feeding programs for dry lot production will require more protein, while feeding programs for pasture systems have more roughage in the diet. Because sheep are ruminant animals, they are capable of utilizing a wide variety of feedstuffs to meet their nutrient requirements.

About three weeks after weaning, the ration given to lambs can be changed. Once the lambs reach about 60 pounds, they do not need as much protein. Protein sources like soybean meal can be removed from the ration and replaced with high-quality alfalfa hay. Lambs should gain well to market weights of around 100 pounds on this type of ration. Changes in the diet should be made gradually to allow rumen microorganisms to adapt in order to avoid digestive problems. Rations should be kept fresh and available at all times to reduce overeating and digestive upsets. Lambs can be very finicky about the quality of the ration.

Producers in certain regions need to be aware of certain mineral deficiencies in the soil, such as selenium or copper, that can affect the nutritional quality of roughage. Selenium and copper deficiencies in sheep can result in reduced growth and illnesses. Producers should supply supplements to provide adequate intake of these nutrients.

*Figure 7.1 - Tail Docking and Castration*



Producers should also be aware of and able to recognize poisonous plants that could threaten the life or health of their sheep. Some of the more common poisonous plants in Missouri are milkweeds and weeds from the nightshade family. However, many other common plants may be poisonous to sheep if they accumulate high levels (1 percent or more) of nitrates.

To improve gain for lambs that will be fed into the summer months, producers may shear their lambs in late May. This practice makes lambs more comfortable. It also reduces the occurrences of pneumonia and other conditions that bother full-fleeced lambs in the summer.

## Records

As with all records, accurate information is necessary for making management decisions. Better management practices can then be implemented, which will lead to higher profits for the producer. During the period discussed in this lesson, some of the essential records that must be kept by producers include the amount and type of feed given before weaning, age of the lamb at weaning, amount and analysis of feed given during the growing stage, and age in days and weight at marketing.

## Summary

Certain management practices are important during the growth of the lamb to successfully produce a lamb crop. Care of newborn lambs is important to prevent losses. Castration and tail docking are two major procedures that must be done by skilled producers. Mistakes during these procedures could cause a major setback to the lamb. Properly designed feeding programs during weaning and growing are important to produce profits. As with any stage of production, accurate and inclusive records must be kept.

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## *Lesson 8: Management of Sheep Breeding Stock*

Management of breeding stock is vital to sheep enterprises because producers wish to maximize the quality and quantity of the lamb crop. Replacement animals should also be managed carefully; ewe and ram lambs kept for replacement stock need to be well fed and adequately developed at breeding time. Care of mature ewes and rams is equally important.

### Management Practices for Ewes

During the early stages of their growth, replacement ewe lambs will be fed and managed like the market lambs. However, if ewe lambs are to be used as replacements, they should be removed from the feeding herd at about 75 pounds and fed a less concentrated ration. Overfeeding ewe lambs will cause them to become too fat for breeding and will lower conception rates.

The ewe lamb will reach puberty at eight to ten months of age, depending on the breed, but should not be bred at this time. Breeding should take place when the female is about 70 percent developed in body size, so that the ewe will lamb at about 24 months of age. Because gestation averages 147 days in length, the ewe should be about 19 months of age when bred.

From puberty until breeding, the lambs should be fed according to a feeding program designed to keep them in good condition but not too fat. Pasture or other high quality roughage, along with some grain, should be fed to ewes. About 10 to 14 days before breeding, the female should be flushed by giving her extra grain consisting of corn and oats.

An important management factor for any lambing program is the timing of breeding. The timing is determined by when the producer wants the ewes to lamb. Producers commonly breed their ewes to lamb in either the spring or fall.

Spring lambing takes place in late February, March, or April, depending on when ewes are bred. Breeding should take place in August or September, the middle of the normal breeding season. Ewes are sheared prior to lambing and may be crotched before breeding. Spring lambing may result in higher lambing rates because breeding takes place during the optimal time. Early spring lambing will aid in controlling parasites. However, if early spring lambing occurs, producers may have to deal with severe weather during lambing, which in turn requires better housing to guard against the elements. If lambing occurs too late in the spring, the producer may not be able to market the lambs early enough to take advantage of the higher prices available earlier in the year.

Fall lambing refers to lambs born before December 25. For a fall lambing program, the producer must choose a breed of sheep that will breed out of the normal breeding season. Some possible breeds are Rambouillet, Dorset, Corriedale, Hampshire, and Suffolk. The ewes should be bred in May, June, or early July. They may be sheared in April or May prior to the breeding season; they also may be crotched before lambing. The lambs will be marketed in early spring, when higher prices are usually received for the lambs. One disadvantage of fall lambing is that more grain is needed for feed due to the lack of pasture. It is also difficult to breed ewes out of season, and lambs may be lighter in weight at birth.

Pregnancy testing is very important after breeding. Producers should avoid the cost of feeding and housing unproductive open ewes. Testing allows producers to determine whether rebreeding is necessary. Making this determination as soon as possible is important to profits and uniformity in lambing crops.

A pregnant ewe needs feed, water, shelter, and exercise. Good nutritional and health management practices at this time will affect lamb size and the number of lambs produced. Producers should observe the ewes frequently during this period for pregnancy-related diseases; sheep should be observed at least twice a day. A good quality pasture may be all that is necessary to meet the ewe's nutrient requirements during gestation. Producers should take care not to overstock the ewe herd on limited grassland because overgrazing can easily occur. The practice of rotating pastures may preserve pasture quality. If necessary, some supplemental feeding of hay or silage may be given to the ewes. If silage is fed, it must be chopped finer than it would be if fed to cattle. Feeding away from the barn encourages the ewes to walk more, increasing the amount of exercise they receive. During the last six weeks of pregnancy, some grain, protein

supplement, and antibiotics may be fed to keep the ewe healthy. The amount of roughage should still be at a high level to maintain proper weight while not letting the ewe get too fat.

After lambing, the amount of grain should be reduced for the first ten days. A ration with more bulk, such as oats, bran, or hay, should be fed. At about ten days of age, the lamb's milk needs will increase. At that time, the addition of more grain will be necessary. Ewes that are nursing twins will need extra rations. The ewe should always receive plenty of fresh water, especially during lactation.

When the lamb is about two months old, the ewe's ration can be reduced to amounts fed during gestation. At this time weaning may take place, making it necessary to reduce feed intake, which will aid in decreasing milk production.

## Management Practices for Rams

Young rams that are to be used for replacement stock are not castrated. They should be removed from the market herd before the ewe lambs reach puberty. Rams should be at least eight months old before they are used for breeding.

Breeding rams generally require only enough pasture to meet their nutrient requirements. However, during the breeding season, 1 to 1.5 pounds of corn may be fed, especially if the ram is thin. Heavier or larger rams will require larger amounts of feed. Producers should avoid overfeeding rams. Rams that gain too much weight lose interest in breeding.

The ram is normally kept separate from the ewes until breeding time. Conception is then controlled to meet the producer's management schedule. Rams may be kept in a barn or lot with plenty of room for exercise.
Rams usually need little care, but a few management practices are necessary. In spring lambing programs, rams should be sheared in the spring and before breeding. For fall lambing, rams may be sheared in late spring prior to the breeding season. The feet of the ram should be trimmed and in good condition prior to the breeding season. Unsound feet can cause a ram not to breed. Tests for breeding soundness, such as sperm count and libido tests, should be conducted before turning the ram in with the ewes.

## Record Keeping

Records for replacement and breeding include many different types of information. Some of the most important records are amounts and kinds of feed provided, the dates and types of all vaccinations given to breeding animals, the number of ewes exposed to each ram, dates of breeding, dates and the results of pregnancy tests for ewes, and anticipated lambing dates. These records could be very important when deciding whether to cull animals. It would be wise for the producer to develop a management calendar to accompany his record keeping program.

## Summary

The success of the breeding and lambing program depends heavily on the care and feeding of the replacement breeding stock. Proper nutrition and care plays a big role in the fertility of both the male and female. Animals should be in optimum condition to have interest in breeding and the ability to reproduce. Record keeping and a calendar of management activities are important for sheep operations.

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## *Lesson 9: Management Practices for Horse Production*

Management practices for horses are frequently quite different from those for other livestock species because horses are not raised for meat production. However, good management is as important for horses as it is for any other type of animal. Proper management helps to ensure the health and productivity of the horse.

### Management Practices for Foals

Proper care of the navel cord is important with all newborn animals, especially the foal. Shortly after birth, usually within three to five hours, the navel cord breaks 2 to 4 inches from the body. If it does not break, the producer must cut it. To properly cut the cord, a string is tied tightly around it about 6 or 7 inches from the foal. The producer then uses a clean, dull scissors to cut the cord on the side of the string closest to the mare. The end of the cord is then dipped in an iodine solution to prevent infection.

The foal must nurse shortly after birth to receive colostrum from the mare. Colostrum milk is high in nutrients and contains antibodies the foal needs. If the foal has not nursed after two hours, the producer should guide the foal gently to the mare's udder and help it find the teats. The producer may purchase colostrum and keep it on hand in a refrigerator to use if the foal cannot obtain colostrum from the mare.

The foal should have a bowel movement within four to twelve hours after its birth. The feces impacted in the bowel before birth are called the meconium. If it is not eliminated shortly after birth, it will kill the foal. Feeding on colostrum aids the foal in having this first bowel movement. If necessary, the producer should give the foal an enema to promote elimination of the meconium. If the foal starts to scour, milk intake should be reduced.

Unlike the other animals discussed, foals receive special training at an early age. At ten to fourteen days of age, the producer should place a well-fitted halter on the foal. After a few days of wearing this halter, the foal should be tied in the stall next to the mare. The foal should only remain tied for 30 to 60 minutes. The producer should never leave the foal unattended because serious injury could occur if it became entangled. While the foal is tied, handling and grooming should be done. The producer should pick up the foal's feet to allow it to become used to having its feet handled.

At ten to fourteen days after foaling, the producer can also begin leading the foal while leading the mare. Later, the foal can be led by itself, both at a walk and a trot. Foals should also be trained to stop and go on command. The foal should stand in show position when stopped, standing squarely on all four legs with its head up. Care and patience are necessary when working with foals.

Castration is not performed on the young horse as it is with meat animals. This practice is put off until the horse reaches around one year of age. Producers usually castrate horses in the spring before hot weather and flies become a problem. If castration is done before fly season, it reduces the chances of the development of screwworm infestations caused by flies.

### Weaning Foals

Most foals are weaned at four to six months of age. Producers may wean the foals earlier, at about three months, if the mare has been rebred, if it is being worked, or if either the foal or mare is not doing well. The foal must be eating grain and roughage properly before weaning takes place. Reducing the feed given to the mare will aid in drying up her milk and help in weaning the foal.

As with other young animals, when weaning takes place, the foal should stay in the stall area while the mare is removed. This practice will reduce stress on the young animal and cause it to be less excited. Because horses are more nervous than other species of livestock, special care must be used when working with both the adult and young animals. Special care is also necessary because horses are more easily injured, especially in the feet and legs, than other livestock animals. After weaning, the foal should not see the mare for several weeks.

Foals may be allowed to run in the pasture a few days after weaning. Weaned foals should only be pastured together, not with older animals. Producers should avoid having too many foals running together in the same area to avoid them injuring each other. The appropriate number depends on the size of the pasture. The producer should separate timid foals from the others and place them in a separate pen or pasture. Another

management consideration at this time is the condition of the fence. Fence materials such as wood or plastic paneling are better than woven wire.

## Feeding Programs for Horses

Horses are fed according to their size, stage of growth, condition, and the amount of work they are performing. Local feed suppliers can be very helpful in suggesting and formulating rations for horses. All diets should consist of at least 50 percent roughage.

Horses must be fed and watered regularly. The amount and type of feed may need to be adjusted according to the condition of the horse. Condition refers to the amount of fat cover on the animal's body. Moderate body condition is desirable. For moderate body condition, individual ribs should be felt but not seen, the backbone should be level with surrounding tissue, and the area around the tailhead should be slightly rounded. If the horse is too fat or too thin, the producer should adjust the feed accordingly.

If water is not available free-choice, horses should be watered before feeding. This practice will ensure proper water intake and allow the producer to control the amount ingested. A horse that is overheated should not drink too much water, because it could cause colic or founder.

The quality of the feed given to horses is extremely important because they tend to be sensitive to feed quality. Colic and founder are two common digestive disorders caused by improper feeding. Producers should check their feed to make sure it is not moldy or dusty. Horses should never have access to the feed given to cattle. Most cattle feeds have a growth stimulant included for the production of rumen bacteria. The feed is deadly if ingested by a horse because horses are nonruminant animals.

The activity level of the horse will affect feeding. Idle horses are fed an increased amount of hay and may be given only half the grain that active horses receive. A tired horse should be fed only about half the ration, while the rest should be fed about an hour later. After a full feeding of grain, horses should not be worked immediately.

## Management Practices for Mares

If producers wish to control the onset of the breeding season, they may use artificial lights to alter the mare's perception of the length of the day. The easiest method is turning on lights 30 minutes before sundown and leaving them on to produce a total of sixteen hours of light. A lag period of 60 to 90 days exists between beginning the program and the onset of the mare's estrous cycle. If the producer wants to breed the mare in February, the program of daylight extension should begin in November.

Open mares should be fed carefully in preparation for the breeding season. The amount and type of feed will depend on body condition. The energy content of the ration is especially important, and the amount given will depend on the weight of the mare and whether she needs to gain weight. Thin mares may need to be fed supplemental grain.

Pregnant mares should also be fed properly. Healthy pregnant mares that are not too thin or too fat usually do not need extra grain in their diet during the first two-thirds of pregnancy if they are being fed good quality hay. Older and thin mares may need some extra grain. Mares need additional grain in the last third of the gestation period to meet their increased energy needs. Proper nutrition is especially important if a mare is to be rebred during the first estrus cycle after foaling while nursing the newborn foal. Producers should not overfeed pregnant mares. Fat mares will likely have trouble when foaling.

Producers may conduct pregnancy checks in early fall to make sure that mares have not experienced losses during pregnancy. Open mares should be checked by a veterinarian to make sure they are healthy. They can then be handled with other open mares for the next breeding season.

Exercise is necessary during pregnancy. Keeping the mare in good condition helps to prepare her body for foaling. Broodmares can be turned out to pasture together for exercise.

After foaling, lactating mares should be fed properly to meet their nutrient requirements. Very little grain should be fed during the first seven to ten days after foaling, and the amount is then gradually increased to promote milk production. However, too much grain could lead to excess milk production, which could cause the foal to scour.

## Managing Stallions

One major consideration in the management of stallions is their temperament. Stallions are hard to manage and control. The stallion is even more high strung or nervous during breeding season. Special bridles with control bits designed for temperamental animals should be purchased for use at this time.

Stallions require special housing. Because stallions are nervous, they need to be kept in separate quarters from mares. The best arrangement for stallions is a roomy box stall with access to a two- or three-acre pasture for exercise.

A stallion needs exercise and a proper diet. The stallion must receive daily exercise to maintain thriftiness. Producers must remember to add some grain to the stallion's diet for energy during the breeding season.

## Record Keeping

As with other livestock enterprises, keeping an accurate and complete set of records is important to the success of the horse producer. However, they are somewhat different from those of other livestock enterprises; for example, recording weights of the animal at various stages of growth is not important. However, records about teasing dates, breeding dates, palpation results, expected foaling dates, and feeding are kept.

## Summary

Good management of horses is necessary for them to be healthy and productive. Proper management begins with the practices carried out by the producer at foaling and in the following weeks. Weaning foals, mares, and stallions also need appropriate care. All horses require proper feeding. As with any other livestock operation, records are important in horse production.

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## *Lesson 10: Management Practices for Poultry Production*

The consumption of poultry and poultry products is increasing. Much of this increase is due to consumer demand for healthy, economical food. Certain management practices are recommended to increase production when producing poultry and eggs.

### Management Practices for Newly Hatched Poultry

Brooding management is the care and management of the newly hatched poultry. This period includes the first five to six weeks of the chick's life. Providing a young chick with a good start in life is important to its later performance as a layer, broiler, or breeder.

Chicks should not be brooded in a house located near other poultry because of the danger of disease transmission. Research shows that increasing the distance between facilities seems to decrease disease outbreaks. The brooder house should be practically isolated from the rest of the operation. At least 300 feet should separate brooder houses or brooder houses and other livestock buildings. It should be enclosed with a fence, and the entrance gate should be locked at all times. Thought should also be given to including predator control and biosecurity features, such as showers, when designing brooder houses.

Proper management requires that all chicks be approximately the same age, with no more than seven days of age between the youngest and the oldest. Vaccination and feeding programs are almost impossible to manage if the chicks are not the same age. As discussed in earlier lessons, poultry management involves following an all-in, all-out system, in which a group of birds is placed in the brooder house only after all other birds have been removed. The producer must clean and disinfect the facility before bringing in the next batch of chicks.

Temperature control is very important for the survival of the new chick because chicks require heating until they are fully feathered. A temperature of 90 to 95 degrees Fahrenheit may be used for day-old chicks. The temperature is measured about three inches off the floor under the brooder. The temperature is decreased about five degrees each week until it reaches around 70 to 75 degrees. However, the behavior of the chicks is the best indication of the proper temperature. If they bunch together under the brooder and cheep, it is too cold. If they move out from under the brooder, pant, and hold out their wings, it is too hot. Cool temperatures will increase health problems, while high temperatures will decrease growth.

Producers usually supply heat using hover-type floor brooders. A hover-type brooder is a cone-shaped metal canopy hung from the ceiling; the metal cone deflects heat from a heat source toward the floor. This equipment should be ready two weeks before the chicks arrive to test the equipment. Seven to ten square inches of space per bird is necessary under the brooder. Some producers surround the brooder by a brooder guard set out about 36 inches from the edge of the brooder. The guard keeps chicks near the warmth of the brooder. Producers should remove the brooder guard after the chicks are one week old.

Almost all chicks are brooded under the same conditions during the first weeks of their life no matter what type of production system they will move into next. However, the floor space required for each chick during brooding depends on the production purpose to which it will be put and the type of bird. More space is needed for breeding birds than laying birds, while broilers need the least amount of space. For example, broilers require ¾ to 1 square foot of space, while a Leghorn layer pullet requires 1 to 2 feet of space. Adequate floor space is necessary to avoid overcrowding the chicks, which will cause increased death losses and a reduced growth rate.

Another important management consideration for newly hatched poultry is ventilation. Proper air movement is important for controlling humidity and diseases. Stale air seems to promote some poultry diseases. Air flow can be controlled by raising or lowering curtains on open-sided houses. At first the curtains should stay closed, but as the chicks grow older, the curtains may gradually be kept open for longer periods during the day. The length of time will vary depending on the outside temperature and the feather development of the chicks. The curtains should be closed in the evening. Producers may also install mechanical ventilation systems in brooder houses.

Proper lighting is necessary for brooding chicks. During the first week, lights may be left on all night.

The light will help keep the chicks from crowding or piling up if they are disturbed.

Chicks require proper litter during brooding. The litter should be as clean as possible and should not be treated with an insecticide. It should be several inches deep. After the chicks are three weeks old, litter should contain about 25 percent moisture. The moisture is not only important for dust control but also aids in keeping chicks from dehydrating. In addition, chicks do not grow or feather well in a dry atmosphere. Litter should never be too moist, however, because wet litter can promote diseases.

Producers should provide plenty of food and water for chicks. Young birds should be started on feed as soon after hatching as possible. Water and feed should be clean and fresh. Special waterers and feeders should be used until the chicks are large enough to eat and drink from standard equipment. The waterers and feeders should provide adequate space so that each chick has access. Producers should check to make sure that chicks are drinking and eating.

One important management practice that may be performed is beak trimming. Beak trimming is the process of cutting off ⅓ to ½ of the upper beak and about ¼ of the lower beak in chickens, as shown in Figure 10.1. It helps prevent cannibalism. The exact cause of cannibalism is not well understood, but overcrowding, the type of ration, overheating, or too much light may be factors in its occurrence. Beak trimming may be done when chicks are a day old. Chicks may also have their beaks trimmed at one to two weeks of age. If done early, the trimming may not be permanent and may have to be repeated.

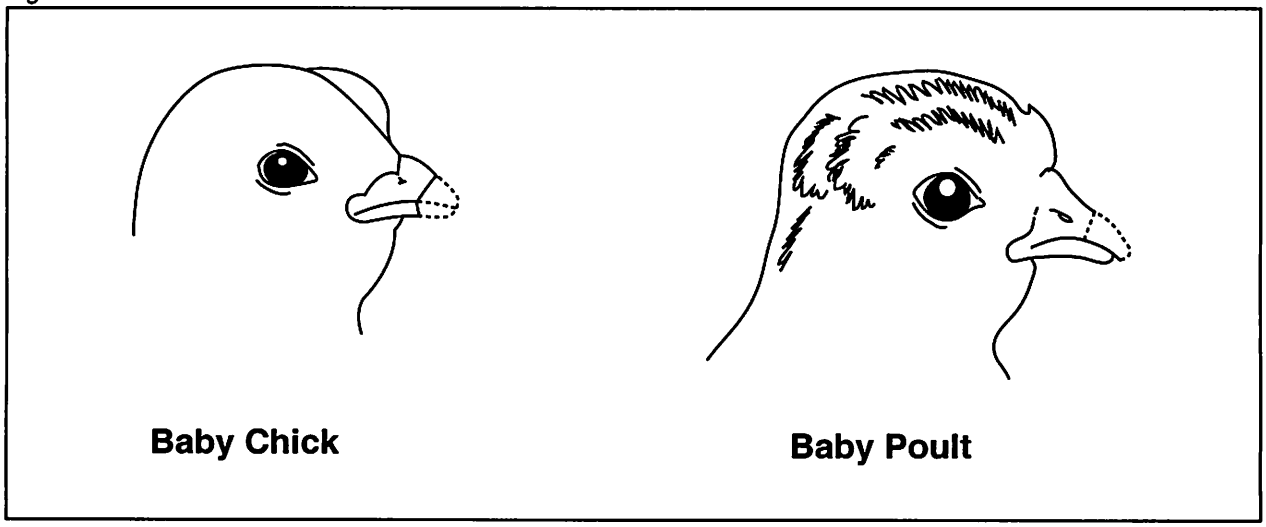
Brooding turkey poults is similar to brooding chicks, with many of the same factors being important. Because of their larger size, more floor, waterer, and feeder space is needed. Young poults require temperatures of 100 degrees Fahrenheit for white birds and 95 degrees for dark birds. Beak trimming involves cutting off ⅝ to ¾ of the upper beak in turkeys, which may be done at one to three weeks of age. In addition to beak trimming, producers may also desnood and clip the toes of poults. Desnooding is the removal of the snood, the fleshy appendage at the base of the upper beak. It helps reduce fighting in males and prevents head injuries. Toe clipping prevents scratches that can cause turkeys to be graded lower at market.

## Feeding Programs for Different Classes of Poultry

Feeding programs vary depending on the type of poultry enterprise. Different programs are required to meet the nutrient needs of poultry. The producer will be either feeding for egg production, meat production, or breeding. Turkeys require a feeding program that differs somewhat from feeding chickens.

Protein levels will vary depending on the type of production. When feeding for egg production, a laying ration should contain about 14.5 percent

*Figure 10.1 - Chick and Poult with Trimmed Beaks*



protein. This protein level is somewhat lower than the protein provided during the growth phase of the young chick. Laying hens on commercial poultry operations may receive higher levels of protein if a phase feeding program is used. In phase feeding, laying hens receive different levels of protein depending on factors such as age and stage of production. They begin the production period at 17 to 18 percent protein, which is fed through the peak production period. The level of protein is then gradually decreased to 15 percent by the end of the laying period. Broilers are always fed a high protein ration. Their rations contain approximately 18 percent from about 6 weeks of age until marketing.

Different vitamins and minerals are required in feeding programs for layers. Calcium, phosphorous, manganese, and vitamin A and D are necessary for proper egg formation.

Feed conversion is important for both laying hens and broilers. Feed conversion refers to the pounds of feed required to produce a dozen eggs or a pound of meat. Various factors can affect feed conversion levels, including the type of feed used, the genetic background of the bird, additives used in the feed, and the general management of the operation. Current feed conversion standards in the broiler industry are about 1.85 to 1.95 pounds of feed for each pound of meat produced. In contrast, feed conversion standards for laying hens are 3 to 3.5 pounds of feed per dozen eggs.

The feeding program for breeding flocks of chickens differs from the programs used for layers and broilers. The breeding flock is fed a special mash that is fortified with extra vitamin A, D, $B_{12}$, riboflavin, niacin, and manganese. The mash is more expensive than feed for laying hens or broilers. Broiler breeder replacement pullets and hens require diets that are low in energy to avoid becoming too fat.

Feeding programs for replacement pullets for laying and breeding flocks often involve restricted feeding. Feed restriction programs are used to avoid overfeeding. Overfeeding will result in hens that reach sexual maturity too early and produce too many small eggs. Methods used to reduce feed intake include skip-a-day feeding, feeding low protein and low lysine diets, and limited feeding. Skip-a-day feeding involves feeding on alternating days between 9 weeks of age and maturity. Low protein and low lysine diets keep pullets from meeting their need for energy and protein for maximum growth. Limited feeding requires putting out only the amount of feed the chickens will consume in a short time, such as two to three hours, and feeding two or three times each day.

The general feeding principles for feeding turkeys are similar to those used in feeding chickens. The major differences are in the protein levels required and the importance of the vitamins biotin and pyridoxine in the diet. Starting protein levels in turkey diets should be about 28 percent. Levels should be reduced to about 26 percent at four to six weeks of age. Growing turkeys should be separated by sex because toms have higher protein needs than hens. Turkeys fed for breeding do not require feed restriction. However, holding rations consisting of average energy levels are fed to maintain stable development of the birds. Breeding rations need to have adequate levels of vitamins and minerals to promote egg formation.

## Management Practices for Producing Meat or Eggs

Pullets raised for laying flocks may be raised in cages or on floors. The trend today is toward confinement in cages. They may be raised in one of two systems: partial cage growing or complete cage growing. In partial cage growing, the chicks are brooded using floor brooding for about 6 to 10 weeks. They are then placed in cages. In complete cage growing, the chicks are brooded and raised in cages.

Controlling the amount of light will determine how fast the chick develops and influence production. As discussed in the unit on breeding, producers can use lighting to control the onset of sexual maturity and the production of eggs in hens. Longer days cause pullets to develop faster, but developing too quickly will result in small eggs. Before the pullets reach 21 weeks, the amount of light received should gradually be decreased to eight hours of light. Producers can then increase the light by 15 minutes a day until 14 to 16 hours of light is provided using artificial or natural and artificial light to stimulate egg production in mature birds. Turkey breeders should receive 14 hours of light a day while laying.

Producers of broilers and turkeys should also control the amount of light provided to encourage eating and growth. Broilers may receive 23 hours of light a day. Producers may also use intermittent light, providing three hours of darkness for every

hour of light. Market turkeys require 16 hours of light.

Many producers use forced molting to increase the productive life of laying hens. Molting is shedding and growing a new set of feathers. Most hens produce an average of 20 eggs per month to 19 to 20 months of age, after which the hen is sold for processing. Molting occurs after 8 to 12 months of production and is accompanied by decreases in egg production. Forced molting involves taking the hens out of production for a certain period to allow their reproductive system to rest during molting, which takes 6 to 8 weeks. The producers can trigger molting by altering the feeding program; they do not feed the birds for a specified time and then provide low nutrient feeds. Molting may be used to provide two or three cycles of production. After molting, hens show improved egg quality over hens that have not molted.

## Records

Good records are the key to good management. They are the basis for making good management decisions relating to selection, breeding, feeding, and marketing. Flock records for layers should include information on egg production (numbers per hen), death losses, egg quality and size, and amount of feed used. Records for broilers and turkeys should include rate of growth, feed consumption, death losses, and quality of the birds produced. From these records, producers can make management decisions or changes to increase profits and decrease losses.

## Summary

Knowing how to manage brooding for chicks and poults and the production of eggs or meat can play a large role in the profits of the operation. Knowing how to feed the different types of poultry can also be important for profits. Keeping records to measure production is another important factor in ensuring that a poultry operation is successful.

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## *Lesson 1: Marketing Options for Livestock Enterprises*

Options available for marketing will depend on the nature of the livestock industry and the nature of the operation. Some producers have a choice of market outlets. The outlet selected will depend on the conditions affecting the individual producer. Production of some livestock species is becoming more concentrated. Fewer operations control the total number of animals being produced. This affects competitiveness in the industry and the marketing options available. Horizontal and vertical integration contributes to the development of this trend. Vertical integration occurs when the same business entity controls the feeding facilities and the packing operations. Horizontal integration exists when supportive or competitive goods, such as feed, are owned by the same entity.

### Marketing Options for Beef

When the beef operation results in a product to be sold, producers need to decide where and how to market their product. Producers must understand the difference between "selling" and "marketing." Selling involves simply taking the price or money the buyer offers. Marketing involves promotion and establishing prices.

Beef producers have many options available for marketing their livestock. Before choosing a method, the producer must understand the basics of each marketing option.

Terminal markets - Terminal markets are commonly called public stockyards. They are usually near a large center of population and owned by a stockyard company. The company charges the producer a fee while animals are in the stockyard but ownership of the animals does not transfer to the stockyard company. Stockyards are holding facilities used until the animals are purchased by a packer for slaughter. Costs at a terminal market include yardage (facility rental), feed, insurance, and a selling fee. These costs are deducted from the price received for the animals. Beef cattle taken to a stockyard are assigned to a commission firm. Most terminal markets have two or more commission firms. A commission firm acts as a selling agent and charges a commission fee to the seller for services in finding a buyer and negotiating the selling price. Today there are about 30 terminal markets, compared to about 80 during the 1920s and 1930s. Fewer producers are using terminal markets to market livestock; only about 12 percent of the packer supply is purchased by this method. Larger beef producers tend to use other methods of marketing.

Auction - At an auction, animals are sold by public bidding with the animals going to the highest bidder. The auction method is used primarily at a local sale barn. They are popular because of the convenience to the producer. Like stockyards, auction barns charge for the use of their facilities. Yardage, insurance, and health inspections are some charges deducted from the selling price. Feeder, slaughter, and purebred breeding animals are sold by this method. In some states, livestock associations coordinate and sponsor consignment auctions for local members of their associations. A consignment auction involves a producer entrusting the livestock for sale under the direction of an agent for a fee. Currently, many feeder animals are sold through the auction process. About 18 percent of the packers' supply comes from auction markets.

Direct or contract sales - Larger beef producers tend to market their animals by direct or contract sales. Typically, no commission firms or brokers are involved with this method. The sales are made to a livestock dealer or order buyer who works for a packer or feedlot company. Animals are bought at the farm and shipped directly to the packer or the feedlot. The price is usually based on the weight of the animals after they arrive at their destination. One major factor that affects price is shrinkage, or the loss of weight during shipping. Distance, weather, and handling during transport can greatly affect animal shrinkage. Increasing numbers of slaughter animals are sold on a grade and yield basis through direct sales. With this system, the value of the animal is determined after it is slaughtered. This method usually provides a better price to the producer who raises higher quality livestock with less fat, or waste, and a higher grade. The number of livestock being sold through direct sales is increasing, providing about 70 percent of the packers' supply. Each year more feeder animals are marketed using this method.

Electronic marketing - One of the most recently developed methods of marketing is electronic marketing. Several livestock associations have established a system of marketing using the Internet. Although this method is currently used for feeder cattle, the potential exists for expansion

into the marketing of other types of cattle. This system is basically the same as an auction. Buyers can bid over the Internet and not have to travel to auction barns. Information gathered by graders about the animals is supplied to the buyer in advance. Graders work for livestock associations and supply information such as how the animals were raised, weight, confirmation, feeding program, and current health.

Futures market - Futures marketing of livestock involves trading contracts for future delivery of a specified amount of an animal, such as pounds of beef. Most trading takes place at the Chicago Mercantile Exchange. This method of marketing involves a broker who receives a fee based on the size of the contract, and an initial amount of money called margin money to support the contract. Producers can hedge on the price received for animals by locking in a price for the livestock. Whether the cash market goes up or down, a producer receives the price stated on the contract. To make a profit, a producer must know the breakeven price before buying a contract. To use the futures market successfully, the producer must keep good records and understand the pricing system. Futures trading with beef cattle can involve feeder and slaughter cattle.

Purebred marketing - Purebred marketing is a specialized business. Purebred cattle are sold through auctions and private sales sponsored by purebred associations. Performance records are supplied to buyers. Advertising is done through breed association publications or magazines.

Beef producers need to be aware of the marketing cycle of cattle. The highest prices follow a cattle inventory cycle of nine to thirteen years. If possible, marketing of the animals should be adjusted to hit the price peaks of the cycle. The strategies, options, and timing of marketing may all be affected by livestock market cycles. For example, if inventories in the feedlot drop and cause prices to rise, a producer may sell feeders to a feedlot instead of feeding them on the operation.

### Marketing Milk

Milk is sold as either Grade A or Manufacturing (referred to as Grade B or Grade C) milk based on the standards under which the milk is produced. Ninety percent of milk sold in Missouri is Grade A. State regulations govern the quality standards of milk. Milk that meets high standards relating to temperature, bacterial count, somatic cell count, and meet minimal facility regulations is marketed as Grade A fluid milk, which receives higher prices than Grade B milk.

Usage of Grade A milk is divided into classes, with Class I milk being marketed as fluid milk for drinking. This class of milk receives the highest price. The supply of milk in excess of the amount needed for drinking is used for other purposes, such as cheese, butter, and frozen dairy products.

About 80 percent of the milk produced is marketed through dairy cooperatives. The other 20 percent is sold to private firms, sold directly to consumers, or used on the operation. Dairy cooperatives provide many services to producers. Most importantly, they supply a daily market. They also provide services such as assisting with quality control, sell milking supplies and equipment, coordinate milk weights and tests, and assist with inspection problems. Cooperatives also provide marketing and market outlook information, assist producers by negotiating milk prices with processors, balance milk supplies among different processors, and participate in federal order hearings.

Federal milk marketing orders were established under the Agricultural Marketing Agreement Act of 1937. The purpose of a federal market order is to maintain an orderly market, establish prices for Class I fluids, and ensure a sufficient quantity of wholesome milk for consumers. The federal government does not purchase milk from producers but is instrumental in maintaining stability in the market. Changes in federal marketing orders are made under the authority of the Secretary of Agriculture and the U.S. Department of Agriculture.

As of January 2000, the pay price is based on the following guidelines: (1) a value is determined for components that are protein, fat, and other (lactose and minerals), (2) a price adjustment for the percentage usage of Grade A fluid (Class I) in the Federal Market Order, and (3) a somatic cell adjustment based from ±350,000 SCC level. The amount of adjustment depends on the cheese price.

The quantity of milk produced nationally varies with the season, with milk production being highest in May and lowest in November. Price also varies seasonally. The lowest prices are paid in May and

June, while the highest prices are paid in November and December. Deductions are made from each milk check to pay for marketing, promotion, and hauling fees.

Since 1971, overall demand for milk products has increased by 1.5 to 3 percent per year. Demand has decreased per capita for fluid milk and increased for cheese. Increased competition from soft drinks and substitute dairy products has also decreased demand for some dairy products. Research and development activities are being conducted by the United Dairy Industry Association and the National Dairy Council to reverse this trend. Most of the advertising dollars spent by the dairy industry are aimed at increasing the demand for Class I milk.

### Marketing Options for Swine

The pork industry uses many of the same marketing options as the beef industry. Swine may be sold through terminal markets, auctions at sale barns, contract or direct sales, electronic marketing, futures marketing, and purebred sales strategies.

The most popular method of marketing swine is the contract, or direct sales method. About 76 percent of all hogs sold in the United States are marketed by this method in which the producer deals directly with the packer/buyer. With direct sales, the animals are transported shorter distances and have less shrinkage. Vertical and horizontal integration contribute to the trend toward direct sales. Livestock alliances also aid smaller producers with this form of marketing. They collect small shipments of hogs from several producers to make a larger delivery to the packer. This form of cooperative marketing gives small producers more bargaining power for pricing.

Other methods of marketing are used in addition to direct sales; however, their popularity is diminishing. About 12 percent of the hogs sold are marketed through terminal markets, while about 8 percent are sold through auctions.

The marketing cycle for hogs is much shorter than for beef cattle because the gestation and growth period of hogs is much shorter. This leads to peaks in hog prices every three to four years. As with other meat species of livestock, the economic principle of supply and demand has a large impact on prices. With a short marketing cycle, rapid increases in supply can occur, sending prices lower more quickly, as demonstrated during the 1998-99 production year. Large supplies of pork drove prices to an all-time low, reaching as low as 9 cents per pound in some sections of the country. In terms of the modern economy, pork was cheaper than during the Great Depression of the mid-1930s. Supply corrections, such as reducing the number of replacement breeding animals, were necessary to cause prices to start increasing steadily.

As with other meat animals, the price received for hogs is based on the quality of the product. Most hogs are sold on a weight basis. Producers receive price discounts for hogs that are either above or below specified weights demanded by the packer. Selling on a grade and yield basis is increasing. A premium is received for animals with less waste and more high-quality meat. Payment is made after the hogs are slaughtered. One problem with this system is the producer is not involved in the evaluation of animals. If an error occurs, the hog is already slaughtered and cut up. If the carcass is condemned, the seller takes the loss.

In addition to the size of the animal, the decision about when to sell hogs is made based on the time of year. Generally, hog prices tend to rise in April and peak in July. These variations in price are beginning to level because large producers tend to distribute farrowing evenly during the year. These trends may cause producers to alter their management and marketing options.

### Marketing Options for Sheep

Sheep and lamb in the United States decreased from about 30 million head in 1950 to about 10 million head in 1994. Reductions in sheep production are the result of marketing challenges from synthetic fibers competing with wool for market share and competition from lamb meat production from other countries, such as Australia.

Producers have two potential sources of income for sheep, meat and wool. The demand in both areas has declined. Greater decreases have occurred in the market for wool, which has led some producers to focus on raising hair breeds of sheep.

Sheep are marketed through similar channels as beef and pork with direct marketing accounting for most of the sales. The use of terminal markets and auctions is decreasing. Most large producers in the western states market their animals directly to packing firms. Producers in midwestern states like Missouri rely on combining their market lambs into larger units for direct marketing to packers. This allows them to bargain for better prices. Wool is marketed in much the same manner. Local producers combine their wool during shearing season and with the aid of wool cooperatives market their product to large buyers. Wool is marketed in two categories: apparel and carpet wool.

Lambs can be marketed as hothouse lambs, animals less than three months of age sold between Christmas and Easter, or graze them through the summer and market them at 110 to 130 pounds in late summer. Lamb prices rise during the spring, peaking in May, and then tend to fall with the lowest packer prices received in June and July.

Wool prices also vary seasonally, with prices at their highest in spring and peaking in May. The price received is largely determined by the amount of clean wool produced. Clean wool is the wool that remains after impurities are removed. The length, density, and diameter of the wool also affect its value by establishing its grade. Domestic wool is generally of lower quality than imported wool because producers in other countries focus more on producing high quality wool.

## Marketing Options for Horses

Marketing horses is different from marketing the other species of livestock discussed in this lesson. They are considered companion animals and are used for pleasure or for work. The most common marketing methods associated with horses are auctions and direct sales. Special purebred marketing is also common with horses.

Most horse sales are a private transaction. A buyer may use several methods to find out about a horse for sale, including looking for advertisements in a newspaper or magazine, finding a dealer over the Internet, or through word of mouth from a friend or neighbor. The price is a matter of private negotiation between the parties involved. Price is established by the condition and age of the animal and the training it has received. Animals that are three to four years of age, in good physical condition, and trained for riding or some other specific purpose command a good price.

A few horse auctions are held in Missouri. Some have regular sales but usually auctions are held on a seasonal basis in the spring or fall. Prices are determined through bidding. Examination of the animal before the sale is customary to establish a fair value.

## Marketing Poultry and Eggs

The poultry industry is almost totally vertically integrated so marketing is very different than for other livestock species. Producers contract with the large integrators, like Tyson or Purdue, and generally do not make marketing decisions. They raise the birds for the integrator; the integrator owns and markets the birds. Few actual sales of live birds or eggs take place. A few poultry producers operate in niche markets, selling specialty, free-range products to consumers through retailers on a local or regional level.

## Selecting a Marketing Option

Producers who have several options for marketing must carefully consider which market will be best for their operation. The option selected will be based on personal preference or decided by consideration of the following factors.

Profit potential - The potential profit is the most important factor to consider when selecting a marketing option. A successful producer will use a variety of marketing strategies or methods with the goal of receiving the most profit depending on the quality, size, and age of the livestock product. A marketing option that is successful one year may not be the best option during the next year.

Location of the production unit - Producers have to figure transportation into their cost of production and their potential profits, especially producers who operate long distances from livestock markets. The only option for some producers might be the local auction market.

Type of livestock product - The type of product will influence where marketing activity takes place. Marketing commodities such as milk or eggs differ from marketing animals sold for slaughter or to other producers.

Quantity of the livestock product - The quantity of the product marketed, in terms of number of head, pounds of milk, pounds of wool, etc., might determine demand for the product by a processor. Many producers form cooperatives or alliances to combine their units of production into larger numbers to effect bargaining power.

Quality of the livestock product - The quality of the product will influence demand, which in turn affects the marketing options available. Poor quality animals may be marketed differently than animals of higher quality.

Market risk - A particular marketing option may involve more risks than others. For example, more risk is involved in selling on the futures market, which involves contracting for a price before the product is produced.

## Developing a Marketing Plan

An effective market planning can add thousands of dollars to a producer's profits each year. Taking an organized approach will not guarantee getting top prices, but it can give a producer much more confidence and increase the potential for profit. The producers who will benefit most from market planning are those who produce commodities traded on futures and/or options exchanges, such as slaughter cattle, feeder cattle, and hogs. These commodities are traded on futures markets because they tend to have a great deal of price volatility.

Effective marketing includes both planning and taking action. Livestock producers who leave out either step will not be as successful. Some producers do poorly because they do not have a plan. When a profitable price opportunity comes along, they are not ready to take advantage of it. Others may plan but fail to stick to the plan. Too often producers are not willing to sell when planned or they panic and sell too soon when the plan says they should wait. Effective market planning should be based on reason, not emotion. An organized approach removes emotion from marketing plans.

Market planning requires several steps. According to market analysts, the five basic steps are as follows.

1. Know the costs of the operation. Analyze the variable and fixed costs associated with the livestock enterprise. An analysis of costs will reveal the breakeven price that must be received for the livestock product to cover the costs of the operation.

2. Know what prices can be expected. As with other businesses, doing market research pays. Producers need to be informed about prices and the market outlook for the coming year. Market research will let the producer know if the price offered on any given day is too low or if it is a good price. An optional step is to look at the operation's product. Producers may want to consider alternative livestock products if the operation is not the most profitable enterprise possible.

3. Study the marketing alternatives. Producers should learn about all of the marketing tools available to them. Considering alternatives, such as futures marketing or various types of cash contracts, could increase the opportunities for success in marketing. It is a mistake to reject other methods of marketing simply because of unfamiliarity.

4. Make a plan. Develop a market plan that reduces risk and put it in writing. A low-risk plan will complete some sales early in the season to cover costs. The plan should involve selling the bulk of the product at a reasonable price objective based on the market outlook. Producers should hold only a small amount of their product in hopes of making a greater profit. A market plan will outline when to market, where to market, and number of units to be sold. Putting together a successful plan will depend on the quality of the market information received and setting the right pricing objectives.

5. Take action and stick to the plan. An annual plan provides a place to start. It will be necessary to maintain accurate cost records and monitor market prices to track the success of the plan. Market outlooks can change with shifts in supply and demand. Plans should be kept up-to-date.

To plan effectively, producers need good marketing information. Sources of information will differ depending on the type of livestock enterprise, but the two general sources are internal and external. Internal information comes from the producer's operation. Producers can track the costs per unit of animals by looking at the

resources available, the history of production, financial statements, and the cost accounting system of the operation. External information includes outside factors that will influence production and prices. This includes weather forecasts, price reports, news developments, supply and demand data, market analysis, and market advisories. Sources of external information include electronic information services (satellite data transmission units), radio, television, newspapers, newsletters, and personal contacts with analysts or brokers.

## Summary

The success of livestock producers will depend on their knowledge and use of livestock marketing. To accomplish this objective, a producer will need to understand the methods of marketing that are available and how they function. The factors that will affect the choice of a particular marketing alternative should be considered. Producers must develop and follow a market plan to obtain the highest level of profit possible.

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# GLOSSARY

## A

**anaphylactic shock:** An allergic reaction that occurs in sensitized animals following injections of vaccines or drugs, ingestion of certain foods, or insect bites.

**anthelmintic:** Compounds that control stomach and intestinal worms.

**antibiotics:** An organic material in nature that slows or stops the growth of disease-causing organisms.

**artificial insemination (AI):** Type of mating system that involves collecting semen from the sire and placing it in the reproductive tract of the dam.

## B

**backcrossing:** Mating sires of one breed with dams of another breed. The crossbred progeny are then mated to males of the same breed as the sire or dam, alternating between them so that a female sired by a male from one breed will be mated to a male from the other breed. Also called crisscrossing.

**backfat:** The amount of fat on the back of an animal; the best indicator of leanness.

**backgrounding:** A system of raising a calf from the time it is weaned from the cow to the feedlot phase.

**bagging:** The swelling of the mammary glands as they fill with milk.

**blemish:** For horses, any abnormality that has no effect on performance.

**body condition:** Amount of fat cover.

**breed character:** The distinguishing characteristics of specific breeds. These characteristics may include such traits as hair color, head shape, overall body shape, etc.

**breeding system:** A system that determines the offspring's breed and its relationship to its parents and other offspring.

**BST:** A supplemental hormone used in the dairy industry to increase the amount of milk produced by cows; also called bovine somatotropin.

## C

**chin ball marker:** A heat-detection device similar in construction to a ballpoint pen attached with a halter to the chin of a teaser bull. As the bull mounts the dam, he rests his head on the rump or back or over the shoulders of the female, and the chin ball marker smears ink on these areas.

**colostrum:** The first milk, rich in antibodies, that is produced by a lactating cow or sow.

**corral mating:** Term used by horse breeders to describe a mating system in which the selected sire and dam are placed together in a corral for servicing.

**crates:** Areas for farrowing that do not allow a sow to turn around.

**crossbreeding:** Mating animals of different breeds.

**crotching:** Shearing the wool from the crotch, udder, and stomach a few inches from the udder of a ewe.

**cubing:** The process of forcing dried hay through holes in a die.

## D

**dairy character:** Physical indications of high milk production.

**Dairy Cow Unified Score Card:** A system of evaluating the general appearance of cows as it relates to milk production potential. Categories evaluated are frame, dairy character, body capacity, feet and legs, and udder.

**dead germs:** Chicken embryos that have died.

**digestible energy (DE):** The total amount of energy in a feed, which is equal to the amount of energy lost through feces subtracted from the feed's gross energy.

**direct labor:** Labor that is directly related to a livestock enterprise, such as time spent working with animals.

**diversification:** The process of becoming involved in other livestock enterprises, such as adding hogs to the beef cattle enterprise.

**dropping:** A common sign of parturition which gives a ewe a sunken appearance in front of the hip bone and may make her appear sway-backed.

**dystocia:** Difficulty during calving.

## E

**entropion:** An eye problem in sheep in which the eyelids are inverted, or turned inward.

**estrus:** Heat period in animals.

**ewe index:** An index used in evaluating a ewe's reproductive efficiency, milking ability, and wool production in comparison to other ewes in the flock.

**Expected Progeny Difference (EPD):** A figure that shows ability of a sire to pass on traits. The number, which may be positive or negative, indicates the expected amount of difference from the average bull's offspring that the offspring of a bull will show for a particular trait.

## F

**farrowing:** The process of birthing swine.

**feed additives:** Products used in animal nutrition that promote feed efficiency and gains by affecting the health or growth of the animal.

**finish:** Degree of fatness suitable for marketing.

**Flock Estimated Progeny Difference (FEPD):** An estimate of the genetic value of every ewe, ram, or lamb in a flock for the traits selected by the producer. Information provided by FEPDs includes values for fleece, growth, and reproductive traits.

**flock mating:** A mating system used by poultry breeders in which several males are placed with an entire flock of females for natural servicing.

**foaling:** The process of birthing horses.

**frame size:** The size of the animal's skeleton (both height and length of the body) in relation to its age.

## G

**gait:** The leg action of a horse

**grade animals:** Animals that are relatively pure but are not eligible for registry by a breed association.

**grading up:** Mating purebred sires to grade females. Also called upgrading.

**grinding:** The simplest, most common, and least costly method of feed processing; it involves reducing the size of the feed by compressing it in a hammer mill or burr mill.

## H

**hand mating:** A controlled natural mating system in which males are kept separate from females at all times prior to a female coming into heat. During estrus, a females is brought to the male for servicing.

**heat-mount detector:** A method of heat detection consisting of a small plastic capsule filled with red dye attached to a fabric base. The detector is placed on a teaser bull using a harness that holds it on the brisket of the bull. If enough pressure is placed on the capsule, the dye will slowly be released to mark the female.

**heat treatments:** Methods of feed processing involving heat or steam; include steam rolling, steam flaking, roasting, popping, extruding, and micronizing.

**hormones:** Substances that are secreted by the endocrine glands into the body fluids and transported to another location in the animal's body where they have specific affects on cell activity.

**hybrid:** An animal produced by crossbreeding.

**hybrid vigor:** Increases in production resulting from crossbreeding, which causes a hybrid animal to out-produce the average of its parents' production. Also called heterosis.

## I

**inbreeding:** Mating animals that are more closely related to each other than the average of the population. They must have related ancestry within the last four or five generations.

**indirect labor:** Labor that is indirectly related to an agriculture enterprise, such as time spent repairing fences.

**inoculants:** An additive that provides a supplement for the natural lactic acid bacteria found on a forage crop.

**intensive inbreeding:** Mating animals that are very closely related and whose ancestors have been inbred for a number of generations; the animals share more than one ancestor. Also called close breeding.

**interfering:** In horses, hitting the cannon or fetlock of the other foot when moving.

## L

**lactation:** Milk production.

**lambing:** The process of birthing sheep.

**linebreeding:** A type of inbreeding that involves mating animals that are somehow related to each other but never closer than half-brother or half-sister.

**loin eye:** Area at the tenth rib that reveals the amount of muscling.

## M

**maternal breeding value (MBV):** A figure used to evaluate the probability of a bull's daughters weaning heavy calves, indicating their ability to provide milk.

**metabolizable energy (ME):** The resulting value if the energy that is lost from urine and gasses is subtracted from the digestible energy (DE).

**milk fever:** A disease that is the result of a lack of calcium salts in the blood of a cow.

**monkey mouth:** An undershot jaw causing the lower teeth to protrude.

**moon blindness:** Occasional blindness.

**mummies:** The remains of fetuses that died in a sow's uterus and have been partially reabsorbed, leaving only the skeletons and other nonabsorbable parts.

## N

**National Research Council (NRC):** A federally funded research division of the U.S. government that publishes information on the nutrient requirements of a variety of species as well as other information affecting animal nutrition.

**natural mating:** Mating that involves physical contact between the male and female with or without human intervention and assistance.

**net energy (NE):** The amount of energy needed by an animal for maintenance and production.

## O

**onformation:** The form and shape of an animal.

**organic product:** A product produced without the use of chemicals or hormones.

**outcrossing:** Mating animals that are from the same breed but not closely related.

**oxytocin:** A hormone that induces delivery during birthing.

## P

**paddling:** In horses, winging the feet outward when moving.

**palatability:** A factor that determines how eagerly an animal will eat a feed.

**parasite:** An organism that gets its nutrients from a larger host.

**parrot mouth:** A condition resulting from a short lower jaw that causes the upper teeth or dental pad to protrude.

**pasture mating:** A mating system in which males and females are kept together in the same pasture during the breeding season or throughout the entire year.

**pelleting:** A process involving feed material with a high moisture content that is heated and forced through holes in a die to produce a compact and nutritious feed pellet.

**pen mating:** A mating system used by poultry breeders in which one male is placed in a pen with several females, usually eight to twenty hens.

**performance data:** Records documenting the reproduction and production of an animal.

**performance tests:** Tests that measure the performance of the overall herd; they may utilize both production and progeny tests.

**pipping:** The point in the incubation period when the bird pecks the shell open.

**Predicted Transmitting Ability (PTA):** Index for certified dairy sires that provides values indicating the bull's ability to pass on economically important traits such as milk fat and type (body conformation).

**presentations:** Positions of pigs when they are born.

**production tests:** Tests that measure the production of a breeding cow by the performance of her offspring.

**progeny tests:** Tests that measure the production of a breeding bull by the performance of his progeny.

**prolapse:** A problem, requiring immediate medical attention, that can occur during parturition when the uterus becomes inverted and is forced out due to extensive pushing, the effect of the calf leaving the cow's body, or the result of the calf being pulled out too rapidly.

**purebred breeding:** The mating of purebred animals of the same breed.

## R

**rectal palpation:** A method of pregnancy detection in which a technician inserts his or her hand into the cow's rectum and determines if the animal is settled or not by feeling the cow's reproductive organs.

**rolling:** Grain is compressed between two rollers set a desired distance apart to produce a flake.

**rotational breeding:** Mating sires of different breeds to succeeding generations of females, ending with a male of the same breed as the female used in the first cross. The series of sires is then repeated.

**ruminants:** Animals, such as cows, that are able to consume large amounts of roughage and utilize their nutrients.

## S

**scratched mouth:** A jaw defect in sheep in which the position of the jaws is correct, but the teeth miss the dental pad.

**silage:** High-moisture crops which are packed to reduce oxygen content and stored in an anaerobic environment in a silo.

**sire summary:** Evaluations of the traits of sires that are considered economically important to producers; these traits include birth weight, yearling weight, and weaning weight.

**snares (or loops):** Instruments used in lambing to pull lambs from the ewe.

**soilage (green chop):** Forages that are cut fresh and fed to livestock rather than being cured.

**Sow Productivity Index (SPI):** An index used in selection that compares a sow to other farrowing sows in a herd by looking at values for number born alive and 21-day litter weight.

**staple:** Wool fiber.

**straightbreeding:** Mating animals of the same breed.

**stud mating:** Mating system used in the poultry industry in which the males are held alone in a pen or coop and the female is brought to the male for servicing.

## T

**teaser bull:** A bull made incapable of impregnating a cow used to signal heat in females. When a cow is in heat, she will allow a gomer bull to mount her. Also called a gomer.

**teasing mill:** A structure that allows breeders to expose the stallion to many mares simultaneously to test for heat.

**teasing rail:** A device used to separate a stallion and mare while determining whether the mare is ready to mate.

**temperament:** The disposition of an animal.

**three-breed cross:** Mating a crossbred female to a male of a different breed.

**thriftiness:** The ability of feeder cattle to gain weight normally and maintain health.

**total digestible nutrients (TDN):** Digestible protein, digestible crude fiber, and digestible fat in a feed that can be converted into energy.

**Total Performance Index (TPI):** An index for dairy cattle that combines the differences for milk production traits and the differences for type traits into a single value rather than evaluating milk fat and body conformation separately.

**two-breed cross:** Mating purebred sires with high grade or purebred dams of another breed.

## U

**unsoundness:** For horses, a leg or hoof abnormality that affects the horse's performance.

## W

**waxing:** The appearance of dried colostrum, which has a waxy texture, on the ends of a mare's teats.

**wool blindness:** The obstruction of vision due to a thick growth of wool around the eyes.

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