

Introduction to the Dairy Industry

Lesson I: Introduction to the Dairy Industry

The dairy industry is an important component of Missouri's animal agriculture industry. Dairy cow operations are found throughout the state. Many Missouri producers derive their entire income from the dairy industry.

The Dairy Industry in Missouri

The many phases of the dairy industry—milk production, transportation, processing, packaging, and merchandising—generate valuable economic activity in Missouri. In the last couple decades, the number of dairy farms and cows has decreased in Missouri and many of the surrounding states. Agricultural leaders in the state are hoping to reverse this trend by encouraging producers to implement better technologies and management strategies for dairy operations that will increase efficiency and improve profit margins.

In 2006, Missouri ranked seventh among the states in the number of milk cow operations and twenty-first in milk production. About 125,000 head of dairy cows were present throughout the state in 2003. Each of these cows produced an average of 14,620 pounds of milk during the

year. The production of milk generated over \$237 million of income in 2003. Dairy producers are primarily located in southwest Missouri around Springfield. As of January 1, 2004, Wright County was the top dairy county in Missouri with 11,500 head of dairy cows. Figure I.1 illustrates dairy cow numbers in the top ten counties.

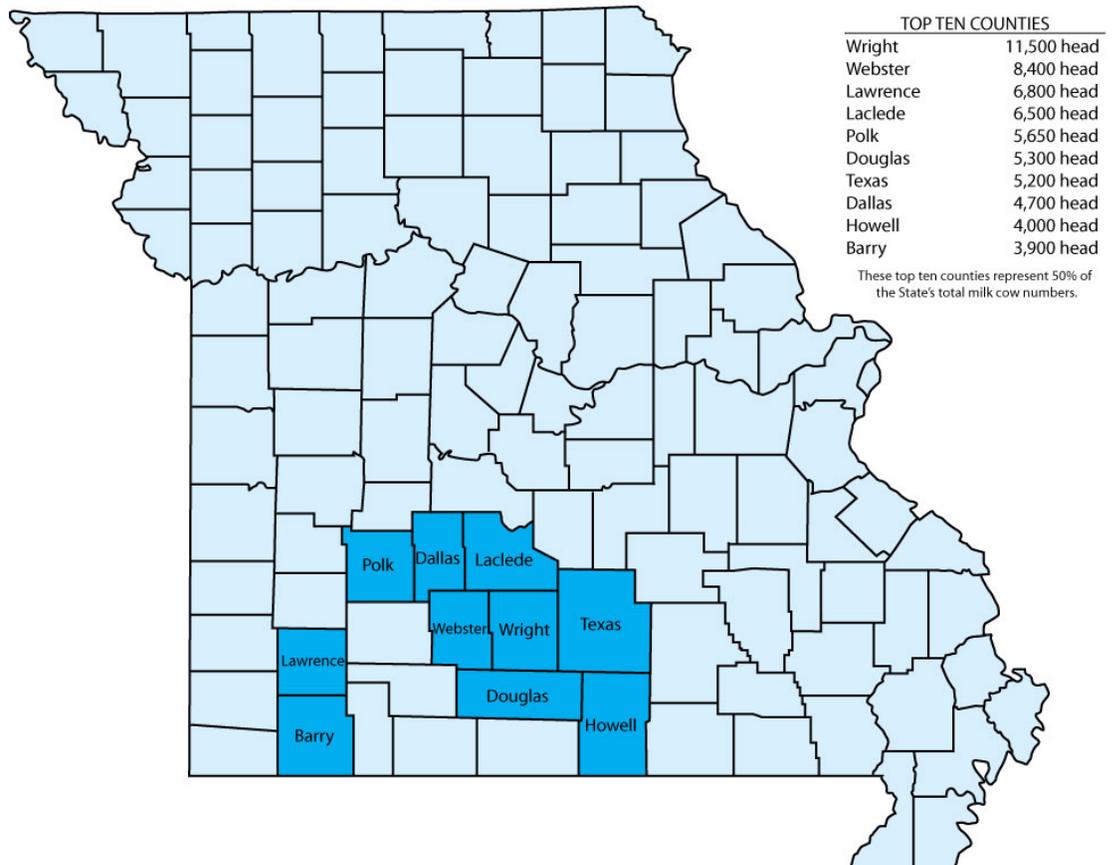
Evolution of the Dairy Industry

The dairy industry began when settlers brought cows to colonial America in the early 1600s. Until the mid-nineteenth century, a cow's owner consumed most of the milk it produced. Some milk and other dairy products were sold to people who lived nearby and did not have their own cows.

In the nineteenth century, technological advancements led to the growth of the dairy industry. Refrigerated railroad cars allowed producers to ship their milk long distances to urban areas. Milk began to be pasteurized, which involves treating milk by heating it to kill disease-causing bacteria. Commercially manufactured cheese became available as well.

These advances allowed dairy production to become a commercial business. Today, dairy operations supply milk

Figure I.1 - Milk Cow Numbers in Missouri, Top Ten Counties, as of January 1, 2004



Introduction to Dairy Production

to many people. Through improved breeding, selection, and nutrition, a modern dairy cow can produce thousands of additional pounds of milk.

Modern Trends

Dairy operations have changed over the last several decades. The number of dairy operations nationwide has decreased, but the number of cows per farm has increased. Dairy production is usually the sole enterprise of these operations.

Milk production per cow has increased due to management factors, including the introduction of BST (bovine somatotropin). BST is a naturally occurring hormone that can be synthesized through biotechnology. It improves milk production when given to lactating cows. Producers are thus able to increase the milk production of existing dairy cows. Using BST requires precise nutritional management of the dairy herd. In the past, some consumers were concerned about the safety of using BST; they feared the residues would show up in fluid milk. Today, however, most consumers have accepted the use of BST.

The location of dairy production has also shifted from the Midwest to the western United States. Large dairies are now found in California, Arizona, and New Mexico. The warm, dry climate allows animals to be managed in dry lots with minimal housing. High quality alfalfa hay grown using irrigation is also abundant, creating a good supply of feed. Dairies in these states are often large, with more than 1,000 head of dairy cows.

Career Opportunities

The dairy industry offers many challenging and rewarding careers. Areas such as production, genetics, nutrition, and veterinary services, as well as dairy product transportation, processing, and promotion, are open to individuals who are interested in the industry. Some possible careers are described below.

Dairy producers are directly involved in the production of milk for fluid milk and milk products, such as cheese and ice cream. They also may supply dairy animals to other producers. Dairy producers often own part or all of their operations.

Other careers are also available in the industry. Loan officers are needed to work in agricultural financing in banks or other lending institutions providing financial management planning or loans for dairy enterprises. Geneticists are available to

help with breeding decisions and reproductive work such as embryo transfer. Feed company representatives provide information about feeds and nutrition to dairy producers. Veterinarians help care for dairy animals and provide advice and supplies to maintain animal health and the production levels of the dairy operation. Equipment sales and service representatives sell and service equipment used for milk production. Fluid milk haulers transport fluid milk to the processing plant or milk cooperative. Processing plant supervisors help ensure the safety of dairy food products. Sales representatives for dairy food products market dairy products to wholesale and retail stores where they are sold to the public.

Conclusion

The dairy industry is important to agriculture in Missouri and the United States. The dairy industry has undergone many changes from its beginnings, when the milk produced by cows was consumed chiefly by their owners. Today Missouri dairy producers are producing more milk with fewer cows, but the number of dairy operations and cows are decreasing. In addition to milk production, thousands of other careers are tied to the modern dairy industry.

Credits

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Lesson 2: Breeds of Dairy Cattle

Compared to beef cattle, few breeds of dairy cattle exist. Most dairy cows are purebred. The primary objective of selecting a breed is to find cattle that will produce large amounts of milk over a long period.

Breeds

Six major dairy breeds are used in Missouri. They are Ayrshire, Brown Swiss, Guernsey, Holstein, Jersey, and the Milking Shorthorn.

Ayrshire - This breed is red and white in color. Ayrshire cows are generally excellent grazers with high quality udders. Ayrshires are not used extensively in the dairy industry because of their low milk production in comparison to Holsteins and Brown Swiss cattle. The breed originated in Scotland and was imported into America in the early nineteenth century.

Brown Swiss - Brown Swiss cattle are light to dark brown with black noses and tongues. The cows are large in size. They rank second to Holsteins in average pounds of milk produced per animal. Brown Swiss cattle are recognized as a heat-tolerant breed and are often used in tropical areas of the world. They can be used as a dual purpose breed for milk and beef production. This breed was first brought to the United States from Switzerland in 1869.

Guernsey - Guernsey cattle are pale yellow and white in color. Milk from Guernseys has a golden color due to high levels of beta-carotene, a source of vitamin A. Guernseys are second to Jerseys in the percentage of fat and protein in their milk. This breed was first imported into the United States from the Isle of Guernsey in the English Channel in the early 1800s.

Holstein - Holsteins are the most popular of all dairy breeds. Worldwide, Holsteins are the most numerous breed of cattle. They are black and white, or occasionally red and white. Holsteins are the largest of the dairy breeds in size. Cows of this breed rank first in average pounds

of milk produced per animal. Holstein cattle were first imported into the United States from the Netherlands in the early seventeenth century.

Jersey - Jersey cattle vary in color from fawn to light brown, gray, or almost black. Jerseys tend to be the smallest of the dairy breeds in size. Cows produce milk that has the highest percentage of milk fat and milk protein of the breeds. This breed is recognized as more tolerant of heat stress than Holsteins. Jerseys were imported into the United States in the early nineteenth century from the Isle of Jersey in the English Channel.

Milking Shorthorn - Milking Shorthorns are red, white, or any combination of the two colors. They are known as a dual purpose breed because the cattle can be used for both beef and milk production. Milking Shorthorns were recognized as a breed in the 1940s. The breed originated in England.

Breed Selection

Selecting breeds to be used in a dairy operation depends on the goals of the producer. The primary goal of most producers is to maximize milk production, which is why Holsteins are by far the most popular dairy breed. However, other breeds have desirable qualities that the producer may wish to add to his or her herd. For example, many producers have herds primarily consisting of Holsteins, but they include some cows from other breeds that produce more milk fat and milk protein to boost the levels of these components in their milk. The selection of individual animals is important as well because animals from all breeds can be high producers.

Conclusion

The major dairy breeds are the Ayrshire, Brown Swiss, Guernsey, Holstein, Jersey, and Milking Shorthorn. Most producers seek to maximize milk production when selecting one of these breeds for their dairy operations.

Introduction to Dairy Production

Credits

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Principles of Dairy Cattle Selection

Lesson 3: Principles of Dairy Cattle Selection

Dairy producers face a major task when selecting replacement heifers and choosing which cows in the current herd to keep or to sell. Maximizing milk production is the primary goal of dairy producers. When a producer selects females for his or her herd, the decision may affect the operation's long-term success in the dairy industry because of the longevity and genetic influence of the dairy cow and her offspring.

Parts of a Dairy Cow

When describing dairy cattle, proper terminology is essential to be able to communicate properly with other individuals involved in the dairy industry. Figure 3.1 is an illustration of the parts of a dairy cow.

Dairy Cow Unified Score Card

The dairy breed associations and dairy producers developed the Dairy Cow Unified Score Card (Figure 3.2) in the

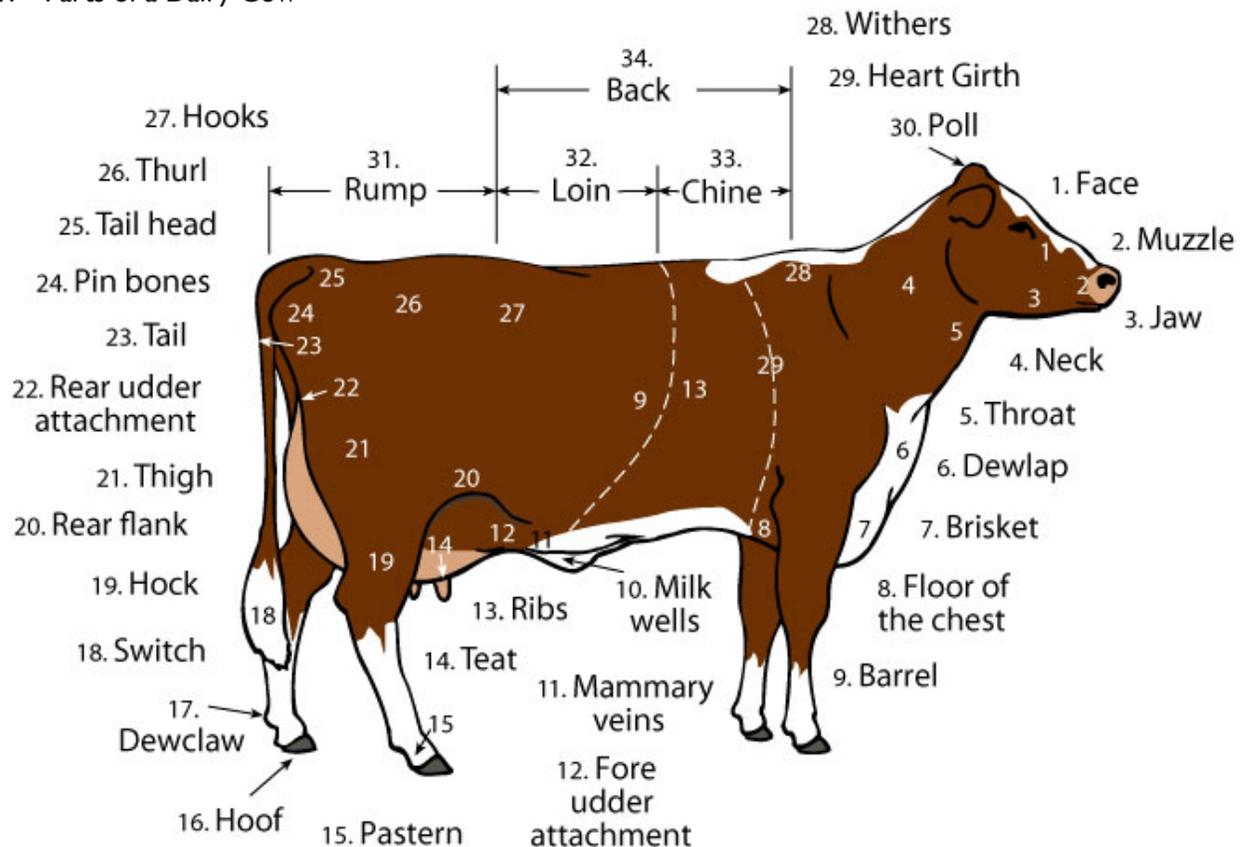
1940s. The dairy score card has been revised often, most recently in 1994. Producers should use the score card to help evaluate and select cows for production. It compares cows to an ideal cow, which is given a score of 100 points; they are then classified according to their scores. The classifications are as follows:

Excellent	90-100 points
Very Good	85-89 points
Good Plus	80-84 points
Good	75-79 points
Fair	70-74 points
Poor	Less than 70 points

The Dairy Cow Unified Score Card looks at five major traits for classification. These traits are frame, dairy character, body capacity, feet and legs, and udder.

Frame (15 points) - The skeletal parts of the cow, except the feet and legs, are evaluated in this category. Dairy cattle should be tall and long-bodied with a straight, strong back; a long, level rump; and a long, clean neck.

Figure 3.1 - Parts of a Dairy Cow



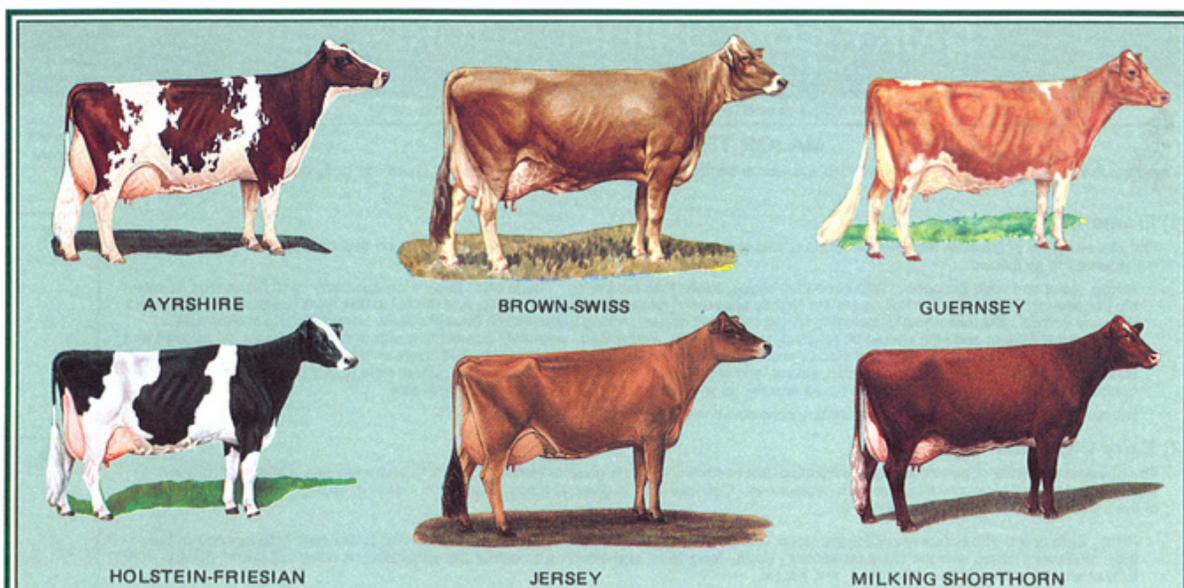
Introduction to Dairy Production

Figure 3.2 - Dairy Cow Unified Score Card

DAIRY COW UNIFIED SCORE CARD	
Copyrighted by The Purebred Dairy Cattle Association, 1943. Revised, and Copyrighted 1957, 1971, 1982, and 1994.	
<i>Breed characteristics should be considered in the application of this score card</i>	
MAJOR TRAIT DESCRIPTIONS	Perfect Score
<p>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.</p> <p>1) Frame - 15% 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: 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. Rump, Stature, and Front End receive primary consideration when evaluating Frame.</p>	15
<p>2) Dairy Character - 20% 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: 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.</p>	20
<p>3) Body Capacity - 10% 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: 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. The Barrel receives primary consideration when evaluating Body Capacity.</p>	10
<p>4) Feet and Legs - 15% 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: 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. Slightly more emphasis placed on Feet than on Rear Legs when evaluating this breakdown.</p>	15
<p>5) Udder - 40% 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: Udder Depth - moderate depth relative to the hock with adequate capacity and clearance. Consideration is given to lactation number and age. Teat Placement - squarely placed under each quarter, plumb and properly spaced from side and rear views. Rear Udder - wide and high, firmly attached with uniform width from top to bottom and slightly rounded to udder floor. Udder Cleft - evidence of a strong suspensory ligament indicated by adequately defined halving. Fore Udder - firmly attached with moderate length and ample capacity. Teats - cylindrical shape and uniform size with medium length and diameter. 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.</p>	40
TOTAL	100

PARTS OF A DAIRY COW

Principles of Dairy Cattle Selection



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 dishd; 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 dishd; 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 moderately dishd; 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 dishd; 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 dishd; 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 dishd 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 definitely 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. Uncaulved 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 usefulness: *Slight to serious discrimination.*

OVERCONDITIONED

Slight to serious discrimination.

FREEMARTIN HEIFERS

Disqualification.

Introduction to Dairy Production

Dairy character (20 points) - Dairy character provides a prediction of future milk production through the evaluation of milking ability. Dairy cattle should have wide, flat ribs and be lean in appearance, with sharp withers.

Body capacity (10 points) - Body capacity is an evaluation of the volume of the cow. It determines the amount of feed the animal is able to consume, which affects milk production. Dairy cows should be long, deep, and wide through the barrel and chest floor.

Feet and legs (15 points) - Looking at the feet and legs allows an individual to evaluate skeletal soundness, or the ability of the cow to move easily.

Udder (40 points) - The udder is the most important part of the dairy cow. Udders are evaluated for milk production and productivity over time. The cow's udder size, cleft, balance, and teat placement should be considered.

Linear Evaluation

Linear evaluation is another type of evaluation system in which a computer program is used to score cattle for individual traits. Dairy producers use this information to improve the functional type of the dairy herd by selecting animals for breeding.

Linear classification scores cows on seventeen linear traits by assigning a numerical score between one and fifty. A linear trait is a simple trait that can be scored along a range from one extreme to another. Depending on the specific trait, a high, low, or moderate point value is desirable. The linear traits are:

- stature
- strength
- body depth
- dairy form
- rump angle
- rump width
- rear legs (side view)
- foot angle
- fore udder attachment
- rear udder height
- rear udder width
- udder cleft

- udder depth
- front teat placement
- teat length
- rear legs (rear view)
- udder tilt

Linear evaluation and classification allows producers to pinpoint specific traits in cows that should be improved and then select bulls for breeding. They can also evaluate and select bulls for breeding by using their daughters' scores. Future generations of replacements will be sounder and more productive.

Summary

To help in evaluating animals, producers must know the correct names of the parts of a dairy cow. The Dairy Cow Unified Score Card is one method of evaluating dairy cows for selection. Linear evaluation is a more trait-specific approach for selecting dairy animals for breeding.

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Lesson 4: Herd Management

Dairy herd management is an important part of dairy production. Dairy operations require a large investment and usually operate on narrow profit margins. Producers must be aware of many factors to run a successful dairy operation. These factors are production costs, facility requirements, raising replacement heifers, reproductive management, nutritional needs, methods of feeding, record keeping, and marketing milk.

Production Costs

Start up costs for dairy operations are quite high and require a large investment of capital. However, the types of production costs associated with dairy operations are very similar to other animal production systems. Dairy farms require more facilities than beef cattle production. Feed costs are the major cost of a dairy operation on a daily basis. Dairy operations are also extremely labor intensive, and the producer may have to hire outside help for milking. Other costs are marketing fees, fees for milk testing, veterinary fees and medicine, and building repair and maintenance.

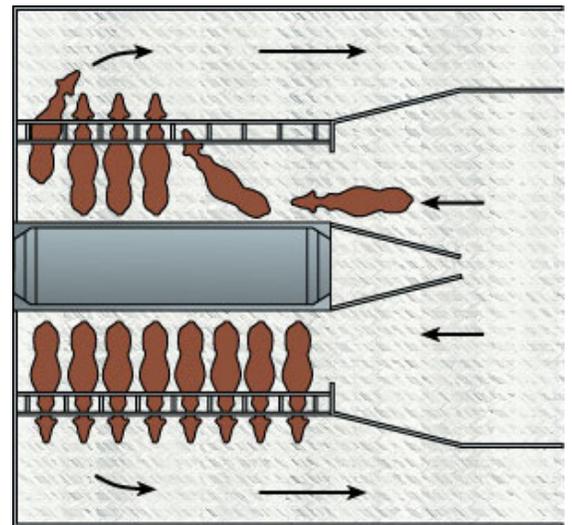
Dairy cattle can generate income from the sale of milk and cattle, including youngstock (calves and heifers), breeding bulls, and cull cows. The worksheet pictured in Figure 4.1 (see page 10) allows dairy producers to calculate income after deducting operating expenses. The producer can use this information on income and expenses to make management decisions that will allow him or her to lower costs and increase profits.

Facilities

Dairy production has extensive facility requirements. The basic dairy facility requirements are a milking parlor, free stall or stanchion barn, feed storage, waste storage, and heifer development facilities.

Milking parlors are required for modern dairies that produce Grade A milk, or milk that is pure enough to use for fluid milk consumption. Cows are brought to the milking parlor for milking. Modern parlors are computer controlled and highly automated. In the parallel milking parlor, illustrated in Figure 4.2, the cows stand at a 90° angle on both sides of a pit where the milkers stand.

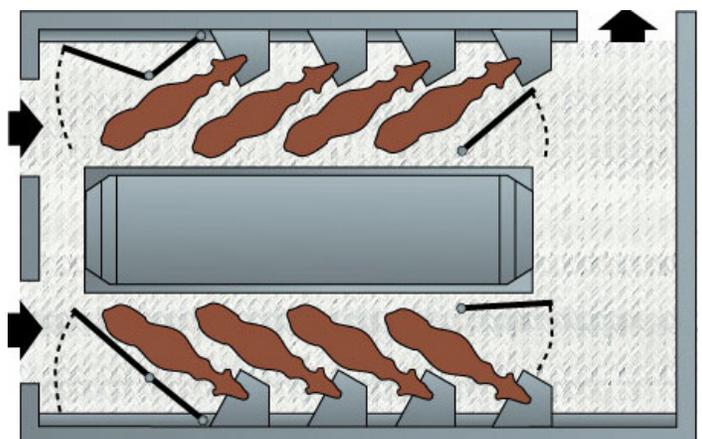
Figure 4.2 - Parallel Milking Parlor



between the hind legs. Another design is the herringbone design. In a herringbone milking parlor, cows stand at an angle on both sides of a pit. The design allows easy access to each cow's udder from the side for putting on and removing the milking units. A herringbone milking parlor is shown in Figure 4.3.

Cows spend most of their time in the pasture or in free stall or stanchion barns. Free stall barns have a series of separate stalls where cows can lay down. They can move freely between the stalls. Stanchion barns are similar to free stall barns, but a headgate or a chain and collar confine the cows to their stalls. The stanchion barn allows cows to be fed separately, and the amount of feed can be regulated according to their production level.

Figure 4.3 - Herringbone Milking Parlor



Introduction to Dairy Production

Figure 4.1 - Monthly Worksheet for a Dairy Operation

Monthly Worksheet

Name of farm: _____ Name of operator: _____ Month: _____

Gross income	Your farm	Example farm
1. (a) Pounds of milk sold for the month (from your milk check)		181,903
(b) Divide (a) by 100 to get milk sales in hundredweights		1,819
2. Gross milk price (\$ per hundredweight)		\$12.50
3. Compute gross milk sales by multiplying 1(b) by step 2		22,738
4. Livestock sales related to dairy		3,000
5. Capital revolvments and other dairy income		0
6. Add lines 3, 4 and 5 for total gross receipts		25,738
Variable expenses	Your farm	Example farm
7. (a) Market value of purchased concentrates, alternative feeds, vitamins and minerals		6,250
(b) Market value of purchased forages consumed		2,873
(c) Market value of home-raised grains consumed		667
(d) Market value of home-raised haylage and silage consumed		0
(e) Market value of home-raised hay consumed		0
8. Estimate the monthly value of pasture consumed		
(a) Average number of head on pasture for the month		20
(b) Monthly pasture charge		\$5
(c) Multiply (a) by (b)		100
9. Total 7(a) through 7(e) and 8(c) to compute the total value of feedstuffs consumed		9,890
10. Estimate the true cost of labor for the dairy enterprise		
(a) Amount spent for hired labor for the month (including benefits)		2,000
(b) Hours of unpaid family labor		330
(c) Value of family labor		\$5
(d) Multiply (b) and (c)		1,650
(e) Value of your operator labor		200 hours x 8 = 1,600
(f) Portion of time the labor force was used on the dairy enterprise		75%
(g) Add lines (a), (d) and (e) and multiply by (f)		5,250 x .75 = 3,938
11. Milk check deductions		1,764
12. Expenses for DHIA fees		200
13. Expenses for artificial insemination		283
14. Expenses for veterinary fees and medicine		500
15. Expenses for dairy supplies; the portion of the following costs related to the dairy only		667
16. Expenses for fuel and oil		.3 x 299 = 90
17. Utility bills		.5 x 558 = 279
18. Building repairs		208
19. Machinery repairs		.33 x 1,050 = 347
20. Farm taxes		0
21. Farm insurance		.5 x 300 = 150
22. Any legal and professional fees		.5 x 42 = 21
23. Car and truck expenses		.5 x 333 = 167
24. Other expenses		100
25. (a) Interest payments		1,567
(b) Portion of the interest payment that went for the dairy enterprise		75%
(c) Multiply (a) by (b)		1,175
26. Get estimate for annual depreciation expenses of dairy enterprise. Divide this by figure 12		642
27. Estimate total operating expenses by adding steps 9, 10(g), 11 through 24, 25(c) and 26		20,419
28. Estimate income over operating expenses by subtracting step 27 from step 6		5,318

From *How to Compute Your Cost of Producing Milk (G3651)*, University Extension agricultural publications, University of Missouri-Columbia.

Feed storage facilities are another requirement for dairy operations because of the large amount of feed fed to each cow. Upright silos and pit silos hold corn silage or haylage. Most dairies also have grain and bulk bins that hold prepared feeds or supplements.

Most dairies also require waste storage facilities because of the amount of production that takes place in confinement in barns, which generates a lot of manure. Producers may store wastes in lagoons and holding tanks. Lagoons are artificial waste holding areas that resemble ponds. A water-tight concrete or coated steel tank may also be used for manure storage. The tank may be above or below ground.

Finally, dairy farms usually raise their own replacement females. Producers usually raise heifers in hutches where each is kept individually until weaning. After weaning, they are moved to group pens to be raised.

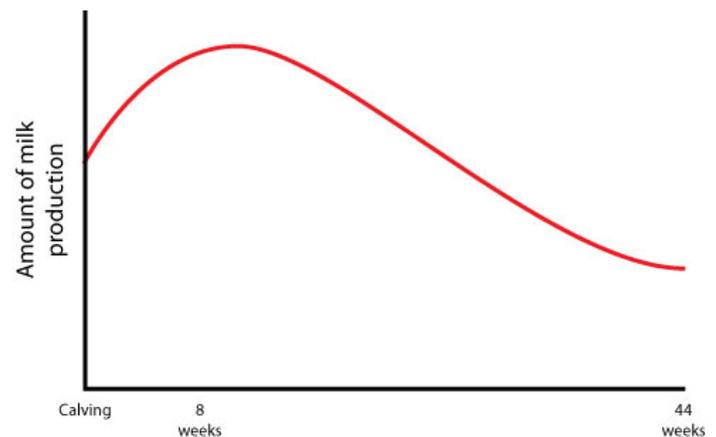
Raising Dairy Replacements

Many dairy producers raise their own replacement animals; other producers specialize in raising replacement heifers for other producers. Dairy producers who raise replacement heifers should consider the number of females needed each year as well as proper development. Heifers should be ready to calve at approximately 24 months of age and weigh 1,000 to 1,300 pounds, depending on the breed. Careful feeding is essential if heifers are to reach this weight at the right time for breeding. Small, thin heifers give less milk. Producers should also not allow heifers to become too fat. Research has shown that excessive fat deposits in the udder may reduce future milk production.

Reproductive Management

Good reproductive management is essential for success in the dairy industry. Cows must become pregnant and calve for milk production, or lactation, to begin. Lactation normally peaks at approximately eight weeks after calving. It then slowly declines, as shown on the graph in Figure 4.4.

Figure 4.4 - Lactation Curve



Cows must be rebred between 40 and 100 days after calving to maintain the cycle of milk production. The producer should “dry off,” or stop milking, the cows at approximately 40 to 50 weeks of lactation, depending on the level of milk production and the expected calving date. Most dairy operators will dry cows off when milk production dips below 35 to 40 pounds daily. The dry period with no milk production allows the cow to replenish her body and rest and prepare to have her next calf. The dry period should last 40 to 70 days, with an average of 60 days. When the cow gives birth, the lactation cycle begins again.

Most dairy cows are artificially inseminated. Artificial insemination (AI) permits the dairy producer to use bulls that are genetically superior. It also helps control the spread of reproductive diseases. Artificial insemination permits producers to keep more accurate records about reproduction, including breeding dates used to calculate the expected calving dates needed to figure the proper dry period. Artificial insemination is also used because of the problems associated with keeping a dairy bull on the farm, since dairy bulls are often very aggressive. Some producers also use embryo transfer to increase the spread of superior genetics in the herd by using superior cows.

Nutritional Requirements

Dairy cattle have the same basic nutritional needs as all animals. Dairy cattle require energy (from carbohydrates and fats), protein, vitamins, minerals, and water. However, lactating dairy cows produce a lot of milk, and they therefore require large quantities of feed stuffs. The cow’s nutritional needs are highest when lactation peaks.

Introduction to Dairy Production

Lactating cows consume 3 to 4 percent of their body weight as dry matter. A 1,000 pound dairy cow would require 30 to 40 pounds of dry feed per day. Roughages (forages) should make up at least 40 percent of the diet to maintain correct microbe populations in the rumen. The cow's production level (pounds of milk produced daily) and body condition (thin to fat) determine the exact nutrient needs of the cow. The poorer a cow's body condition is, the higher her nutritional requirements will be; poor body condition also affects the lactation curve, which will not peak as high.

Feeding Dairy Cattle

Dairy producers can meet the nutritional needs of their cattle through different feeding methods. The traditional feeding method involves feeding forages and grain separately. Producers may feed the forages as pasture or as hay or silage. Protein supplements, or concentrates, are added to the diet to increase the amount of protein. They may be fed in the barn mangers or in the milking parlor during milking.

Management-intensive grazing can also be used effectively in dairy production. With management-intensive grazing, producers rotate cows between grazing units in a preplanned cycle; they are moved when they consume the forages on the grazing unit. This type of grazing system helps lower costs by reducing the costs associated with equipment for harvesting forages and purchased feeds.

A method of feeding that is becoming more common is feeding a total mixed ration (TMR). A total mixed ration is a mixture of all the feed ingredients needed by dairy cattle, including forages, grain, and supplements; the cattle receive all these components of their diet at once. The advantages of total mixed rations include being able to feed a precisely balanced ration and reduced labor. However, special equipment for weighing and mixing the ration must be purchased; existing facilities may also need to be modified to feed total mixed rations.

Record Keeping in Dairy Operations

Proper record keeping is essential to successful dairy production. Dairy producers should record milk weights and milk composition test results and breeding and calving information for all the cows in their herd.

Milk composition test results are available from the Dairy Herd Improvement Association (DHIA). DHIA is a recording service that monitors and records information on milk production levels and milk composition for individual cows. The association also transfers records to the respective breed associations. Independent personnel collect these records to maintain the accuracy of the data. DHIA is a voluntary association, but many producers use its resources and services.

Dairy producers should also record when cows are bred and when they calve to maintain maximum production per cow. Producers who use registered animals are required to provide actual birth dates and pedigrees listing the animal's ancestors for each animal registered with the breed association.

Marketing Milk

Most of the milk sold is marketed through cooperatives, such as Mid-America Dairymen (Mid-Am). The producer is a member of the cooperative and sells milk directly to it. The cooperative combines milk from many producers. A larger quantity of milk gives it more marketing flexibility; the cooperative also has more options for places where the milk may be shipped.

The federal government sets base milk prices for producers to keep consumer milk prices fairly constant throughout the year. Producers receive bonuses based on the fat and protein content of their milk, low bacteria counts, and low somatic cell counts. Somatic cells are white blood cells, which fight infections. A low somatic cell count indicates that the herd is healthy.

Summary

Dairying generally requires a significant investment. It has many associated costs, including large capital outlays for facilities and cows. Dairy operators must manage production carefully, be good nutritionists, and keep accurate records for success in the dairy industry. The United States government sets the base milk price received by producers. Most milk is marketed through a cooperative.

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Introduction to Dairy Production

Lesson 5: Head Health

Dairy production is similar to other livestock production systems in the sense that dairy producers must maintain high levels of herd health to be successful. Producers must be able to recognize, treat, and prevent health problems.

Common Dairy Health Concerns

Dairy producers encounter many herd health challenges. Dairy cattle are susceptible to all of the diseases that affect beef cattle. However, health problems affecting the ability of a dairy cow to produce high quality milk are by far the most serious. If a dairy cow loses her ability to produce milk, she is no longer useful to the producer. Major dairy health concerns are milk fever, ketosis, foot rot, hairy heel warts, laminitis, and mastitis.

Milk fever - Milk fever results from a calcium imbalance in dairy cattle and involves abnormally low levels of calcium in the blood. Cows usually become ill after they begin lactation. Milk fever seems to be more prevalent in older high-producing animals. Symptoms include loss of appetite, staggering, and paralysis. If untreated, milk fever can cause death. A veterinarian can treat this illness by giving cows an intravenous injection of calcium. Prevention of milk fever involves feeding rations with correct levels of calcium and phosphorus to dry cows.

Ketosis - Ketosis is a nutritional problem. Cows that are underfed during the period of high lactation shortly after calving may develop ketosis. It causes reduced milk production. Other symptoms include weight loss and a fruity odor to the cow's breath and milk. Ketosis may be treated with injections of glucose or hormones. Feeding high energy diets to lactating dairy cattle can prevent this disorder.

Foot rot - Foot rot is caused by a wound between the toes. Symptoms are lameness, swelling, fever, decreased appetite, and a sharp decrease in milk production. Foot baths and antibiotics are used to control and treat the disease.

Hairy heel warts - This disease causes an extremely painful growth on the skin on the heels of the rear feet. Cows may avoid putting weight on their heels. The disease is also associated with decreased milk production. The infected area may be treated with the use of antibiotic sprays.

Laminitis - Laminitis, or founder, is caused by high concentrate levels combined with insufficient levels of long fiber from forages for adequate cud chewing. This creates acidic conditions in the rumen. Symptoms include lameness and poor milking performance. Producers can prevent laminitis by careful management of feeding. Aggressive foot trimming may be required as well.

Mastitis - Of all the dairy diseases, mastitis causes the greatest economic losses. Countless dollars are lost through reduced milk sales resulting from mastitis each year. Mastitis is an infection of the cow's udder caused by bacteria entering the udder through a teat. The disease may also result from an injury to the cow's udder. It has an acute form and a chronic form.

Clinical or acute mastitis is easy to detect because the cow's udder is severely swollen, and the milk is bloody or clotted. Cows with clinical mastitis may show a loss of appetite. Their milk production is severely reduced.

Subclinical or chronic mastitis is harder to recognize because the symptoms are not as easy to see. Cows with the subclinical form of the disease usually have decreased milk production and an elevated somatic cell count. The milk may appear normal to the herd manager, or it may be a little watery.

Prevention and Control of Mastitis

Because of the potential for economic losses to a dairy program from mastitis, prevention and control is critical to successful dairy operations. Proper sanitation is one of the most important parts of mastitis prevention. Milking equipment must be sanitary to keep cows from being infected by the milking units. Before milking, milkers should strip the teats, removing a small amount of milk that is higher in bacteria. They should then wash and dry the teats before attaching the milking units. After milking is completed, the teats should be dipped in an acceptable disinfectant. Milkers may also predip the teats before milking instead of washing them.

Producers should give tests at least once every month to detect the high somatic cell counts caused by subclinical mastitis. The California Mastitis Test (CMT) is one test used to look for mastitis in the herd. Producers can administer

Introduction to Dairy Production

this test themselves. Laboratory tests can be used to determine somatic cell counts more accurately.

Producers also try to keep infections from starting during the dry period. They treat the cow's mammary glands with long-lasting antibiotics that will combat infections and prevent mastitis.

If cows do suffer from mastitis, prompt treatment is essential. Producers can treat cows in several ways. Milking the cow frequently is one method; the toxins causing the infection can be milked out with repeated milkings. Some producers give cows an injection of oxytocin, which is a naturally occurring hormone causing milk secretion. The additional oxytocin allows the cow to be more completely milked out with a normal milking routine. Cows may also be given antibiotics to treat mastitis. However, the milk from cows treated with most antibiotics must be discarded instead of sold.

Health Concerns of Raising Replacements

Producers separate most dairy replacements from their dams at a very young age, usually within one to three days after calving. They then put the lactating cows into production. After the calves are segregated, they are switched to a powdered milk replacer and started on grain after several weeks.

Several diseases can affect replacement dairy heifers. Diarrhea, or scours, is the biggest health concern of raising replacements. This disorder can cause severe dehydration if not properly treated. Other health problems include reproductive diseases such as brucellosis and leptospirosis. Brucellosis causes abortions, sterility, and reduced milk production. Leptospirosis also causes abortion. Diseases like infectious bovine rhinotracheitis (IBR), pasteurilla (PI3), bovine virus diarrhea (BVD), and blackleg are also of concern to producers.

Producers must vaccinate their replacement heifers to prevent these diseases. Heifers should be vaccinated against IBR, PI3, BVD, and blackleg between weaning and eight months of age, with boosters given as appropriate. Heifers should be vaccinated against brucellosis at four to seven months of age. They should be vaccinated against leptospirosis and other reproductive diseases before

breeding. Producers should consult their local veterinarian and/or animal health supplier for the exact timing of all vaccinations.

Routes of Administration

Producers can administer animal health products in a variety of ways. Common routes of administration are intramuscular, subcutaneous, oral, intranasal, and intravenous. They are illustrated in Figure 5.1.

Intramuscular (IM) - Intramuscular injections are made into the muscle. They should be given in the neck, never along the back or hip of the animal. Intramuscular injections are used for antibiotics and some vaccines.

Subcutaneous (Sub-Q) - Subcutaneous injections are given between the skin and muscle. They should be given in the loose skin on the side of the neck. This route is recommended because of the potential for tissue damage when injections are given into muscle tissue.

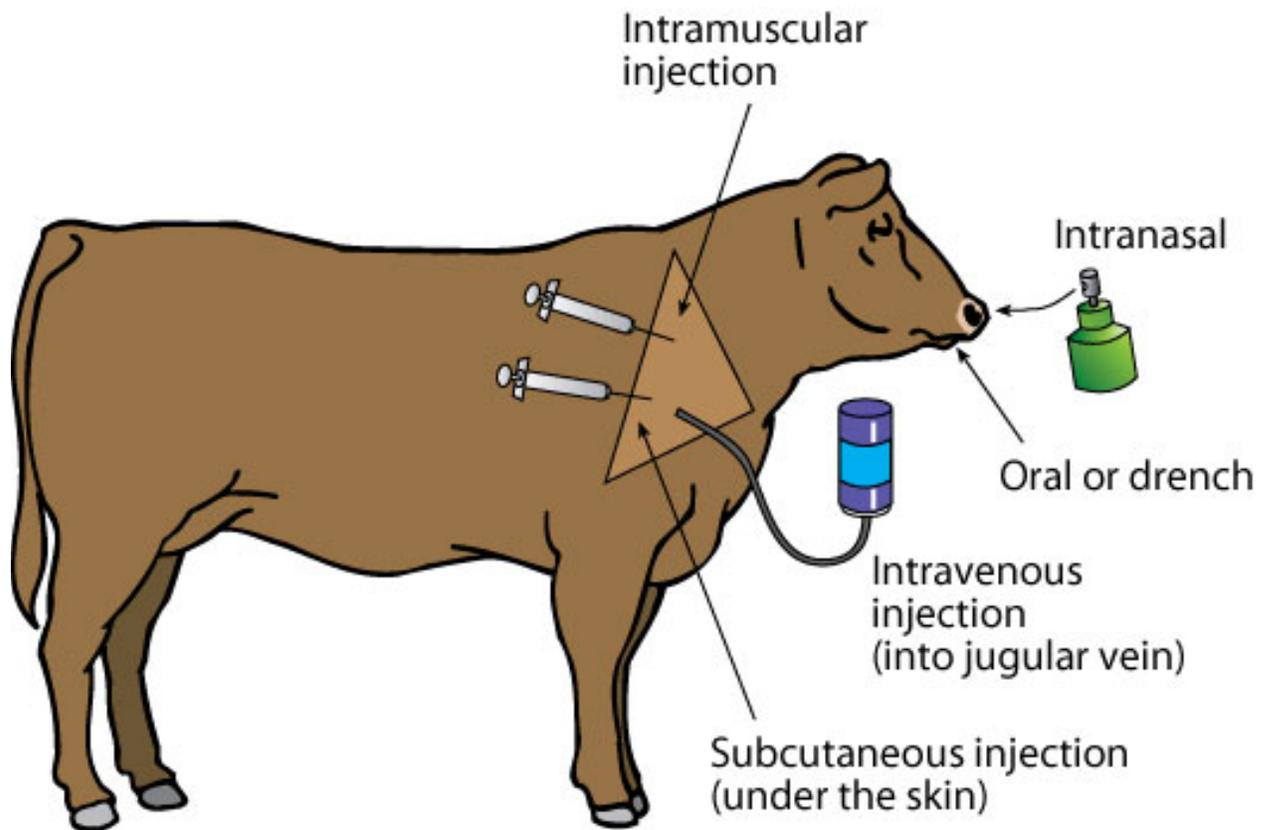
Oral - An oral, or drench, is given through the animal's mouth. Dewormers and some vaccines are given orally.

Intranasal (IN) - Like nasal sprays used by humans, intranasal vaccines are sprayed into the nasal cavity.

Intravenous (IV) - Intravenous treatments are given directly into the jugular vein of the animal. Either injections or actual drip IVs can be administered in this way.

Subcutaneous injections should be used whenever possible when injecting vaccines, but directions must be read and followed exactly! Dairy producers should always consult with their veterinarian first before giving any medical products to their animals. They should also read the labels on vaccines, dewormers, or medicine to check on the proper routes of administration, expiration date, and use of the product. The producer should be aware of withdrawal dates, which indicate the number of days after the injection is given before the cow's milk can be sold. Special precautions must be taken when using any animal health product on or around lactating cows. Producers must be certain that the product is approved for lactating cows.

Figure 5.1 - Routes of Administration



Summary

Dairy producers must be able to recognize and treat diseases in lactating cows such as milk fever, ketosis, and mastitis. Of these diseases, mastitis has the biggest economic impact because of losses in milk production. Producers should also be aware of health concerns for replacement heifers, since their health will affect future production. Any medications given to treat dairy cattle must be used correctly.

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Introduction to Dairy Production

Lesson 6: Industry Issues

The American public is becoming more aware of agricultural production practices. People unfamiliar with animal agriculture frequently do not fully understand modern livestock management techniques. Dairy producers must be educated about industry issues to be able to address them effectively.

Consumer Concerns

American consumers are concerned about waste management, the use of medications in lactating cows, and animal welfare.

Dairy production often takes place on a large scale and partially in confinement settings. Dairy cattle kept in confined areas produce large amounts of waste. Consumers worry that improperly handled, untreated wastes will contaminate ground and surface water.

Drugs given to lactating cows also concern the public. People sometimes fear that medications given to lactating cows end up in fluid milk. They believe that these drugs may be harmful to humans, since they are meant for use in cattle.

The welfare of dairy cattle is a third issue of concern to consumers. They are worried about how management practices affect animal comfort and well-being. Consumers fear, for example, that cows and calves do not have sufficient freedom to move around and that cattle may not always be adequately supplied with shade and shelter.

Addressing Consumer Concerns

Dairy producers and the dairy industry are working to address consumer concerns about waste management, medications, and animal welfare. The National Milk Producers Federation and the Milk and Dairy Beef Quality Assurance Center are two industry organizations that provide information to producers about practices that might concern consumers. Their goal is to improve the quality of milk and dairy beef products by educating producers about management practices. The industry is also working to educate consumers about dairy production.

The industry is educating dairy producers about proper waste storage, management, and land application of wastes to avoid incidents that could damage the industry. Dairy producers must be aware of environmental laws and conscious of their part in preserving the environment.

The industry organizations mentioned above have initiated Milk and Dairy Beef Quality Assurance programs. They are designed to educate producers about management practices that can help them produce high quality milk and pure beef products. The voluntary programs focus on several points that can help producers improve their milk, including proper herd health management, sanitation, feeding, and record keeping.

Information on taking care of dairy cattle is also available to educate producers about management practices that will ensure animal welfare. For example, the American Farm Bureau and other dairy-related agencies have produced a two-part series of booklets about caring for dairy animals. The goal of producers is to provide care that results in productive, healthy, contented cows.

Food Safety

The consumers of American dairy products can be sure that products are safe because of inspections by the United States Department of Agriculture (USDA) and state regulatory agencies. State inspections are generally carried out twice a year to look at factors such as drug usage and sanitation in the milking parlor. When milk is picked up from the producer, samples are tested for contaminants at both the farm and the processing plant to confirm that the milk is safe for fluid use or for further processing into products such as cheese, ice cream, and yogurt. Milk that is unfit for human use is added to animal feeds or dumped. Milk quality is monitored from the time it leaves the dairy until it reaches the consumer's home.

Conclusion

Dairy producers must address the concerns of the consumers of dairy products. By learning more about these issues and improving their management practices, producers can show that they can produce safe dairy foods in an environmentally conscious way. Industry groups and

Introduction to Dairy Production

producers are also working to educate consumers about dairy production and the safety of dairy products. The USDA plays an important role in assuring the safety of these foods.

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