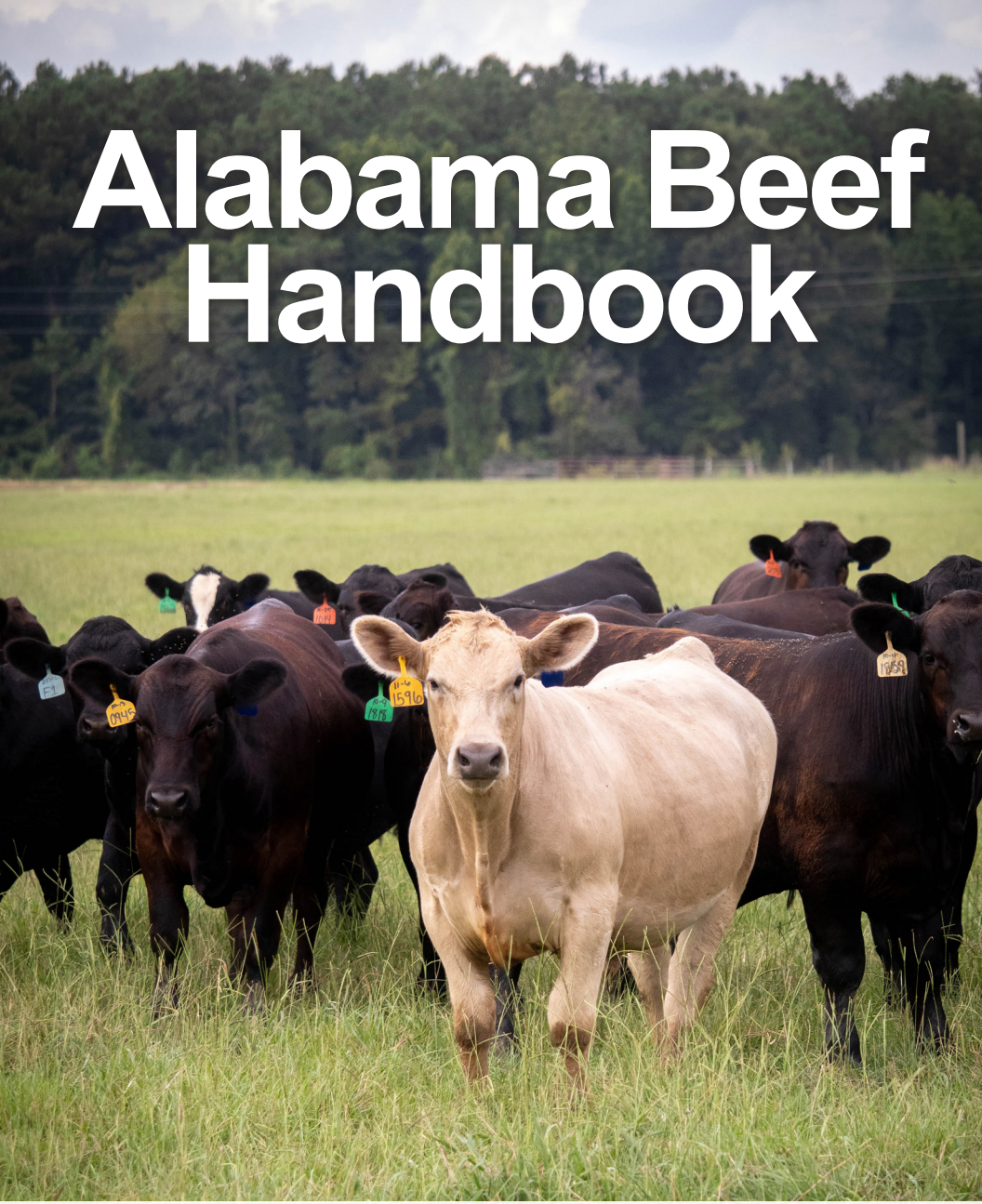
Alabama Beef Handbook



ALFA FARMERS

AUBURN

extension
ALABAMA A&M and AUBURN UNIVERSITIES

ALABAMA CATTLEMEN'S ASSOCIATION

Alabama Beef Handbook

Providing Alabama beef producers with Extension-based research and practices to aid with risk management, improve profitability, and maintain competitiveness in today's cattle industry

Preface

Beef cattle represent one of the largest segments of Alabama's agriculture industry, providing a great source of income for the state. This handbook explains basic beef cattle practices and is intended to aid beef cattle producers in today's business. The recommendations and guidelines suggested in this guide address common questions and concerns about running a profitable beef cattle business.

The authors do not assume any responsibility, make any guarantees, or offer any warranties in regard to the results obtained from the use of any management practices or suggestions made in this guide.

The following contributed to this guide:

- **Kim Mullenix**, *Department Head and Professor, Animal Sciences, Auburn University*
- **Soren Rodning**, *Extension Specialist, Professor, Animal Sciences, Auburn University*
- **Lisa Kriese-Anderson**, *Professor Emeritus, Animal Sciences, Auburn University*
- **Michelle Elmore**, *Associate Extension Professor, Animal Sciences, Auburn University*
- **Brittney Goodrich**, *Former Extension Specialist, Auburn University*
- **Leanne Dillard**, *Extension Specialist, Associate Professor, Animal Sciences, Auburn University*
- **W. Ken Kelley**, *Extension Agent, Farm and Agribusiness Management, Auburn University*
- **Max Runge**, *Extension Professor, Agricultural Economics and Rural Sociology, Auburn University*
- **D. Alex Tigue**, *Former Extension Agent, Auburn University*
- **Rishi Prasad**, *Extension Specialist, Associate Professor, Crop, Soil, and Environmental Sciences, Auburn University*
- **M. Kent Stanford**, *Associate Extension Professor, Crop, Soil, and Environmental Sciences, Auburn University*
- **Josh Elmore**, *Extension Agent, Animal Sciences and Forages, Auburn University*
- **Court Green-Johnson**, *Extension Agent, Animal Sciences and Forages, Auburn University*

Acknowledgments: The contributing authors wish to thank **Mary Kendall Dixon**, designer, for her contributions to the original design of this handbook.

Front cover photo credit: Alabama Cattlemen's Association.

This publication was made possible by funding from Alabama cattle producers and the Alabama Cattlemen's Association through its state Beef Checkoff program, the Alabama Farmers Federation, the ALFA State Beef Committee, the United States Department of Agriculture National Institute of Food and Agriculture, and the Southern Risk Management Education Center (Project 13689).

Table of Contents

Forage Management

Forage Crops

Forage crops make invaluable contributions to the total ecosystem in which we live. Forages provide most of the nutrition for beef cattle, dairy cattle, and sheep. They also supplement the diets of many other farm animals, including horses, swine, and goats. In addition, they provide food and shelter for countless species of wildlife.

Forage crops are important in rotations with row crops and horticultural crops. They are a primary source of pollen and nectar for bees and in the production of honey. They also add immeasurable beauty to the countryside. More significantly, they protect the soil from erosion and thus make a major contribution to improving the quality of our water.

The immense significance of forage crops is revealed by a single statement: Forage crops occupy more open land in Alabama than all other crops combined.

Categories of Forage Crops

More than forty species of forage crops are commonly grown in Alabama. Each is normally distinguished as being the following:

- A grass or a legume
- An annual or a perennial
- A warm-season or cool-season plant

Use of these criteria creates eight basic categories that include all commonly used Alabama forages.

Table 1. Forage Grasses and Legumes

	Adaption		Seeding Rate* (pounds/acre)	Planting Depth (inches)	Optimum Planting Date
	Area[1]	Soils			
Grasses					
Warm-Season Perennials					
Bahiagrass	C, S	Moist, sandy bottoms to droughty uplands	B[2]: 15–20	1/4–1/2	Early spring after frost; S only: late summer and fall
Bermudagrass (seed propagated)	N, C, S	Well drained, light sand to clay loam	Hulled B: 5–10 Unhulled B: 10–15	1/4–1/2	March–early summer
Bermudagrass (vegetatively propagated)	N, C, S	Well drained, light sand to clay loam	Rows: 10 bushels (sprigs) B: 30–40 bushels (sprigs)		Late Feb.–early summer when soil moisture is adequate
Dallisgrass	N, C, S	Moist, fertile, well drained	B: 10–15	1/4–1/2 (Germination is often low; adjust rate accordingly.)	Feb.–March
Johnsongrass	N, C, S	Medium to heavy	B: 20–30 D[3]: 10–15	1/2–1	April–July

[1]N = north, C = central, S = south; [2]B = broadcast; [3]D = drilled

*All seeding rates based on pure live seed (PLS)

Table 1. Forage Grasses and Legumes (cont.)

	Adaption		Seeding Rate* (pounds/acre)	Planting Depth (inches)	Optimum Planting Date
	Area[1]	Soils			
Grasses					
Warm-Season Annuals					
Crabgrass	N, C, S	Well drained, pH 5.8–7.5	3–5	1/4–1/2	Late Feb.–April
Pearl millet	N, C, S	Well drained, fertile (Avoid lime in Black Belt soils.)	D[2]: 12–15 B[3]: 20–25	1/2–3/4	N: April–July C: April–July S: April–July
Sorghum-sudan hybrids	N, C, S	Well drained, productive	D: 12–15 B: 15–20	1/2–1	N: May–Aug. C: April–Aug. S: April–Aug.
Sorghum, sweet and forage	N, C, S	Well drained	B: 8–12 Silage: D: 4–6	1–2	Late April–May S: as late as July 1 for forage sorghum

[1]N = north, C = central, S = south; [2]D = drilled; [3]B = broadcast

*All seeding rates based on pure live seed (PLS)

Table 1. Forage Grasses and Legumes (cont.)

	Adaption		Seeding Rate* (pounds/acre)	Planting Depth (inches)	Optimum Planting Date
	Area[1]	**Soils**			
Grasses					
Cool-Season Perennials					
Tall fescue	N, C	Moist, fertile bottoms, productive uplands	B[2]: 15–20 D[3]: 10–15	1/4–1/2	Sept.–Oct.
Orchardgrass	N	Well drained, medium to heavy, fertile	D: 15–20	1/4–1/2	Sept.–Oct.
Cool-Season Annuals					
Oat, rye, wheat, triticale	N, C, S	Well drained, sandy to clay loams	D: 60–90 B: 90–120	1–2	N: Sept.–Oct. C: Sept.–Oct. S: Sept.–Nov. Overseeded: 5 weeks later
Annual ryegrass	N, C, S	Clay loam to sandy	B: 25–30 D: 15–25	0–1/2	N: Sept.–Oct. C: Sept.–Oct. S: Sept.–Nov. Overseeded: 5 weeks later

[1]N = north, C = central, S = south; [2]B = broadcast; [3]D = drilled

*All seeding rates based on pure live seed (PLS)

Table 1. Forage Grasses and Legumes (cont.)

	Adaption		Seeding Rate* (pounds/acre)	Planting Depth (inches)	Optimum Planting Date
	Area[1]	Soils			
Legumes					
Warm-Season Perennials					
Sericea lespedeza	N, C, S	Well drained (Avoid lime soils of Black Belt.)	B[2]: 20–30 D[3]: 15–20	1/4	March–May
Perennial peanut	S	Well drained, sandy	V[4]: 60–80 bushels (sprigs)		Dec.–early March
Annuals					
Alyceclover	S	Fertile, well drained	B: 15–20	1/4–1/2	May 15–July 15
Cowpea	N, C, S	Well drained	D: 30–40 B: 120	3/4–1¼	May 1–June 15
Sunn hemp	N, C	Well drained (Avoid lime soils of Black Belt.)	B: 25–30	1/4–1	Feb. 15–March 15

[1]N = north, C = central, S = south; [2]B = broadcast; [3]D = drilled; [4]V = vegetatively propagated

*All seeding rates based on pure live seed (PLS)

Table 1. Forage Grasses and Legumes (cont.)

	Adaption		Seeding Rate* (pounds/acre)	Planting Depth (inches)	Optimum Planting Date
	Area[1]	Soils			
Legumes					
Cool-Season Perennials					
Alfalfa	N, C, S	Deep, fertile, well drained	B[2]: 20–25	0–1/4	N: Aug. 15–Oct. 1 C: Sept. 1–Oct. 1 S: Oct. 1–Nov. 1
White and ladino clover	N, C, S	Moist bottoms and productive uplands	B: 2–3	0–1/4	Sept.–Oct. (also Feb.–March in N,C)
Red clover (acts as annual in South Alabama)	N, C, S	Moist bottoms and productive uplands	D[3]: 6–10 B: 12–15	1/4 –1/2	Sept.–Oct.

[1]N = north, C = central, S = south; [2]B = broadcast; [3]D = drilled

*All seeding rates based on pure live seed (PLS)

Table 1. Forage Grasses and Legumes (cont.)

	Adaption		Seeding Rate* (pounds/acre)	Planting Depth (inches)	Optimum Planting Date
	Area[1]	Soils			
Legumes					
Cool-Season Annuals					
Black medic	Black Belt	Lime soils	B[2]: 10	0–1/4	Sept.–Oct.
Caley pea	Black Belt	All Black Belt soils, pH 6.5 or higher	B: 50	1/2–1	Sept.–Oct. 15
Arrowleaf clover	N, C, S	Well drained, medium to highly fertile	B: 5–10 (scarified seed)	0–1/2	N: Sept. 1–Oct. 1 C: Sept. 15–Oct. 15 S: Sept. 15–Nov. 1 Overseed: 5 weeks later
Ball clover	N, C, S	Sandy loam to clay, tolerates moist soils	B: 2–3	0–1/2	Sept.–Oct.
Crimson clover	N, C, S	Well drained (Avoid lime soils of Black Belt .)	B: 20–30 D[3]: 15–20	0–1/2	N: Sept. 1–Oct. 1 C: Sept. 15–Oct. 15 S: Sept. 15–Nov. 1 Overseed: 5 weeks later

[1]N = north, C = central, S = south; [2]B = broadcast; [3]D = drilled

*All seeding rates based on pure live seed (PLS)

Table 1. Forage Grasses and Legumes (cont.)

	Adaption		Seeding Rate* (pounds/acre)	Planting Depth (inches)	Optimum Planting Date
	Area[1]	**Soil**			
Legumes					
Cool-Season Annuals					
Subterranean clover	N, C, S	Well drained, productive	B[2]: 8–10	1/4–1/2	Sept.–Oct.
Common vetch	N, C, S	Well drained	B: 30–40	1–1½	N: Sept. 1–Oct. 15 C: Sept. 1–Oct. 15 S: Sept. 15–Nov. 1
Hairy vetch	N, C, S	Well drained	B: 20–25	1–1½	N: Sept. 1–Oct. 15 C: Sept. 1–Oct. 15 S: Sept. 15–Nov. 1

[1]N = north, C = central, S = south; [2]B = broadcast

*All seeding rates based on pure live seed (PLS)

Table 2. Characteristics of Forage Grasses and Legumes

	Tolerance to				
	Seeding Vigor	**Soil Acidity**	**Poor Drainage**	**Drought**	**Grazing**
Warm-Season Perennial Grasses					
Bahiagrass	P	E	G	E	E
Bermudagrass	F	E	P	E	E
Dallisgrass	P	F	E	G	G
Johnsongrass	G	F	E	G	P
Switchgrass	P	F	F	E	P
Warm-Season Annual Grasses					
Crabgrass	G	G	P	F	E
Pearl millet	E	E	P	E	F
Sorghum	G	P	P	E	F
Sorghum × sudan	E	P	F	G	F

E = excellent, G = good, F = fair, P = poor
Nongrazing-tolerant varieties; grazing-tolerant varieties rated G
Adapted from *Southern Forages: Modern Concepts for Forage Crop Management*, 5th ed.

Table 2. Characteristics of Forage Grasses and Legumes (cont.)

	Tolerance to				
	Seeding Vigor	**Soil Acidity**	**Poor Drainage**	**Drought**	**Grazing**
Cool-Season Perennial Grasses					
Orchardgrass	F	F	F	F	G
Tall fescue	G	G	G	G	E
Cool-Season Annual Grasses					
Annual ryegrass	G	G	E	F	E
Oats	E	F	F	F	G
Rye	E	G	F	F	G
Triticale	E	F	F	F	G
Wheat	E	P	G	F	G

E = excellent, G = good, F = fair, P = poor
Nongrazing-tolerant varieties; grazing-tolerant varieties rated G
Adapted from *Southern Forages: Modern Concepts for Forage Crop Management*, 5th ed.

Table 2. Characteristics of Forage Grasses and Legumes (cont.)

	Tolerance to				
	Seeding Vigor	**Soil Acidity**	**Poor Drainage**	**Drought**	**Grazing**
Warm-Season Perennial Legumes					
Perennial peanut	V	G	P	G	F
Sericea lespedeza	P	E	F	E	P
Warm-Season Annual Legumes					
Annual lespedeza	F	E	F	G	G
Sunn hemp	G	G	P	G	F

E = excellent, G = good, F = fair, P = poor, V = vegetatively propagated
Nongrazing-tolerant varieties; grazing-tolerant varieties rated G

Adapted from *Southern Forages: Modern Concepts for Forage Crop Management*, 5th ed.

Table 2. Characteristics of Forage Grasses and Legumes (cont.)

	Tolerance to				
	Seedling Vigor	**Soil Acidity**	**Poor Drainage**	**Drought**	**Grazing**
Cool-Season Perennial Legumes					
Alfalfa	G	P	P	E	P–G
Red clover	E	F	F	F	F
White and ladino clover	F	F	G	P	E
Cool-Season Annual Legumes					
Arrowleaf clover	F	F	P	F	G
Ball clover	P	F	E	F	F
Berseem clover	G	P	E	F	F
Caley pea	G	F	G	F	F
Crimson clover	E	G	P	F	F
Hairy vetch	E	G	P	F	F
Subterranean clover	G	G	G	F	E

E = excellent, G = good, F = fair, P = poor

Nongrazing-tolerant varieties; grazing-tolerant varieties rated G

Adapted from *Southern Forages: Modern Concepts for Forage Crop Management*, 5th ed.

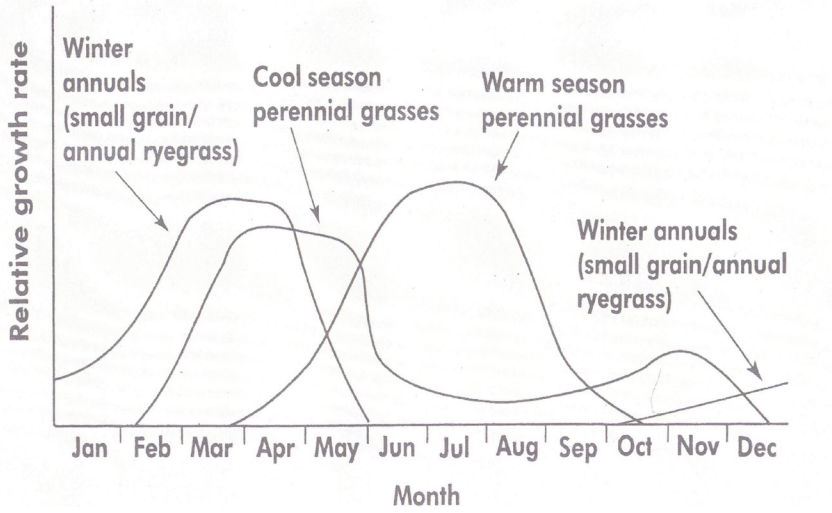


Figure 1. Usual distribution of growth of various categories of forage crops. Adapted from *Southern Forages: Modern Concepts for Forage Crop Management*, 5th ed.

Select Grazing Terms

Grazing method. A defined method of grazing management designed to achieve a specific objective.

Grazing system. An integrated combination of animal, plant, soil, and environment, along with one or more grazing methods designed to achieve a specific goal.

Stockpiling forages. Deferring grazing and allowing forage to accumulate until a later period.

Continuous stocking. A grazing method where animals have unrestricted access to the entire unit of land throughout the grazing season.

Forward grazing. A grazing method where two or more groups of animals with different nutritional requirements graze sequentially on the same area (synonyms: first-last grazing, leader-follower, top and bottom grazer).

Rotational stocking. A grazing method that rotates periods of grazing and periods of rest on the same unit of land, moving animals among two or more paddocks in the system.

Set stocking. Grazing a fixed number of animals on a fixed land area during the grazing season.

Strip grazing. A grazing method that confines animals to a small strip of area for a relatively short period of time before each rest period (synonym: intensive rotational grazing).

Table 3. Guidelines for Rotational Stocking of Selected Forage Crops[1]

	Target Height (inches)		
Forage Crop	**Begin Grazing**	**End Grazing[2]**	**Usual Days of Rest**
Alfalfa (hay types)	10–16	3–4	28–35
Alfalfa (grazing types)	10–16	3–4	28–35
Bahiagrass	10–14	3–4	10–20
Bermudagrass	10–14	4–6	25–30
White and subterranean clovers[3]	8–10	3–5	20–35
All other clovers[3]	8–10	3–5	20–35
Dallisgrass	8–10	3–4	7–15
Tall fescue	8–12	4–8	15–30
Johnsongrass	16–20	8–12	30–40
Orchardgrass	8–12	4–8	15–30
Pearl millet	20–24	8–12	20–30
Annual ryegrass	6–12	3–4	15–30
Sericea lespedeza	8–15	4–6	20–30
Rye, wheat, oat, triticale	8–12	3–4	15–30
Forage sorghum	20–24	8–12	15–20
Sorghum × sundangrass hybrids	20–24	8–12	15–20

Adapted from *Southern Forages: Modern Concepts for Forage Crop Management*, 5th ed.

[1]These are merely guidelines. Stocking rates and growing conditions greatly affect forage growth. Also, the more closely pastures are grazed, the longer the rest period generally needs to be for forages that are sensitive to defoliation.

[2]When deciding when to end grazing, consider the nutritional requirements of the livestock being grazed. The closer a pasture is grazed, the lower the forage quality will be toward the end of that particular grazing cycle.

[3]Clovers are typically grown in pastures in mixtures with grasses. White clover and subterranean clover are quite tolerant of close defoliation; most other clovers are not.

Major Benefits of Improved Grazing Management[1]

- Forage plants have better cold and drought tolerance due to better root systems resulting from prevention of overgrazing.
- Weed problems are fewer due to reduced opportunity for selective grazing; livestock are forced to eat weeds, thus making it more difficult for weeds to survive and to make seed.
- Forage plants can be managed for reseeding in connection with other pasture management objectives.
- Forage plants are vigorous and regrow more quickly after being grazed, thus making them more competitive.
- Higher-quality forage can be provided to animals that have the highest nutritional requirements. Techniques to accomplish this include creep grazing and forward grazing (see Grazing Terms).
- Soil quality in pastures improves over time due to higher organic matter levels, better soil structure, and less compaction.
- Water quality improves resulting from reduced erosion in pastures or from grazing management that minimizes contamination of surface water by particulate matter or by bacteria and nutrients in waste.
- Runoff is less due to presence of sod that holds water and has a higher water infiltration rate and to increased water-holding capacity of the soil.
- Livestock are gentler, easier to observe, less inclined to tear down fences, and easier to work.
- Livestock can be used to “trample in” seed by concentrating high numbers of animals in an area for a short period of time.
- Livestock have less opportunity to overgraze certain plants or pasture areas. Plants that are not tolerant of being grazed closely or frequently are ensured rest.
- Nutrient recycling is more efficient due to more even distribution of dung and urine in pastures.
- Pasture height can be kept close to optimum more of the time, thus reducing leaf aging, leaf drop, and increased fiber content of forage. This results in a higher-quality diet for grazing animals (figure 2).
- Livestock internal parasite problems are reduced as a result of avoiding grazing pastures too closely.

[1]Not all benefits will be realized at the same time, but all are possible.

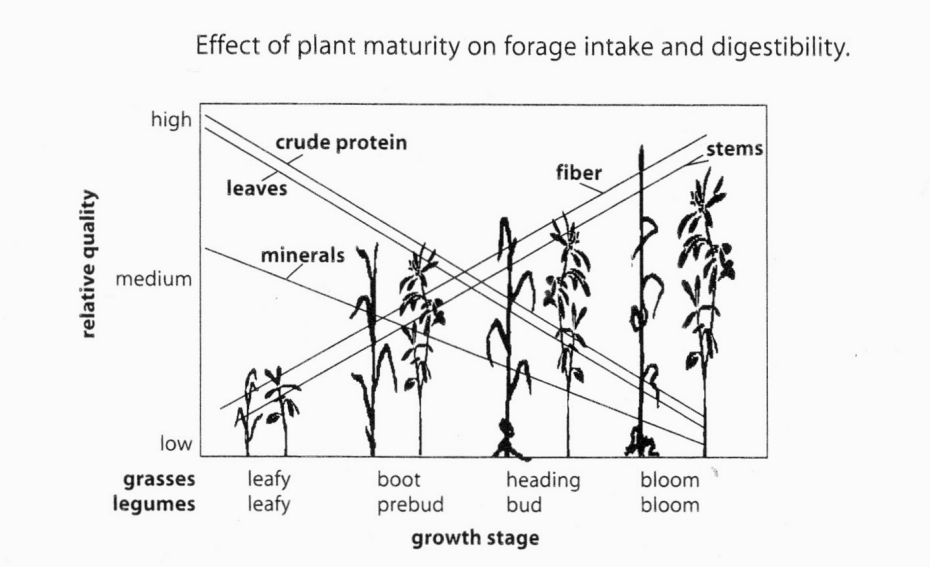


Figure 2. Effect of plant maturity on forage intake and digestibility. Adapted from *Forage-Animal Management Systems*. Used with permission of Virginia Cooperative Extension, Virginia Tech, and Virginia State University.

- A higher percentage of pasture growth is available for feeding; thus, less hay or other expensive stored feed materials is needed.
- Using recommended grazing heights allows for enough leaf area to remain for optimum forage regrowth.
- Rotational grazing allows producers more control of grazing heights, reduces animal selection, and allows plants a rest period between grazing periods. In a continuous grazing system, animals have unrestricted access to the pasture, allowing for selection. This can lead to overgrazing, depletion of root reserves, and potentially plant death.

Key Concepts of Hay Storage

- Weathering of hay results in losses of dry matter, lowered forage quality, reduced hay intake, and greater refusal.
- The lowest losses occur when hay is stored inside a building. Building a hay storage facility may be economically justifiable if hay losses are otherwise high. The more valuable the hay, the easier it is to justify spending time and money to reduce storage losses.
- Contact with soil is usually the most important source of spoilage of hay stored outside and should be eliminated if possible. This and other outside hay storage tips are illustrated in figure 3.
- Some heating of hay is normal.
- If heating is excessive soon after baling, monitor the temperatures over time.
- Maximum temperature is usually reached 1 week after baling but can occur up to 3 weeks later.
- Avoid placing freshly cut hay in an area where it is touching dry hay.
- 120 degrees F = protein breakdown
- 140 degrees F = sugar caramelization
- 150 to 180 degrees F = F fire (likely)

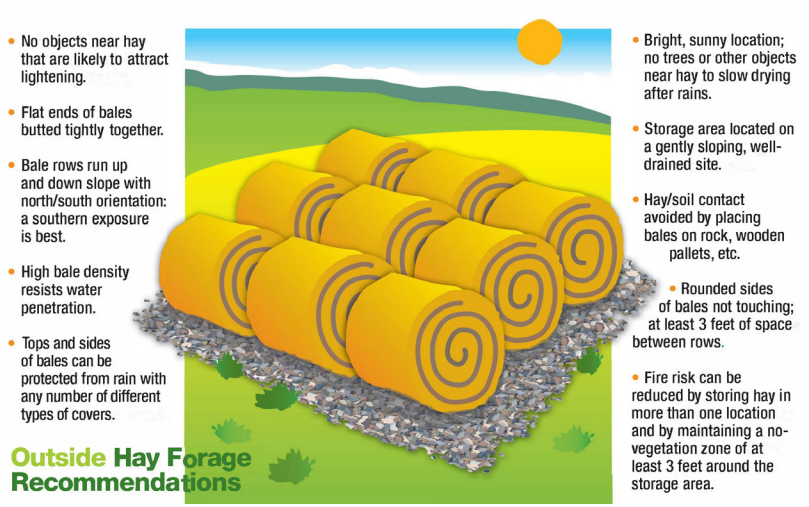


Figure 3. Outside hay storage recommendations

Table 4. Approximate Hay Storage Crude Protein and Total Digestible Nutrients (TDN) Content of Selected Forage Crops

	Average Nutrient Level	
	Crude Protein Percent	**TDN Percent**
Cool-Season Forage Crops		
Alfalfa (early bloom)	17–22	58–65
Arrowleaf clover	14–17	56–64
Oats	10–14	55–62
Orchardgrass	12–15	54–58
Red clover	14–16	57–62
Rye	8–12	54–60
Annual ryegrass	10–17	55–64
Soybean	12–16	54–58
Tall fescue	10–15	54–58
Wheat	8–12	54–60
Warm-Season Forage Crops		
Annual lespedeza	12–16	52–58
Bahiagrass	8–11	50–54
Coastal bermudagrass (4-week cutting interval)	10–14	55–60
Common bermudagrass	9–11	50–58
Dallisgrass	8–12	55–56
Johnsongrass	10–14	55–58
Pearl millet	8–14	50–58
Sericea lespedeza	12–16	50–56
Sundangrass	9–12	55–60

Adapted from *Southern Forages: Modern Concepts for Forage Crop Management*, 5th ed.

Table 5. Recommended Stage to Harvest Various Forage Crops for Hay

Forage Crop	Time of Harvest
Alfalfa	Bud stage for 1st cutting, 1/10 bloom for 2nd and later cuttings. For spring seedlings, allow 1st cutting to reach full bloom.
Orchardgrass, timothy, or tall fescue	Boot to early head stage for 1st cutting; 2nd and latter cuttings at 4-to-6-week intervals.
Red, crimson, and arrowleaf clovers	Early bloom
Rye, oats, wheat, triticale, and annual ryegrass	Boot to early head stage (boot preferable for rye).
Sericea lespedeza	15 to 18 inches high leaving 4-inch stubble; do not cut between mid-August and killing frost.
Annual lespedeza	Early bloom and before bottom leaves begin to fall.
White (ladino) clover	Cut at correct stage for companion plant.
Johsongrass, sudangrass, sorghum × sudangrass hybrids, and pearl millet	40 inches high or early boot stage, whichever comes first; leave 4-to-6-inch stubble on johnsongrass; leave 6-to-8-inch stubble on sorghums.
Bermudagrass	15 to 18 inches high for 1st cutting; 2nd and latter cuttings at 4-to-5-week interval or when 15 inches high.

Adapted from *Southern Forages: Modern Concepts for Forage Crop Management*, 5th ed.

Sampling Forage for Laboratory Analysis

Identification of a Forage Lot

A forage lot is defined as forage taken from the same farm or field and cut under uniform conditions within a 48-hour period. A lot can represent several truck or wagon loads, but all forage should have been harvested and stored under identical conditions.

For accurate test results, store hay or silage by lots, and take separate samples from each lot. Note any special conditions that result in quality differences in a lot, such as rain damage during harvest or excessive weed populations. Noting these conditions and differences will allow you to assess at a later time the reasons for quality variations.

How to Take a Hay Sample

Use a good probe. Use a hay probe with an internal diameter of 3/8 to 5/8 inches. The cutting edge should be at a right angle to the shaft. Keep the cutting edge sharp; dull probes will not obtain a representative sample. Core samplers that cut through a cross-section of a bale provide the best representation of stems and leaves. Avoid using open augers, as they selectively sample leaves.

Sample at random. Select bales at random from throughout the hay lot. Avoiding some bales and choosing others based on appearance will bias the sample. For stacked hay, take samples from bales at various heights in the stack.

Take enough core subsamples. Take at least twenty core samples from a hay lot to minimize sample variation.

Use the proper technique. For rectangular bales of all sizes, insert the hay probe 12 to 18 inches deep at a right angle into the center of the bale ends. For round bales, insert the probe at a right angle to the outside circumference of the bales.

Handle samples correctly. Combine core samples from a given lot into a single sample and store in a sealed plastic freezer bag. Samples should be protected from heat or direct sun and promptly sent to a laboratory for analysis. Each sample should weigh approximately 1/2 to 3/4 pounds. Note that many labs will not grind entire larger samples, and samples that are too small will not adequately represent the hay lot.

Common Components of a Nutritive Value Analysis

Dry matter (DM). Percent forage samples are oven dried to determine the amount of water and dry matter in a sample. A goal of 85 percent dry matter is preferred for hay. Baleage may contain between 40 and 60 percent dry matter, and silage between 30 and 40 percent dry matter to ferment properly. Compare results on a dry matter basis for ration development purposes.

Crude protein (CP). Percent CP is the total nitrogen in a forage sample multiplied by a 6.25 correction factor.

Neutral detergent fiber (NDF). Percent NDF value is the total cell wall, which consists of hemicellulose, cellulose, and lignin. As forage NDF increases, forage intake decreases.

Acid detergent fiber (ADF). Percent acid detergent fiber is an estimation of the component of the forage that is indigestible to the animal. This value refers to the cell wall portions of the forage that are made up of cellulose and lignin. The greater the ADF, the less digestible forages become to the animal.

Total digestible nutrients (TDN). Energy value of forage is expressed as TDN. The greater the value, the more energy-dense the forage is considered.

Calcium and phosphorus. These are two key macrominerals required daily in beef cattle diets.

Relative forage quality (RFQ). This is a single number that can be used to compare the overall quality of one or more forage samples. In general, RFQ values range from 50 to 250, with the upper end representing the highest-quality forage.

How to Take a Soil Sample

Fertilizer recommendations are only as good as the soil sample submitted for analysis. It is important that a soil sample accurately represent the area from which it is taken.

Generally, a sample should be a composite of subsamples taken with a soil probe from ten to twenty spots in the field or sampled area. Depth of sampling is important: probe plowed fields to plow depth; probe sod or other unplowed areas to a depth of 2 to 3 inches.

A sample should normally represent no more than 10 acres or even less if cropping or fertilization history of various areas differ. Remember that fertilizer and lime recommendations vary for different crops. When submitting the sample for analysis, specify the type(s) of forage(s) to be grown.

Key Facts about Soil pH and Lime

- A soil pH of 7.0 is neutral. As soil reaction goes above or below this number, the soil is considered increasingly alkaline or acidic, respectively.
- Soil pH is a logarithmic scale. For example, a soil pH of 5.0 is 10 times more acid than a soil pH of 6.0.
- Most forage crops perform best when the soil pH is in the range of 6.0 to 6.5.
- Lime can be applied anytime field conditions permit.
- Fineness of lime is important. To qualify as being high-grade lime, 90 percent or more of the material should be capable of passing through a 10-mesh sieve.
- Calcitic lime is composed primarily of calcium carbonate. Dolomitic lime contains at least 6 percent elemental magnesium.
- Application of lime corrects soil acidity, supplies calcium and/or magnesium, increases availability of some nutrients, and promotes desirable biological activity.
- Lime moves slowly through the soil and reacts slowly. Where possible, apply lime and till it into the top few inches of soil 3 or 4 months before planting.
- Locations with Black Belt soil can have a pH of 7.0 to 8.5 (basic); therefore, liming typically is not required for these soils. However, soil testing is still very important to determine N, P, and K needs for the crop.
- As a result of the basic pH and the heavy clay soils, some forages do not grow well in the Black Belt. Consult with local Extension agents to determine the best forage system for the soil type.

Nutrition Management

Beef Cattle Are Ruminant Animals

Beef cattle play an important role in the food supply chain. They can use forages and feed by-products to meet their nutritional needs. This is because cattle are ruminant animals, which are able through microorganisms in their digestive system to utilize resources that cannot be used by humans. Ruminant animals have a complex digestive system with three compartments prior to the stomach. The compartments are the rumen, reticulum, omasum, and abomasum, or the "true stomach."

Water

Water is the most important part of beef cattle diets. It influences feed intake, animal performance, and efficiency of production. Daily water requirements of beef cattle change based on animal age, size, stage of production, and the environment.

Table 6. Daily Water Requirements (Gallons per Day) for Various Classes of Cattle at Temperatures 40 to 90 Degrees F

	Mean Air Temperature (°F)					
Animal Class/ Stage of Production	**40**	**50**	**60**	**70**	**80**	**90**
Growing Calves	---------- Gallons Per Head Per Day ----------					
400 pounds	4.0	4.3	5.0	5.8	6.7	9.5
600 pounds	5.3	5.8	6.6	7.8	8.9	12.7
800 pounds	6.3	6.8	7.9	9.2	10.6	15.0
Pregnant cows	6.0	6.5	7.4	8.7	9.8	11.5
Lactating cows	11.4	12.6	14.5	16.9	17.9	16.2
Mature bulls	8.7	9.4	10.8	12.6	14.5	20.6

Nutrition Terminology

Dry matter intake. The portion of forage or feed remaining when water is removed. Intake defines how much dry matter the animal consumes per day. This amount determines the quantity of nutrients the animal is getting in the diet on a daily basis.

Total digestible nutrients. A measure of daily energy requirements or energy provided by a forage or feedstuff. Lactating beef cows have a greater TDN requirement (62 percent) than dry, pregnant cows (48 percent).

Crude protein. An estimate of the total nitrogen in a forage or feed multiplied by a 6.25 correction factor. Daily crude protein requirements of cows generally range from 7 to 12 percent CP depending on their stage of production.

Minerals. Required in relatively small amounts but important for maintenance, growth, and health of beef cattle. Macrominerals are needed in greater amounts in the diet, whereas microminerals (trace minerals) are needed in relatively small quantities. Calcium (Ca) and phosphorus (P) are two minerals required in the greatest amount daily by beef cattle. Ca and P are important for bone development, milk production, and maintenance.

Vitamins. Allow cattle to efficiently use the protein and energy in feeds. Many vitamins needed by cattle are plentiful in common feeds or manufactured by the animal, except for vitamins A and D.

Nutrient Requirements of Beef Cattle

Nutrient requirements of cattle change with age, stage of production, sex, breed, and environmental conditions. Tables 7, 8, and 9 provide information on basic nutrient requirements of beef cattle based on weight and stage of production.

Table 7. Daily Dry Matter Intake and Diet Nutrient Densities for Beef Cows
Mature Weight = 1,000 pounds

	Months Since Calving											
	1	2	3	4	5	6	7	8	9	10	11	12
1,000-pound cow weaning 7-month-old weighing 456 pounds												
DM lb./day	21.6	22.1	23.0	22.5	22.1	21.7	21.1	21.0	20.9	20.8	21.0	21.4
TDN %	55.8	56.6	54.3	53.4	52.5	51.8	44.9	45.7	47.0	49.1	52.0	55.7
CP %	8.7	9.1	8.4	8.0	7.5	7.1	6.0	6.2	6.5	7.0	7.7	8.7
Ca %	0.24	0.25	0.23	0.22	0.20	0.19	0.15	0.15	0.15	0.24	0.24	0.24
P %	0.17	0.17	0.16	0.15	0.14	0.14	0.11	0.11	0.11	0.15	0.15	0.15
1,000-pound cow weaning 497-pound calf												
DM lb./day	24.0	25.0	25.4	24.4	23.5	22.7	21.1	21.0	20.9	20.8	21.0	21.4
TDN %	59.6	60.9	58.6	57.0	55.4	54.0	44.9	45.7	47.0	49.1	52.0	55.7
CP %	10.5	11.2	10.4	9.6	8.9	8.2	6.0	6.2	6.5	7.0	7.7	8.7
Ca %	0.30	0.32	0.30	0.27	0.24	0.22	0.15	0.15	0.15	0.24	0.24	0.24
P %	0.20	0.21	0.19	0.18	0.17	0.15	0.11	0.11	0.11	0.15	0.15	0.15
1,000-pound cow weaning 535-pound calf												
DM lb./day	26.4	27.8	27.8	26.4	24.9	23.7	21.1	21.0	20.9	20.8	21.1	21.4
TDN %	62.8	64.5	62.1	60.1	57.9	55.9	44.9	45.7	49.1	52.0	55.7	55.7
CP %	12.1	12.9	12.0	11.1	10.0	9.1	6.0	6.2	6.5	7.0	7.7	8.7
Ca %	0.35	0.38	0.35	0.32	0.28	0.25	0.15	0.15	0.15	0.24	0.24	0.24
P %	0.22	0.24	0.22	0.21	0.19	0.17	0.11	0.11	0.11	0.15	0.15	0.15

Table 8. Daily Dry Matter Intake and Diet Nutrient Densities for Beef Cows
Mature Weight = 1,200 pounds

	Months Since Calving											
	1	2	3	4	5	6	7	8	9	10	11	12
1,200-pound cow weaning 7-month-old weighing 496 pounds												
DM lb./day	24.4	24.9	26.0	25.6	25.1	24.8	24.2	24.1	24.0	23.9	24.1	24.6
TDN %	55.3	56.0	53.7	52.9	52.1	51.5	44.9	45.8	47.1	49.3	52.3	56.2
CP %	8.4	8.8	8.1	7.7	7.3	7.0	6.0	6.2	6.5	7.0	7.7	8.8
Ca %	0.24	0.25	0.23	0.21	0.20	0.19	0.15	0.15	0.15	0.26	0.25	0.25
P %	0.17	0.17	0.16	0.15	0.14	0.14	0.12	0.12	0.12	0.16	0.16	0.16
1,200-pound cow weaning 558-pound calf												
DM lb./day	26.8	27.8	28.4	27.4	26.5	25.7	24.2	24.1	24.0	23.9	24.1	24.6
TDN %	58.7	59.9	57.6	56.2	54.7	53.4	44.9	45.8	47.1	49.3	52.3	56.2
CP %	10.1	10.7	9.9	9.2	8.5	7.9	6.0	6.2	6.5	7.0	7.7	8.8
Ca %	0.29	0.31	0.29	0.26	0.24	0.22	0.15	0.15	0.15	0.26	0.25	0.25
P %	0.19	0.21	0.19	0.18	0.17	0.15	0.12	0.12	0.12	0.16	0.16	0.16
1,200-pound cow weaning 598-pound calf												
DM lb./day	29.2	30.6	30.8	29.4	27.9	26.7	24.2	24.1	24.0	23.9	24.1	24.6
TDN %	61.6	63.2	60.8	59.0	57.0	55.2	44.9	45.8	47.1	49.3	52.3	56.2
CP %	11.5	12.2	11.4	10.6	9.6	8.8	6.0	6.2	6.5	7.0	7.7	8.8
Ca %	0.34	0.36	0.34	0.31	0.27	0.25	0.15	0.15	0.15	0.26	0.25	0.25
P %	0.22	0.23	0.22	0.20	0.18	0.17	0.12	0.12	0.12	0.16	0.16	0.16

Table 9. Daily Dry Matter Intake and Diet Nutrient Densities for Beef Cows
Mature Weight = 1,400 pounds

	Months Since Calving											
	1	2	3	4	5	6	7	8	9	10	11	12
1,400-pound cow weaning 7-month-old weighing 535 pounds												
DM lb./day	27.1	27.6	28.9	28.5	28.0	27.7	27.2	27.0	26.9	26.8	27.0	27.6
TDN %	54.9	55.5	53.3	52.5	51.8	51.2	45.0	45.8	47.3	49.5	52.6	56.6
CP %	8.2	8.6	7.9	7.6	7.2	6.9	6.0	6.2	6.5	7.0	7.8	8.9
Ca %	0.23	0.25	0.23	0.21	0.20	0.19	0.16	0.16	0.16	0.27	0.26	0.26
P %	0.17	0.17	0.16	0.15	0.15	0.14	0.12	0.12	0.12	0.17	0.17	0.17
1,400-pound cow weaning 612-pound calf												
DM lb./day	29.5	30.5	31.3	30.3	29.4	28.6	27.2	27.0	26.9	26.8	27.0	27.6
TDN %	58.0	59.1	56.8	55.5	54.1	53.0	45.0	45.8	47.3	49.5	52.6	56.6
CP %	9.8	10.3	9.6	8.9	8.3	7.7	6.0	6.2	6.5	7.0	7.8	8.9
Ca %	0.28	0.30	0.28	0.26	0.24	0.22	0.16	0.16	0.16	0.27	0.26	0.26
P %	0.19	0.20	0.19	0.18	0.17	0.16	0.12	0.12	0.12	0.17	0.17	0.17
1,400-pound cow weaning 656-pound calf												
DM lb./day	31.9	33.3	33.7	32.3	30.8	29.6	27.2	27.0	26.9	26.8	27.0	27.6
TDN %	60.7	62.2	59.8	58.1	56.2	54.7	45.0	45.8	47.3	49.5	52.6	56.6
CP %	11.1	11.8	11.0	10.0	9.3	8.5	6.0	6.2	6.5	7.0	7.8	8.9
Ca %	0.33	0.35	0.32	0.30	0.27	0.24	0.16	0.16	0.16	0.27	0.26	0.26
P %	0.22	0.23	0.21	0.20	0.18	0.17	0.12	0.12	0.12	0.17	0.17	0.17

Expected Dry Matter Intake Requirements of Beef Cattle

An estimate of dry matter intake for various classes of beef cattle can be determined as a percentage of expected body weight intake per day. For example, a mature, dry cow is expected to consume 2 to 2½ percent of her body weight per day in dry matter. Using this example, a 1,300-pound cow consuming 2 percent of her body weight per day in dry matter is equivalent to 26 pounds.

Table 10. Daily Expected Dry Matter Intake of Various Classes of Beef Cattle

Animal Class	Expected Dry Matter Intake Range (percent of body weight per day)
Beef cow (dry)	2
Beef cow with calf	2.5
Heifer, replacement	2.5–3
Stocker cattle	2.5–3

Adapted from NRC, 2016

Forage Quality and Animal Intake

Forage quality is a major factor influencing the intake and nutrients received by beef cattle from grazed or conserved forages. Greater forage quality increases intake potential, whereas low-quality forage may limit intake (table 11).

Table 11. Influence of Forage Quality on Expected Dry Matter Intake of Mature Beef Cows

Hay Quality	Class of Cattle	Dry Matter Capacity, Percent of Animal Body Weight
Low quality (less than 52% TDN, 8% CP (i.e., mature grass hay)	Dry cows	1.5
	Lactating cows	2.0
Average quality (52% to 56% TDN, 9% to 12% CP (i.e., boot stage and early-bloom grass hay)	Dry cows	2.0
	Lactating cows	2.3
High quality (> 56% TDN, 12% CP (i.e., preboot stage grass hay)	Dry cows	2.5
	Lactating cows	2.7
Lush, growing pasture	Dry cows	2.5
	Lactating cows	2.7
Baleage or silage	Dry cows	2.5
	Lactating cows	2.7

Classification of Feedstuffs

Feeds that make up beef cattle rations can be classified as roughages, energy sources, protein sources, and minerals. Roughage, primarily from forage, supplies the majority of TDN in cattle diets in Alabama. Energy sources, such as grains and certain by-product feeds, are high in TDN (70 to 90 percent). Energy feeds are often used to supplement lower-quality forage in winter months or to provide additional TDN while cattle are on pasture. Protein sources are generally cereal grain by-products and milling by-products of seeds high in oil. Minerals are used to supplement the other components of the diet.

Supplementation Guidelines

- Provide about 30 inches of linear bunk or trough space for each cow being supplemented.
- Balance supplemental feeding rations based on forage analysis results.
- Compare costs of supplemental feedstuffs based on cost per unit of energy or protein provided.
- A cost calculator is available at www.alabamabeefsystems.com.

Storage of Feeds

Table 12. Nutritional Value (TDN and CP) and Bulk Density of Commonly Used Feed Sources in Alabama

Commodity	Pounds/ Cubic Feet	CP Percent	Pounds/ Cubic Foot
Corn, cracked	88	9	45
Corn, shelled	88	9	33
Corn gluten feed	73	25	
Cotton by-product (gin trash)	55	11	
Cottonseed, whole	90	24	25
Cottonseed meal	23	70	38
Distillers grain (dried)	95	28	26
Oats	82	12	7
Peanut hulls, loose	40	11	11
Peanut skins	69	14	28
Soybean hulls, loose	14	80	40
Soybean hulls, pelleted	14	80	40
Soybean meal	43	70	

Selecting a Mineral Product

Trace mineral salt is not a complete mineral; it contains no calcium or phosphorus. When evaluating the composition tag on a bag of minerals, look for the following:

- 15 to 30 percent salt
- 6 to 12 percent calcium
- 6 to 12 percent phosphorus
- 1 to 4 percent magnesium (or 8 to 14 percent for high magnesium)
- 0.09 to 0.18 percent copper
- 0.18 to 0.36 percent zinc
- 0.0026 to 0.0052 percent selenium

If concentrations of these minerals are considerably outside of these ranges, look for another bag of minerals. Consumption levels are generally between 2 and 4 ounces of product per day. Remember that zinc and copper in sulfate form are more available than in oxide form.

Mineral Additives

Many mineral formulations offer inclusion of additive technologies. Definitions of commonly included additives are described below:

Ionophores. Products such as Rumensin or Bovatec are often added to mineral supplements to improve feed efficiency. Blending these products with minerals helps ensure more consistent consumption and can have positive effects on feed efficiency on grazed forage systems or in drylot settings.

Fly control. Many mineral packages may include the addition of insect growth regulators (IGR) or larvicides as fly control. These products work by providing control through manure. Product efficacy is based on cattle consuming the mineral product consistently containing these products and starting cattle on these products prior to fly issues reaching threshold levels of concern.

Combination of ionophores and fly control. Both of these products may be present in some mineral formulations. Additional feed antimicrobials or antibiotics may require a Veterinary Feed Directive.

Table 13. Mineral Requirements of Beef Cattle

Mineral	Units	Growing and Finishing Cattle	Pregnant Cows	Lactating Cows	Maximum Tolerable Level
Calcium	%	0.30–0.60	0.30	0.25	-
Chlorine	%	-	-	-	-
Chromium	ppm	-	-	-	1,000
Cobalt	ppm	0.10	0.10	0.10	10
Copper	ppm	10	10	10	100
Iodine	ppm	0.50	0.50	0.50	0.50
Iron	ppm	0.10	50	50	1,000
Magnesium	%	0.10	0.12	0.20	0.40
Manganese	ppm	20	40	40	1,000
Molybdenum	ppm	-	-	-	5
Phosphorus	%	0.15–0.30	0.17	0.20	-
Potassium	%	0.60	0.60	0.70	3
Selenium	ppm	0.10	0.10	0.10	2
Sodium	%	0.06–0.08	0.06–0.08	0.10	-
Sulfur	%	0.15	0.15	0.15	0.40
Zinc	ppm	30	30	30	500

Cow Management

Beef cow nutrient requirements begin increasing about 60 days prior to calving and reach their peak during the first 60 days post-calving. Nutritional demands are highest during this time for maintenance, lactation, and postpartum recovery. As the cow moves closer to weaning a calf, typically around 7 to 8 months of calf age, nutrient requirements decrease.

A nonlactating, gestating cow has the lowest nutrient demand and represents a more economical time to add body condition or weight to animals. Matching forage and feed resources with animal nutrient demands is critical to ensure nutrient needs are met, while efficiently utilizing nutritional resources.

Calf Management

Creep Feeding

- The most common creep feed is high in energy (greater than 65 percent TDN) and about 16 percent crude protein. High-energy creep feeds generally result in the greatest weight gain. Creep feeding can also be used to introduce calves to the feed they will be fed at weaning time, which can smooth the transition to the new ration.
- Creep feeding typically begins at 3 to 4 months of age when calf demands for growth are high.
- Creep feeders should have openings of 16 to 20 inches wide and 36 to 42 inches high.
- Use of creep grazing programs can also support good calf gains rather than use of traditional grain-based creep diets. Use high-quality forages to provide supplemental nutrition to calves in creep-based programs.

Backgrounding Weaned Calves

A good nutritional program supports the growth and performance of calves during the preconditioning period. During this time, calves often undergo the transition from a forage and milk diet to a forage and concentrate diet.

Training can be accelerated by placing feed bunks (containing high-quality palatable hay top-dressed with supplement) perpendicular to fence lines so that calves can easily find feed when they walk the fence. Calves should have between 1½ and 2 feet of bunk space per head to prevent crowding.

Weaned calves often lose weight during the first week postweaning due to the stress of the weaning process and acclimation of the rumen microbes to a new diet. They will slowly begin to regain weight within 2 to 3 weeks.

Conduct a forage analysis to determine the type and level of additional feed supplementation needed to reach projected weight gain goals during the backgrounding period. Provide access to a free-choice mineral or a mineral mixed into feed supplements to help meet micronutrient requirements and provide more consistent mineral delivery in the diet.

Replacement Heifer Development

This phase occurs from the time of weaning until breeding. In general, a growth rate of 1 to 1½ pounds per day from weaning to breeding is needed for growing heifers to reach 65 percent of mature body weight. A more specific growth rate can be estimated by (1) evaluating the amount of gain needed between the time of weaning and breeding, and (2) estimating the number of days remaining until the breeding period.

In the Southeast, warm-season perennial grass pastures, such as bermudagrass, bahiagrass, or dallisgrass, may provide close to 1 pound per day average daily gain during peak growth. However, additional supplementation may be required to achieve greater gains or as forage becomes more mature and less productive late in the growing season.

Cool-season forages (annuals and perennials with or without legumes) generally provide high-quality forage growth during the winter and spring months and can support up to 2 pounds per day average daily gain. In the fall, stockpiled tall fescue may support gains of 1½ pounds per day without supplementation. Stockpiled warm-season perennial grasses may also reduce hay needs, although supplementation with a high-energy protein supplemental feedstuff may be needed to meet gain goals.

Drylot development programs rely more on conserved forages, where animals are developed in nongrazing paddocks. These programs rely more heavily on conserved forages than on grazed pasture. The first step to develop a cost-effective supplementation program is to conduct a forage analysis. This provides needed information on digestibility, crude protein, and fiber value of the forage to be used as part of the nutrition program.

First-Calf Heifers

First-calf heifers need extra energy and protein because they are still growing. Heifers require a diet that is at least 62 percent total digestible nutrients and 11 percent crude protein.

Consider separating mature cows and first-calf heifers into different management groups about 30 days before calving to help provide more targeted supplementation to replacements. Following their first calf, increase energy and protein supplementation in the diet by up to 20 percent to help cattle maintain adequate body condition.

Depending on forage quality, choosing a supplement with a good combination of energy and protein is important for lactating females. Energy is often the first most limiting nutrient in cattle diets post-calving, and is especially the case with first-calf heifers.

The following two charts provide example diets for replacement heifers (mature weight 1,300 pounds).

Fall Calving

Pregnant Replacement Heifers (last 60 days before calving)	Lactating First-Calf Heifers
• Warm-season grass pasture + 3–5 lb. 50:50 soyhulls: corn gluten feed • 25–30 lb. good-quality hay or baleage + 3–5 lb. 50:50 soyhulls: corn gluten feed	• Limited grazing cool-season grass pastures (annuals or perennials) • Stockpiled tall fescue + 5 lb. 50:50 soyhulls: corn gluten feed • Stockpiled bermudagrass + 7 lb. 50:50 soyhulls: corn gluten feed • 25–30 lb. good-quality hay or baleage + 5 lb. 50:50 soyhulls: corn gluten feed

Winter/Spring Calving

Pregnant Replacement Heifers (last 60 days before calving)	Lactating First-Calf Heifers
• Limited grazing cool-season grass pastures (annuals or perennials) • Stockpiled tall fescue + 3 lb. 50:50 soyhulls: corn gluten feed • Stockpiled bermudagrass + 5 lb. 50:50 soyhulls: corn gluten feed • 25–30 lb. good-quality hay or baleage + 3 lb. 50:50 soyhulls: corn gluten feed	• Actively growing cool-season grass pastures (annuals or perennials) • 25–30 lb. good-quality hay or baleage + 5 lb. 50:50 soyhulls: corn gluten feed

Table 14. Daily Dry Matter Intake and Diet Nutrient Densities for Pregnant Replacement Heifers

	Months Since Conception								
	1	2	3	4	5	6	7	8	9
1,000-pound mature weight									
DM lb./day	16.7	17.2	17.7	18.2	18.7	19.4	20.0	20.7	21.3
TDN %	50.1	50.2	50.4	50.7	51.3	52.3	54.0	56.8	61.3
CP %	7.2	7.2	7.2	7.2	7.3	7.6	8.0	8.7	10.0
Ca %	0.22	0.22	0.22	0.21	0.21	0.20	0.32	0.31	0.31
P %	0.17	0.17	0.17	0.17	0.17	0.16	0.23	0.23	0.22

Months Since Conception									
	1	2	3	4	5	6	7	8	9
1,200-pound mature weight									
DM lb./day	19.3	19.8	20.3	20.9	21.5	22.2	23.0	23.7	24.4
TDN %	50.5	50.5	50.7	50.9	51.4	52.3	53.8	56.2	59.9
CP %	7.2	7.2	7.2	7.2	7.3	7.5	7.9	8.5	9.6
Ca %	0.23	0.23	0.22	0.22	0.22	0.21	0.31	0.31	0.30
P %	0.18	0.18	0.18	0.17	0.17	0.17	0.23	0.22	0.22
1,400-pound mature weight									
DM lb./day	21.7	22.3	22.9	23.5	24.2	24.9	25.8	26.6	27.4
TDN %	50.7	50.8	50.9	51.2	51.6	52.4	53.7	55.8	59.0
CP %	7.2	7.2	7.2	7.2	7.3	7.5	7.8	8.4	9.3
Ca %	0.24	0.24	0.23	0.23	0.22	0.22	0.31	0.31	0.30
P %	0.18	0.18	0.18	0.18	0.18	0.18	0.23	0.22	0.22

Bull Management

The desired rate of gain can be determined by evaluating weight at the beginning of the development period and at projected mature weight. Bulls generally should reach 75 percent of their mature weight at 2 years of age. In general, this requires a growth rate of 2 to 3 pounds per day during this time period from weaning to yearling stage.

Developing bulls at a moderate rate of gain (2 to 2½ pounds per day) can be achieved using a combination of high-quality grazed forages, conserved forage resources, and supplemental feedstuffs. Most warm-season forage resources, such as bahiagrass, bermudagrass, and dallisgrass, can support gains of 1 to 1½ pounds per day during the peak growing season but are insufficient to support moderate rates of gain alone. Cool-season annuals, such as small grains and ryegrass, can support gains up to 2½ pounds per day when forage is managed to keep in a vegetative stage of growth.

When using conserved forages, such as hay, baleage, or silage, in bull development rations, a forage analysis is needed. The Auburn Soil, Forage, and Water Testing Laboratory offers both forage and feed analysis services that can help producers understand the relative energy and protein value of feed resources.

Based on forage analysis results, a supplementation strategy can be developed to help growing bulls achieve moderate rates of gain. In general, a high-energy and moderate-protein feed source often is used to support these production goals. This is because energy tends to be the most limiting nutrient in forage-based diets in the southeastern United States. Feedstuffs should be evaluated based on the total cost per pound of nutrient. Feed supplements should contain a minimum of 65 to 70 percent TDN and 12 to 14 percent CP.

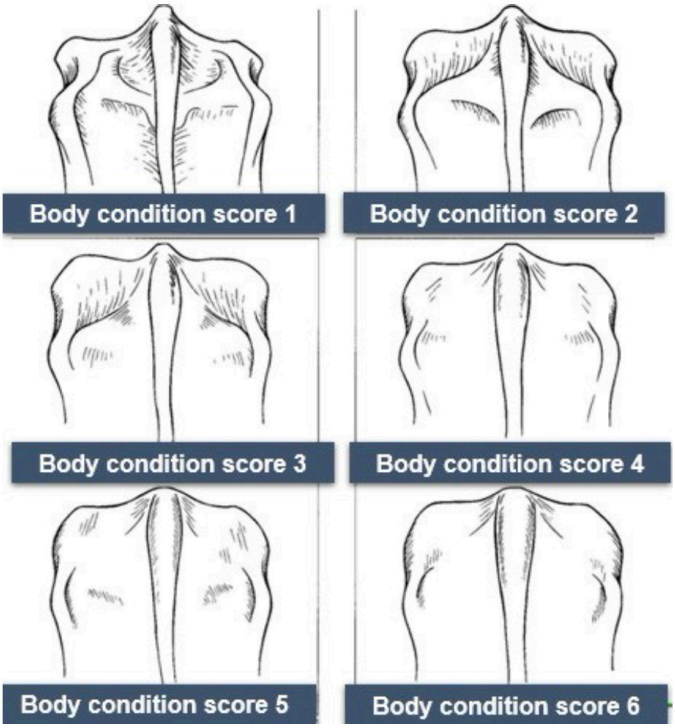
Body Condition Scores

Body condition scoring is an on-the-hoof visual appraisal using numbers (1 to 9) to suggest the relative body fat of the beef cow. With this 9-point scale, a score of 1 represents a very thin body condition, and a score of 9 represents extreme obesity. For mature cows, a target BCS score of 5 to 6 is recommended at calving. However, because heifers are still growing, their nutritional requirements are higher, so they should be managed to calve in BCS 6. It is important to remember that the single greatest factor influencing rebreeding performance of beef cows is body condition at calving.

Condition scoring cows and heifers allows us to properly plan and adjust forage and feeding programs. Following are key times to body-condition-score beef cattle:

- Weaning
- 60 to 90 days prior to calving
- At calving
- The beginning of the breeding season

Keep records of body condition scores to track changes in the herd throughout the calendar year. For most cows, an increase of one body condition score equates to gaining about 80 to 100 pounds of body weight. The accompanying photos and descriptions describe the nine body condition scores.



Steps to Evaluating Body Condition Score

- Evaluate fat cover from the front, side, and rear of the animal.
- Ask if the skeletal structure is visible or if the animal has a smooth appearance.
- Use table 16 to determine relative condition.

Body Condition Score and Reproductive Implications

Body condition score relates to overall reproductive health of cows and first-calf heifers and represents a measure of energy reserve of the animal. Decreased conception rates and increased calving interval length is often observed in animals with a body condition score that is too low or too high (tables 15 and 16).

Table 15. Relationship of Body Condition Score to Beef Cow Performance

BCS	Pregnancy Rate (%)	Calving Interval (Days)
3	43	414
4	61	381
5	86	364
6	93	364

Table 16. Problems Associated with Thin and Fat Body Condition

Thin Condition BCS 1 to 4	Fat Condition BCS 8 to 9
Failure to cycle	Costly to maintain
Failure to conceive	Increased dystocia
Increased calving interval	Impaired mobility
Increased days to estrus	Failure to cycle
Decreased calf vigor	Failure to conceive

Table 17. Descriptions of Body Condition Scores for Beef Cattle

Score	Description
1	**Emaciated.** No palpable fat is detectable over the spinous processes, transverse processes, ribs, or hooks. The tailhead and ribs appear very prominently.
2	**Poor.** Animal is still somewhat emaciated but the tailhead and ribs are less prominent. Individual spinous processes are still sharp to the touch. Some tissue cover is present over the ribs toward the top of the back.
3	**Thin.** Beginning of fat cover is detectable over the loin, back, and foreribs. Backbone is still highly visible. Processes of the spine can be identified individually by touch and may still be visible. Spaces between the processes are less pronounced.
4	**Borderline.** The foreribs are not noticeable, although the twelfth and thirteenth ribs are still noticeable to the eye, particularly in cattle with a big spring of rib and ribs wide apart. The transverse spinous processes can be identified only by palpation to feel rounded rather than sharp. Full but straightness of muscling is evident in the hindquarters.
5	**Moderate.** The twelfth and thirteenth ribs are not visible to the eye. Areas on the side of the tailhead are filled but not mounded.
6	**High moderate.** The ribs are not noticeable to the eye. There is fat around the tailhead. The hindquarters are full and plump. The skin has a smooth appearance.
7	**Good.** Abundant fat cover is evident on either side of the tailhead. The cow appears in very good flesh but not overconditioned.
8	**Fat.** The animal is very fleshy and appears overconditioned. Large fat deposits are present over the ribs and around the tailhead. Fat pones around tailhead are obvious.
9	**Extremely fat.** The overall appearance is blocky. Tailhead and hooks are buried in fatty tissue. Bone structure is no longer visible and barely palpable.

Herd Health

Health Management

To protect animal health, and for efficient use of time, labor, money, and other resources, cattle herds should have a comprehensive herd health management program that includes, but is not limited to the following:

- Herd immunization (vaccination)
- Parasite control (internal and external)
- Proper culling guidelines
- Biosecurity
- Nutrition
- Reproductive management
- Beef quality assurance (BQA)

Contact your local veterinarian, Extension agent, state Extension specialists (nutritionists, geneticists, reproductive physiologists, environmental experts), and others to gather the information you need to develop an effective herd health management program that meets the specific needs of your operation.

Bovine Immunization Guidelines

A successful herd health program involves proper herd immunization (vaccination) to prevent and control a variety of infectious diseases. Selecting the proper vaccines for your herd, however, can be a difficult task, considering the large number of available vaccines. Following are some points to consider when developing a vaccination program for your herd:

- Determine the goals of your vaccination program. What disease do you want to prevent and control and in what type/age animal? Different herds will have different goals and vaccination protocols.
- Determine the type of vaccine to use, such as killed, modified-live, or toxoid.
- Discuss these goals with your herd health veterinarian and Extension agent.

Vaccines are generally categorized as killed vaccines (KV), toxoids, or modified live vaccines (MLV). Each category has its advantages and disadvantages.

Table 18. Killed Vaccines (KV) and Toxoids

Advantages	Disadvantages
• Available for many diseases • No risk of the vaccine organism spreading between animals • Minimal risk of causing abortion • No on-farm mixing required	• More likely to cause allergic reactions and post-vaccination lumps • Two initial doses required • Slower onset of immunity

Table 19. Modified Live Vaccines (MLV)

Advantages	Disadvantages
• One initial dose may be sufficient, but boosters sometimes required • Stimulates rapid, strong, and long-lasting immunity • Less likely to cause allergic reactions and post-vaccination lumps	• Potential risk of causing abortion or transient infertility if not used according to label directions • Must be mixed on-farm and used within about 30 minutes

Vaccines are available for many diseases. Not all diseases, however, are a routine threat to many beef herds, and some vaccines are not sufficiently effective to justify their use. Therefore, every cattle operation will have unique vaccination requirements based on individual herd goals.

The following guidelines for vaccinating cattle may not be applicable in all situations. The best use of these guidelines is as a starting point to develop an effective vaccination protocol with your herd health veterinarian or Extension agent. When appropriate, ensure that products are safe for pregnant animals and for calves nursing pregnant cows.

Properly store and administer vaccines according to label directions; adhere to designated meat withdrawal times; and follow all other BQA guidelines. For detailed information regarding specific vaccine efficacy and safety data, see productdata.aphis.usda.gov**.**

Nursing Calves

- 7-way clostridial (blackleg)
- IBR/BVD/PI_3/BRSV:

  IBR = infectious bovine rhinotracheitis

  BVD = bovine viral diarrhea

  PI_3 = parainfluenza$_3$

  BRSV = bovine respiratory syncytial virus
- Calfhood vaccination for brucellosis if recommended by herd veterinarian
- For consideration: leptospirosis 5-way vaccine for future replacement heifers and bulls. Leptospirosis 5-way vaccination may not be necessary for future feeder calves depending on location.

Preconditioned Feeder Calves

- IBR/BVD/PI_3/BRSV
- 7-way clostridial (blackleg)
- *Mannheimia haemolytica*
- *Pasteurella multocida*
- *Histophilus somni*

Breeding Animals

Replacement heifers, cows, and bulls should generally be vaccinated at least 6 to 8 weeks before the breeding season so that immunity is high during the breeding season.

- IBR/BVD/PI_3/BRSV
- Leptospirosis 5-way
- Vibriosis (*Campylobacter fetus*)

Cattle Parasites

Effectively controlling internal and external cattle parasites is an economically important management practice.

Consequences of Internal Parasitism

- Reduced appetite
- Protein loss from damaged tissues
- Anemia (in some cases)
- Impaired immune function
- Decreased weight gain
- Decreased milk production
- Decreased reproductive performance
- Less beef per acre produced

Controlling Stomach, Lung, and Intestinal Parasites

- Many dewormers (anthelmintics) are available for controlling stomach, lung, and intestinal parasites in cattle. Consult your herd health veterinarian for product recommendations and treatment schedules specific to your operation.
- Always read product labels carefully for storage, dosage, route of administration, and withdrawal guidelines. Following label directions ensures product efficacy and safety and promotes the production of safe, wholesome beef.
- When applicable, always make sure the product used is safe for pregnant animals.

Dewormer Resistance and Parasite Control

In general, cattle dewormers are no longer working as effectively due to dewormer resistance caused by changes in the genetic makeup of parasite populations that allows parasites to survive dewormer exposure. The result is a demonstrated reduction in the efficacy of dewormers.

There are several factors that contribute to development of dewormer resistance, but a primary cause is overuse of dewormers in cattle production systems. New strategies for dealing with parasites are therefore needed.

Cattle producers should consider shifting focus away from strictly deworming programs and towards more comprehensive parasite control programs. The goal should be to minimize short-term economic losses and health problems while being sustainable in the long term.

Following are questions to ask in relation to developing effective parasite control programs:

- What impacts the number of parasites on pasture?
- What impacts the number of parasites in an animal?
- What are ways to maintain a higher proportion of susceptible parasites (refugia) on the farm or ranch?

Impacts on the number of parasites on pasture:

Climate, weather, pasture type, quality, topography, drainage, and rotation all influence the prevalence of parasites on pasture. Some of these cannot be changed, and even the factors that can be changed may take considerable planning and money and may not impact parasite numbers enough to be worth it. The bottom line is to focus on managing pastures for grass health and cattle nutrition.

Impacts on the number of parasites in an animal:

- Pasture contamination
- Level of dewormer resistance
- Age and sex of animals. Calves to 2-year-olds are most susceptible; bulls are more susceptible than cows.
- Breed. Brahmans are tolerant of external parasites but are not necessarily more tolerant of internal parasites.
- Previous exposure. Cattle can develop some immunity to parasites.
- Genetic susceptibility
- Other stressors
- Adequate nutrition. The amount and quality of forage, trace minerals, etc., is important.

Maintaining a higher proportion of susceptible parasites (refugia) on the farm or ranch:

Dewormer resistance is a demonstrated reduction in the efficacy of a dewormer due to a change in the genetic makeup of the parasite population that allows them to survive dewormer exposure. One of the most effective ways to combat dewormer resistance is to maintain a higher proportion of susceptible parasites (refugia) on the farm or ranch through various management strategies. Refugia specifically refers to the population of parasites with susceptible genes in which dewormers are still effective. Refugia can be found on pasture and in animals and can help dilute the proportion of resistant parasites in the population.

Examples of ways to keep refugia:

- Selective nontreatment. For example, do not deworm cows once they have weaned their first calf. Older cows then serve as a source of refugia. Typically, about 20 percent of animals harbor roughly 80 percent of the parasites in a herd. If a cow is unable to thrive in this management system, she might be more susceptible to parasitism and possibly harbor a higher proportion of parasites relative to her herd mates. She might need to be culled for the benefit of the rest of the herd.
- Selective treatment of only those animals that will benefit most from treatment, leaving the rest of the herd untreated. For example, treating only calves, young females that have not yet weaned their first calf, and bulls; adult cows are not treated.
- Leaving a percentage of a group untreated. The percentage left untreated is best based on the level of dewormer resistance identified through diagnostics, but that might not always be available, so some strategies to consider could include the following:
  - Treat only 90 percent of a group of calves.
  - Leave about 10 to 30 percent of replacement heifers untreated.
- Select individuals to leave untreated based on weight or random selection. For example:
  - Do not treat the heaviest animals.
  - Do not treat every tenth animal (if using 10 percent calculation) or every fifth animal (if using 20 percent), etc., unless it looks like it's lagging behind the rest of the group.

Actions to avoid:

- DO NOT deworm an entire group of cattle, especially if using two or more classes of dewormer at the same time. An exception to this would be deworming stockers going to the feedlot and grazing "nonpermanent" pasture.
- Do not use the same pastures for young stock year after year. For example, do not raise replacement heifers in the same pasture every year. Instead, consider moving the "heifer pasture" around on the ranch.

Common External Parasites

- Horn flies
- Stable flies
- Face flies
- Horse flies
- Lice
- Ticks
- A variety of other biting insects

Consequences of External Parasitism

External parasites are a nuisance that cattle must spend time and energy warding off. The more time and energy devoted to fighting external parasites means less time and energy devoted to being productive. Consequences can include the following:

- Anemia in some cases
- Decreased weight gain
- Decreased milk production
- Decreased reproductive performance
- Less beef-per-acre produced
- Damaged hides
- Transmission of diseases by many external parasites

Controlling External Parasites

Many sprays, back rubs, dusts, feed additives, and ear tags are available for controlling external parasites. Some dewormers used for controlling internal parasites also control external parasites (endectocides). Consult individual product labels for specific information.

Horn fly resistance to insecticides is a serious problem, but it can be managed with appropriate rotation between classes of insecticides. Do not just rotate product names, as different product names may actually be in the same chemical class. Consult table 20 for help differentiating product ingredients by chemical class.

In general, do not use different chemical classes of insecticides in the same year. For example, do not use a pyrethroid ear tag with an organophosphate spray in the same year. When used together during the same year, flies develop resistance to both classes of insecticides simultaneously.

The products used and the treatment protocol depend on a number of factors, such as the following:

- What products have been used in the past?
- Has resistance become a problem on your operation?
- How close are neighboring herds, and what products are they using?

With so many factors to consider, it is very important to consult your herd health veterinarian or Extension agent for product recommendations and treatment protocols specific to your operation.

Table 20. Categories of Insecticide Chemical Classes and Active Ingredients

Insecticide Chemical Class	Representative Active Ingredients
Endectocides	Milbemycin Avermectin
Endosulphan	Endosulfan
Organophosphates	Chlorpyrifos Coumaphos Diazinon Dichlorvos Fenthion Phosmet Pirimiphos-methyl Tetrachlorvinphos Trichlorfon
Pyrethroids	Cyfluthrin Cypermethrin Fenvalerate Lambdacy-halothrin Permethrin Zetacypermethrin
Pyrethrins	Pyrethrins

Growth-Stimulating Implants

When used correctly, growth-stimulating implants offer cattle producers an effective, easy-to-use method of increasing the weight of weaned and stocker calves. If producers adhere to label directions, beef from cattle properly treated with implants is just as safe as beef from nonimplanted cattle.

Follow all label directions to maximize the safety and effectiveness of implants. Generally, male calves should be implanted when they are castrated.

Do not implant replacement heifers or bull calves that are intended for breeding. This can hinder the development of the reproductive organs, resulting in subfertility.

Correctly Administering Implants

See product labels for specific instructions.

1. Properly restrain the animal.
2. Determine which ear to implant. Implant all calves in the same ear to minimize confusion.
3. Clean the implant site with a disinfectant to reduce contamination of the needle wound.
4. Once the ear is clean, proceed with the implantation process. Do not implant a dirty ear, as this greatly increases the chances for implant site infections.
5. Select the proper implant site on the back of the ear (figure 4).
6. Grasp the ear with one hand while using your other hand to position the implant gun parallel to and nearly flush with the ear.
7. Put the point of the needle against the ear with the beveled part facing outward.
8. Use the tip of the needle to prick the skin. Then, lift slightly to completely insert the needle under the skin. Place the implant needle between the skin and cartilage in the middle third of the ear.
9. Depress the plunger of the implant gun and withdraw the needle. Some implant guns automatically withdraw the needle as the plunger is depressed, leaving a pocket for the implant. Other implant guns require manual withdrawal of the implant needle to create a small pocket prior to depressing the plunger.
10. Feel the ear for the implant under the skin to ensure proper placement.
11. Disinfect the implant gun needle between usages.

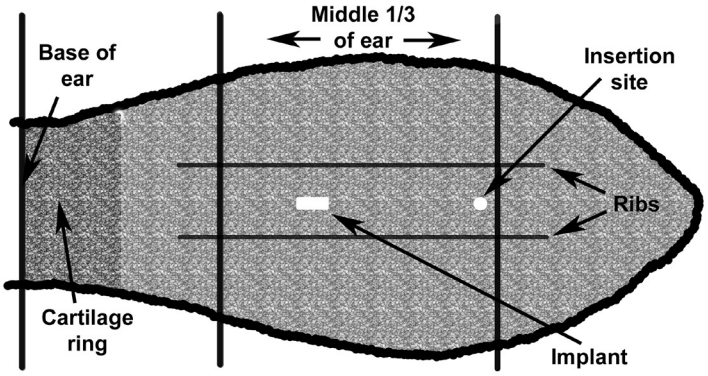


Figure 4. Proper implant site

Precautions to Take When Implanting Cattle

- The animal may throw its head when you grasp its ear and insert the needle. To prevent this, use a nose lead, halter, or a head gate equipped with a head and nose bar.
- Avoid piercing or cutting ear veins with the needle.
- Do not allow the needle to gouge or pierce through the cartilage. If resistance is felt when inserting the needle, the cartilage has probably been gouged. Pellets may be covered with scar tissue and walled off, resulting in poor drug absorption and decreased gain.
- Implant only a properly cleaned and disinfected ear and with a disinfected implant needle. Failure to properly disinfect the ear or implant needle increases the risk for implant site infection and abscess formation, both of which will greatly reduce or eliminate the effectiveness of the implant.
- Never sacrifice a careful implantation technique for speed.

Annual Cow Evaluation: "Seven Quality Checks"

Performing an annual cow evaluation allows producers to treat or cull less productive or undesirable cows. The seven quality checks that follow are a starting point for evaluating a cow's reproductive performance, as well as detecting physical abnormalities that may hamper its production. The performance of a cow's progeny should also be evaluated.

Pregnancy. Perform a pregnancy check every year, and cull open (nonpregnant) cows before spending extra money to maintain them another year with no return on investment.

Eyes. Bovine ocular neoplasia or “cancer eye” is a common cause of cow carcass condemnation. Cancer eye can rapidly become severe (resulting in blindness) and spread to other parts of the body (resulting in carcass condemnation) if not detected early.

Mouth. Cows must have adequate teeth to harvest forage for body condition maintenance and milk production to support calf growth.

Feet and legs. Lame cows have a difficult time grazing as well as walking to feed bunks or water. As a result, they lose body condition, wean poor calves, and do not rebreed. Some causes of lameness are treatable.

Udder. It takes a good udder to produce sufficient milk to raise a good calf. Look for “blind quarters” (quarters that are not producing milk) and “bottle teats” (teats that are large and difficult to nurse).

Body condition. Thin cows lack energy reserves and usually do not rebreed.

Disposition. Cows with bad dispositions often produce excitable calves that do not gain as well in the feed yard and may produce undesirable “dark cutting” meat. They also can make working the herd difficult and dangerous.

Determining the Age of Cattle

A common method for determining the age of cattle is by examining the teeth, as illustrated in figure 5. Consider the following when aging cattle by their teeth:

- Mature cattle have thirty-two teeth, eight of which are incisors in the front of the mouth on the lower jaw. (There are no upper incisors.)
- Aging cattle by their teeth requires evaluating the time of appearance (eruption) and the degree of wear of the temporary and permanent incisors (table 21).

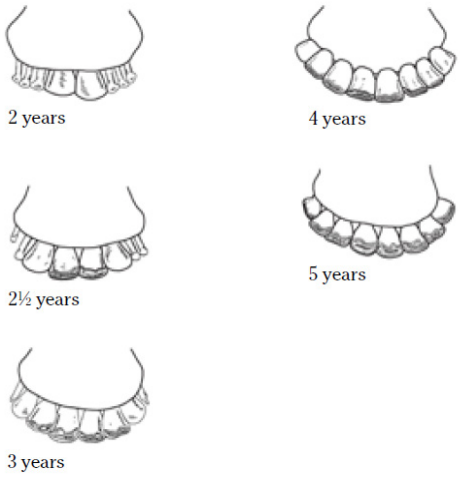


Figure 5. Aging cattle by teeth

Table 21. Guidelines for Aging Cattle[1]

Teeth (permanent)	Eruption (age in years)	In Wear (typically 6 months after eruption) (age in years)	Neck of Tooth Visible Above Gum Line (age in years)
First incisors (I1) (two central incisors)	1½–2	2–2½	6
Second incisors (I2)	2–2½	2½–3	7
Third incisors (I3)	3	3½	8
Fourth incisors (I4) (two outer incisors)	3½–4	4½	9

[1] Based on when permanent incisors erupt and are "in wear" and when the neck of the tooth is visible above the gum line

Biosecurity

A biosecurity plan is an innovative approach to managing the risk of disease introduction and spread on your livestock operation. It is designed to help livestock producers identify disease risks and manage them through practical measures for common, everyday infectious diseases as well as for new or unexpected diseases.

An effective biosecurity plan manages disease by evaluating and addressing the primary routes of disease transmission, therefore controlling many diseases at the same time. The five primary routes of disease transmission are aerosol, direct contact, fomite or traffic, oral, and vector.

Aerosol transmission occurs when disease agents contained in droplets pass through the air from one animal to another. Proximity of infected and susceptible animals is typically required for aerosol transmission.

Direct contact transmission of disease agents occurs when a susceptible animal directly touches an infected animal through open wounds, mucous membranes, blood, saliva, nose-to-nose contact, rubbing, or biting.

Fomite transmission occurs when a disease pathogen is carried or spread from one animal to another by an inanimate object such as boots, buckets, tattoo pliers, implant guns, castration equipment, used needles, grooming equipment, etc. Vehicles, trailers, and even human clothing are also considered fomites and can spread disease through traffic transmission.

Oral transmission occurs when an animal licks or chews on contaminated environmental objects or consumes contaminated feed or water.

Vector-borne transmission involves the spread of disease through an insect. Ticks and mosquitoes are biological vectors. These insects commonly become infected from a diseased animal and then spread the disease by injecting the disease agent into another animal. Flies are a common mechanical vector, simply carrying the disease agent on their bodies and passing it from animal to animal.

A biosecurity plan involves multiple components and results in practical measures for implementation. The first step involves assessing the risk areas on a livestock facility based on a “routes of disease transmission” approach. After identifying risk areas, determine disease management measures, prioritize, and start them.

Following are examples of biosecurity practices that will greatly minimize the risk of disease transmission:

- Do not intentionally commingle animals from different herds.
- Provide a buffer between adjoining herds so that no fence line contact is available.
- Isolate new herd additions for 4 to 6 weeks and have your veterinarian test for appropriate diseases before allowing new animals to commingle with your herd. Identify isolation areas prior to purchase.
- Isolate animals returning from livestock shows.
- Post signs indicating that a biosecurity plan is in effect.
- Educate all visitors about the biosecurity plan in effect.
- Ensure that all visitors are dressed appropriately. Provide coveralls and boots, or make sure visitors are wearing clothing free from contact with other cattle.
- Recognize that you are also a source of contamination for your herd. If you are around other cattle, shower and change clothes before working with your livestock.
- Clean and disinfect your truck and trailer after hauling cattle. Anyone hauling cattle for you should do the same.
- Clean and disinfect other equipment as necessary.
- Apply appropriate insect control.

Your Veterinarian’s Role in Herd Health

Your veterinarian plays an important role in preventing, diagnosing, and treating disease. Selecting the right treatment depends on accurately diagnosing the problem. Work with your local veterinarian to develop a healthcare program designed to fit your specific needs, and establish a valid veterinarian-client-patient relationship (VCPR).

The following constitutes a valid veterinarian-client-patient relationship:

- Your veterinarian is responsible for the health care of your herd.
- You follow your veterinarian’s treatment and drug withdrawal instructions.
- Your veterinarian is familiar with the animals on your farm.
- Your veterinarian is available for follow-up visits.

The Decision to Treat

Even with superior herd management, some animals will become sick or injured. The decision to treat them should be based on specific criteria. Answering questions such as the following could be helpful as you make your decision:

- Will the animal return to a healthy, productive state without treatment?
- Will treatment return the animal to a healthy, productive state?
- What treatment best fits the disease and herd management?
- Should the animal be sold?
- Should the animal be euthanized?

Understanding, Storing, and Administering Drugs

Understanding Drug Labels

All products, including antibiotics, hormones, vaccines, dewormers, pain medications, and feed additives, should be used according to label directions to achieve maximum product efficacy and safety. Following label directions includes proper product storage, route of administration, reason for administration (indication), and dose administered. Any deviation from label directions will result in decreased product efficacy and is illegal in many situations.

You are ultimately responsible for any drug residues in your animals. Therefore, it is crucial that you become familiar with drug labels. All drugs, whether over-the-counter (OTC), prescription (Rx), or veterinary feed directive (VFD) contain the following basic information on the label:

- Name of drug
- Active ingredients
- Instructions for use
- Withdrawal times
- Quantity of contents
- Name of distributor
- Any other cautionary statements

Types of Drugs

Over-the-Counter (OTC)

- Can be administered by a producer without the order of a veterinarian.
- Can only be used according to the label directions. It is illegal for a producer to use an OTC product in any manner other than what is prescribed on the label. A veterinarian can prescribe “extra-label” use of an OTC product when necessary.

Prescription (Rx)

- Cannot be administered by producers unless prescribed by a veterinarian.
- Label contains the statement,“Caution: Federal law restricts this drug to use by or on the order of a licensed veterinarian.”

Veterinary Feed Directive (VFD)

- All antibiotics administered through animal feed require a written veterinary feed directive (VFD) from a veterinarian.

To reduce the chance of adverse reactions and to minimize the risk of residues, read and follow all instructions on product labels. Instructions include the following:

- Dosage. Example: “1 mL or cc per 100 pounds”
- Timing (how often and how many times given). Example: “two doses, 3 days apart”
- Route of administration. Example: “intramuscular”
- Warnings or indications. Example: “Not for use in pregnant animals”
- Withdrawal times, if any. Example: “Do not use within 28 days of slaughter.”
- Storage. Example: “Store at 2 degrees F (7 degrees C).”
- Disposal. Example: “Burn container and all unused contents.”
- Shelf life. Expiration date

Failure to understand a product label is not a defense if meat from one of your animals is found to contain drug residues. Contact your local veterinarian or Extension agent if you have questions.

Extra-Label Drug Use

- Extra-label drug use can be prescribed only by a veterinarian.
- A cattle producer cannot use drugs (including OTC drugs) in an extra-label manner without a veterinarian’s prescription. This is off-label and illegal.
- Administering products according to label directions includes dosage, route of administration, reason for administration, and adherence to proper withdrawal times.
- A VCPR must exist for extra-label drug use. As such, the veterinarian must know the producer, be familiar with the farm or ranch and its practices, and be involved in the herd health practices of the operation. In addition, the

veterinarian and producer must properly identify the animal, assign meat and milk withdrawal times, and abide by these withdrawal times to ensure no illegal residues occur.

- Veterinarians are prohibited from using some antibiotics in an extra-label manner.
- Extra-label use of feed medications is prohibited.
- Extra-label use of hormones is prohibited.

Off-label use of vaccines may reduce the efficacy of the vaccine as well as release the manufacturer from any product liability. In other words, if a vaccine is stored and administered according to all label directions and supported by proper documentation, the manufacturer might be liable in the case of an adverse event related to the product. If, however, vaccines are used in an off-label manner, manufacturers are released from all product liability. Therefore, to maintain maximum product efficacy and product liability, it is strongly recommended to use all vaccines according to label directions.

Storing Drugs Correctly

Drug performance declines if the expiration date has passed, the storage temperature is too hot or too cold, or the drugs have been exposed to air or light. All the information you need to meet these requirements should be on the label of the drug container. Be sure to follow these guidelines:

- Check the expiration date on the label.
- Do not save vaccines after the bottle has been partially used. They will likely not be effective for later use and may be contaminated.
- Keep an accurate thermometer in your refrigerator to monitor drug temperature. Some drugs, and most vaccines, need to be refrigerated at 35 to 45 degrees F and must not be frozen.
- Use disposable syringes. Use clean needles to draw contents from multidose bottles. Change needles with every animal or at least every ten to fifteen animals to minimize disease transmission. Do not store medication in syringes, which cannot be labeled easily.
- Avoid exposing vaccines and other medicines to direct sunlight. This may degrade the product. Use an insulated cooler for storing syringes and drugs while working on cattle to avoid sunlight and to maintain the proper temperature.
- Collect used needles in a rigid plastic container. Return used needles to your veterinarian for disposal. Destroy disposable syringes so that they cannot be reused or misused. Read labels. Some drugs and vaccine containers require incineration before disposal. Used needles and scalpels are considered medical waste and must be handled and disposed of in accordance with laws which govern them.
- Consult your local veterinarian with questions on proper use of medications.

Administering Drugs Properly

Administering drugs properly is important for the proper action of the drug and for the prevention of injection site lesions and violative drug residues. The best way to avoid problems is to simply follow label instructions, identify each animal that receives the drug at the time it is administered, and administer the drugs correctly. Proper administration includes selecting the route of administration, choosing the correct needle, choosing the injection site, practicing good sanitation, handling drugs correctly, and applying proper restraint.

Select the best route of administration. Drugs can be administered many different ways, including the following:

- Oral
- Intravenous
- Topical
- Subcutaneous (SubQ = under the skin)
- Intramammary
- Intramuscular (IM = in the muscle)
- Intranasal

Most injections are administered either subcutaneously (SubQ) or intramuscularly (IM) as illustrated in figures 6, 7, and 8. The product label provides the acceptable route(s) of administration. If the label allows for either subcutaneous or intramuscular administration, give the drug subcutaneously to reduce the chances of violative residues and injection site lesions in the muscle.

Figure 6. Use the tenting method for subcutaneous injections.

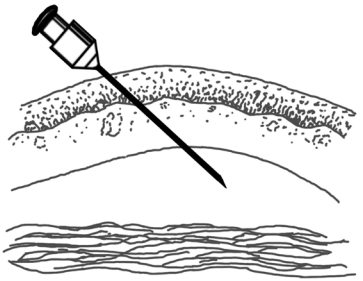


Figure 7. For subcutaneous injections, insert the needle through the skin and into the gap at a 45-degree angle.

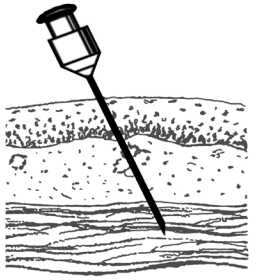


Figure 8. For an intramuscular injection, insert the needle through the skin and into the muscle.

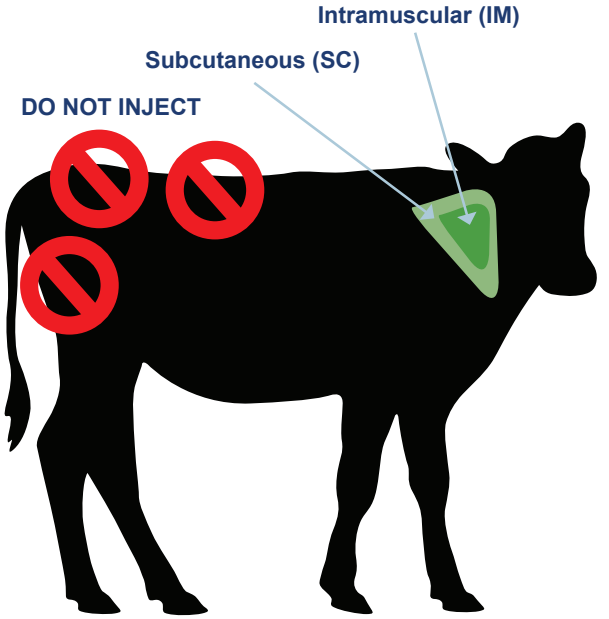


Figure 9. Never inject cattle in the loin, top butt, or rump. For cattle health products, the triangular mass of neck muscle is the only acceptable site for both intramuscular and subcutaneous injections.

Choose the proper location for the injection (figure 9), which is not necessarily the most convenient one. It is the site where the product will be most beneficial without damaging expensive cuts of meat.

- Keep all injections in front of the shoulder.
- **Never inject in the loin, top butt, or rump.**
- For both vaccines and antibiotics, the triangular mass of neck muscle is the only acceptable site for IM and SubQ injections (figure 9).
- Never inject more than 10 ml (cc) into one site.
- When making multiple injections, keep injection sites at least 5 inches apart, being careful not to reuse injection sites.
- To minimize the risk of an injection site lesion, avoid injecting in wet or manure-covered areas.

Choose the correct needle. The correct needle size and length is important to ensure that the entire dose of the drug gets into the animal properly with the least amount of tissue damage. Selecting the proper needle size also reduces the chance of needle breakage. See table 22 for proper needle size selection.

Table 22. Needle Selection Guide

	Intramuscular (IM)		**Subcutaneous (SubQ)**	
Weight	**Gauge**	**Length (inches)**	**Gauge**	**Length (inches)**
Less than 300 pounds	18	1	18	1/2–3/4
300–700 pounds	16–18	1	16–18	1/2–3/4
More than 700 pounds	16–18	1–1½	16–18	1/2–3/4

Livestock Carcass Disposal

An unfortunate consequence of raising livestock is the inevitable death of some animals, despite even the best animal husbandry and veterinary care. Livestock owners must therefore understand responsible carcass disposal to protect their herds from various infectious diseases, protect the environment, and maintain the reputation of the livestock industry.

Proper carcass disposal first and foremost ensures the safety of your herd by potentially removing the source of a variety of infectious diseases and protecting wildlife from the same diseases. Proper carcass disposal also helps avoid environmental problems and bad publicity the livestock industry receives when carcasses are found in inappropriate places, such as creeks, ponds, along the side of the road, etc.

Alabama law requires carcass disposal within 24 hours by one of the following approved methods:

Burial. Animals must be buried at least 2 feet below the surface of the ground. Burial is not an option in those parts of Alabama with a high water table. The Natural Resources Conservation Service (NRCS) is available to help identify appropriate livestock burial sites that meet Alabama Department of Environmental Management (ADEM) regulations.

Burning/incineration. If you use an incinerator to burn mortalities, use one approved by the ADEM Air Division.

Disposal in an approved landfill. Contact your local landfill for more information.

Necropy and disposal. Four Alabama Department of Agriculture Veterinary Diagnostic Laboratories are available to perform an examination into the cause of death (necropsy) and then dispose of the carcass. See appendix A for locations and contact information. Use Alabama Veterinary Diagnostic Laboratories only when the cause of death needs to be determined.

Failure to properly dispose of a carcass is against the law, irresponsible, and potentially detrimental to herd health and the environment. Take care not to contaminate the water table, creeks, ponds, rivers, and watersheds when disposing of a carcass.

If you need assistance, contact ADEM at (334) 271-7700, your local NRCS district office, or the Alabama Cooperative Extension System.

Animal Identification, Performance Records, and Genetics

Unique individual animal identification is necessary for proper herd management. Recording and using information on individual animals enables producers to make informed selection or culling decisions, track medication usage and withdrawal periods, and identify specific animals. Without identification, it becomes difficult to manage the cowherd effectively.

Temporary identification is any type of identification that can be removed or lost. This includes ear tags, electronic ear tags, and neck chains. Permanent identification is with the animal forever. Permanent identification includes tattoos, hot brands, and freeze brands. Permanent identification must be applied properly or individual identification will not be readable.

All identification starts with a system. There should never be two individuals in the herd with the same permanent identification. Many unique livestock numbering systems are available. The two most common are the International Lettering System (table 23) or use of the last digit of the year of birth as the first digit of the identification number followed by the calf birth order (e.g., 9001).

The International Lettering System allows 22 years before another animal has the potential for the same identification number. Each year has a specific letter assigned to that particular birth year. Using the last digit of the birth year system provides 10 years of identification before the same identification number could be used again.

Another simple livestock numbering system is to consecutively number the cattle (e.g., 1 to 999). However, a producer would not be able to quickly identify birth year with this system.

The number of digits used in an individual identification number depends on the numbering system. The calf order of birth can compose the next digits in an individual identification number. Producers with fewer than 100 cows can use two additional digits (e.g., G25 or 925). Producers with more than 100 cows will have to use three additional digits (e.g., G025 or 9025). Other systems use the dam identification number as the additional digits. This is useful to the producer who wants to quickly identify cow families in the pasture.

Table 23. International Lettering System and Corresponding Birth Year

Year	Letter*	Year	Letter*
2025	N	2036	B
2026	P	2037	C
2027	R	2038	D
2028	S	2039	E
2029	T	2040	F
2030	U	2041	G
2031	W	2042	H
2032	X	2043	J
2033	Y	2044	K
2034	Z	2045	L
2035	A	2046	M
***Letters I, O, Q, and V are not used.**			

Source: https://guidelines.beefimprovement.org/index.php/International_animal_identification_letter

Temporary Identification

Ear Tags

The most common form of identification is the ear tag. There are several different types of ear tags. Ear tags are generally inexpensive, ranging in price from $1.25 to $5.00 per tag. Blank tags or preprinted tags can be purchased. The appropriate tagger to match the brand of ear tag is needed to apply the tag.

Follow these steps when tagging an ear:

1. Place the ear tag and ear tag back (if applicable) into the appropriate tagger.
2. Dip the tag and tagger into disinfectant to minimize incidence of infection or warts.
3. Restrain the animal.
4. Apply the tag in the middle rib of the ear at least halfway between the tip of the ear and the base of the ear (figure 10).

Make sure you have a supply of ear tags, a tagger, and an ear marking pen every time you work cattle through the chute to replace needed ear tags.

Electronic ear tags work the same way, only they are applied much closer to the base of the ear to minimize loss. Ear tags are easy to read but can fade after time or get lost. If there is not a permanent form of identification and the tag is lost, the animal can no longer be positively identified.

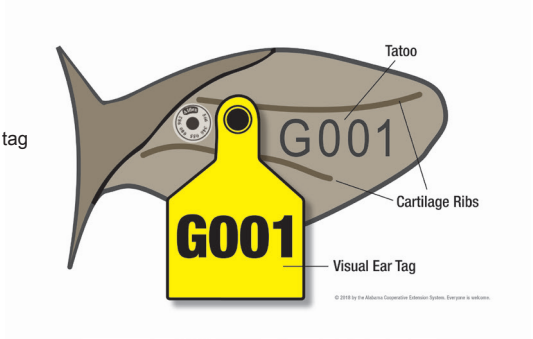


Figure 10. Ear tag

Permanent Identification

Tattooing

A good method for permanent identification is tattooing the ear. Tattooing is simple, but care must be taken to ensure a readable tattoo.

Materials needed to tattoo an animal include a tattoo gun, numbers 0 to 9, letters A to Z if using the International Lettering System, and tattoo ink. Animals should be tattooed at birth or weaning. If the calf loses its ear tag between birth and weaning, time will be spent determining exact identity.

Following are guidelines for application:

1. Load tattoo gun with appropriate letters and/or numbers. Clamp the tattoo gun onto a piece of paper or cardboard to ensure that letters are loaded correctly before tattooing an animal.
2. Dip the tattoo gun and letters into disinfectant to prevent spread of warts.
3. Properly restrain the animal.
4. If needed, clean the ear. Make sure all wax is removed by using an alcohol pad or rubbing alcohol. Leaving wax in the ear will cause the tattoo to fade over time.
5. Rub tattoo ink into the animal's ear in the middle rib. Note the location of the tattoo in figure 10. Ensure that the tattoo will not be placed into the hair of the outer ear. Use green ink for black-hided animals. Black or green ink is okay for nonblack-hided animals.
6. Firmly clamp the tattoo gun into the ink on the ear. One good squeeze is all that is needed.
7. Rub more ink into the tattoo with a toothbrush or your finger and make sure you can read the tattoo. Do not apply an ear tag through the tattoo.
8. Between tattooing each animal, dip the tattoo gun and letters into disinfectant to prevent the spread of warts or potential infection.

Animals must be restrained to read a tattoo. Tattoos are generally paired with a visual ear tag. Using tattoos as permanent identification is cost effective.

Two other forms of permanent identification are hot branding and freeze branding. Both branding methods can cause permanent damage to the hide. Hot or freeze branding should be used only when no other suitable form of permanent identification is available. The ideal location for either type of brand is high on the hip.

Hot Branding

Most hot branders today are electric. These branders are plugged into an outlet and allowed to heat up for 90 seconds. They keep a constant temperature. The optimal hot-brand width is 3/8 inch. Extreme care must be used around electric branders to eliminate accidental burning of workers or pets.

Following are guidelines for hot branding:

1. To begin, make sure the area to be branded is dry. Branding wet cattle will cause an uneven brand. Also do not brand cattle on which you just poured a dewormer or alcohol-based product, as it creates a fire hazard.
2. Properly restrain and squeeze the animal into a chute. You do not want to reapply the brand in the same spot. This can cause blotching or be hard to read.
3. Place the brander firmly on the animal for 15 to 20 seconds. Rock the brand back and forth to get even coverage. Watch the color of the hide closely. Some animals will need less time, others more.
4. When the brand becomes the deep brown color of well-worn saddle leather, take the brander off. Do not leave it on so long that you burn through the hide and expose the white tissue underneath the hide.
5. Repeat for each number or letter. You should be able to see the brand immediately.

Freeze Branding

Freeze branding generally does not cause as much hide damage to cattle and is less painful than hot branding. If done improperly, however, freeze brands are illegible. Freeze branding does not work well on white-haired cattle.

Materials needed to freeze-brand cattle include freeze-branding irons, liquid nitrogen or dry ice, denatured alcohol (95 percent or higher pure alcohol), coolers, clippers, rice-root brush, squeeze bottle, gloves, and safety goggles.

Freeze-branding irons are made of heavy copper or bronze with slightly rounded faces. The letters and numbers should be 3 to 4 inches tall, 3/8 to 1/2 inches thick, and 1 inch deep. Coolers used to hold brands and coolant (liquid nitrogen or dried ice) need to be resistant to extreme cold and alcohol. Use gloves when freeze branding to prevent frostbite.

Following are guidelines for freeze branding:

1. Cool irons for 20 minutes in the liquid nitrogen or a dry ice/alcohol combination. The coolant should cover the head of the iron by at least 1 inch. Frost lines on the handles of the irons indicate they are ready for use.
2. Restrain and squeeze the animal into a chute. Clip the hair from the area to be branded, preferably with surgical blades (regular clippers will work). Make sure to clip closely. Use a rice-root brush to remove clipped hair, dirt, and debris.
3. Use the squeeze bottle to saturate the clipped area with 95 to 99 percent denatured alcohol. If you must use an electric cattle prod, do not use it around the brand area saturated in alcohol; this can create a fire hazard.
4. Immediately and firmly place the freeze-branding iron on the animal. Leave the brand on the animal for 35 to 60 seconds. (You will have to experiment with times at first to get the best brands. In most instances, 45 seconds is enough.) Rock the iron back and forth and top to bottom for an even brand. Keep track of times so you can perfect timing with your cattle. Application of one iron at a time is recommended until you are experienced.
5. Place the iron back into the coolant to recool for 2 minutes between each use. Add more coolant as needed to keep the iron heads covered.

Immediately after freeze branding you will see a frozen indentation of the brand in the animal's skin. In 5 to 10 minutes, the brand site will begin to swell and remain swollen up to 5 days.

In 1 month, the top layer of skin will shed. Watch to see if any do not shed. You may have to rebrand. In 2 months, white hair should begin growing where the brand was applied. Sometimes reclipping the area will allow the brand to be clearly visible.

If you want to brand animals with a farm brand, the brand must be registered with the Alabama Department of Agriculture and Industries. For more information, go to www.agi.alabama.gov or call (334) 240-7263. This does not apply if you are just branding the animal with its individual identification.

Beginning January 1, 2013, the Alabama Department of Agriculture and Industries Animal Disease Traceability rule (80-3-6-40) went into effect. Official ID is required for the following classes of cattle:

- All cattle 18 months of age or older at change of ownership. Exceptions are cattle 18 months of age or older sold for slaughter purposes.
- All female dairy cattle, regardless of age
- All cattle and bison used in rodeo, show, exhibition, or recreational events, regardless of age

For the state of Alabama, official ID can be one of the following:

- Original brucellosis silver metal ear tag
- Brucellosis vaccination orange metal ear tag for heifers
- Official electronic identification (EID) purchased through an approved animal identification (AIN) manager or distributor. These tags begin with the numbers 840 and are fifteen digits in length.

For cattle traveling out of state, it is important to check with the appropriate states to determine their official ID requirements. Many states no longer accept tattoos or brands as official identification.

For current information concerning official ID requirements for Alabama, visit the Alabama Department of Agriculture and Industries website or call the Alabama State Veterinarian at (334) 240-7253.

Beef Cattle Breeds

Beef cattle are classified into two species: *Bos Taurus* and *Bos Indicus*. Since man domesticated cattle, people have bred certain types and kinds of cattle together to form breeds. Today there are over eighty recognized breeds of beef cattle in the world.

In the United States, the most popular beef breeds can be classified as English, Continental, American, or *Bos Indicus*. Each of the breeds in these classifications have certain trait similarities.

Individual animals within a breed or breed type can be very different from the general classifications listed in the table. That is one reason to examine performance and expected progeny difference (EPD) records before making selection decisions.

A website developed by Oklahoma State University, www.ansi.okstate.edu/breeds/cattle, provides a history and short description of most breeds of cattle in the world. This is an excellent beginning resource for those still deciding which breed(s) to use.

Before settling on a breed or breeds, a farm marketing plan should be developed. In many instances, the marketing plan provides good direction on which breeds to use in the breeding program.

Today, all beef breed associations have websites. These websites are extremely useful for current pedigree and EPD information. Breed association websites also provide a variety of information relating to the breed and breed activities.

Table 24. Breed Traits and Classification

Breed Classification				
Trait	**American[1]**	***Bos Indicus***	**Continental**	**English**
Calving ease	Moderate to high	Low	Moderate to high	Moderate
Growth	Moderate	Moderate	High	Moderate
Milking ability	Moderate	Moderate	Low to high	Low to high
Age at puberty	High	High	Moderate to high	Low to moderate
Carcass traits	Moderate	Low to moderate	Moderate to high	Moderate to high
Beef tenderness	Moderate	Low	Moderate	High
Heat and insect tolerance	High	High	Low	Low

[1]American breeds are breeds developed in America with a 3/8 *Bos indicus* and 5/8 *Bos tarus* breeding percentage makeup.

Beef Cattle Conformation

Visual appraisal of beef cattle is extremely important in maximizing longevity and functionality of the cow herd. Without correct structure, especially feet and legs, productivity and lifespan can be significantly decreased. Each year, the cow herd needs to be evaluated for their feet and legs and for their overall structure and muscling.

Evalute feet and leg structure at selection. Correct conformation of feet and legs (figures 11 and 12) and how they blend into the shoulder and hip structure directly impact how well animals can forage and walk to water.

When you watch cattle walk, observe that their back foot steps into the footprint of the front foot. Observing from behind, look for the same distance between the hocks at the pasterns. Any decrease in the ability to forage will have direct impacts on body condition score and production.

Figure 11. Proper hoof structure

Both the front and rear feet should be facing forward with no evidence of toes pointing in (pigeon toes) or pointing out (splay footed). A correct set or angle (45 degrees) of the front and rear legs into the shoulder or hip also is needed. Evaluate animals for being sickle hocked (too much angle from pastern to hock to hip (figure 13) or post-legged (too little angle from pastern to hock to hip (figure 14). Watch for cattle that are also straight in the front shoulder (figures 15 and 16).

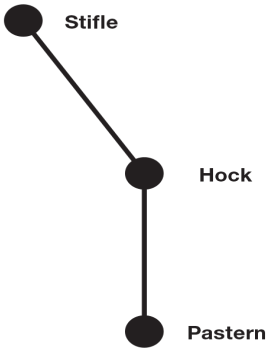


Figure 12. Correct structure desired for angle between stifle, hock, and pastern

Evaluate toe structure. Make sure each toe is the same width and length. If toes are of uneven width, weight will not be distributed evenly. This is especially important for bulls, as it will affect weight distribution on legs and hips during breeding.

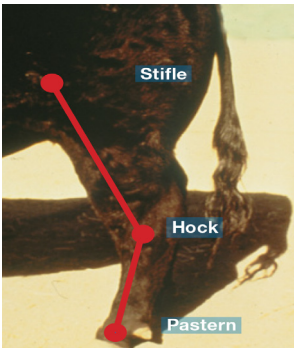


Figure 13. Sickle-hocked steer

Figure 14. Post-legged female

Problems with the hoof, such as excessive or uneven toe growth, may be caused by genetic, nutritional, or environmental factors, or it may be indicative of other structural concerns.

The ideal hoof is free of cracks and other abnormalities and has two symmetrical claws that both point forward. Look for signs of corkscrew claw (figure 17). One toe will be thinner and will grow over the other toe. This eventually will lead to lameness and loss of production. This condition is heritable. The cow should not be allowed to stay in the cow herd.

No matter what breed or type of cattle are being raised, hoof claw and angles can be evaluated with a scoring system from the American Angus Association.

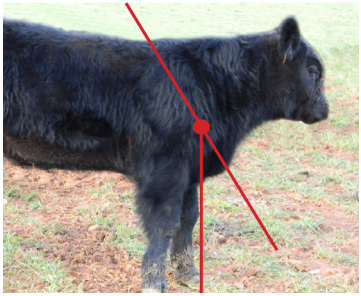


Figure 15. Steer exhibiting a steep or straight shoulder

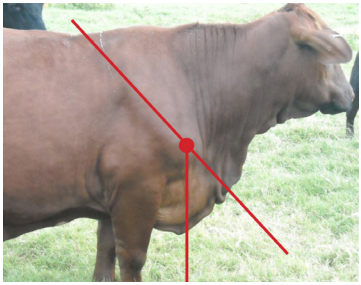


Figure 16. Female with the correct amount of slope to her shoulder

Figure 17. Female exhibiting clinical signs of corkscrew claw

Evaluate cattle for adequate muscling. Beef cattle are raised for beef production. Make sure beef bulls, cows, and calves exhibit average or above average muscling. Generally and on average, bulls and steers should exhibit more muscling than females.

Use the USDA muscling score chart (figure 18) as a guide to evaluate muscling. The target for beef cattle should be USDA 1 or 2 muscling categories. Muscling score will not impact longevity per se in the herd, but it will have economic impacts as calves are sold. Calves with USDA muscle scores 1 and 2 sell for higher prices than calves with USDA muscle scores 3 and 4.

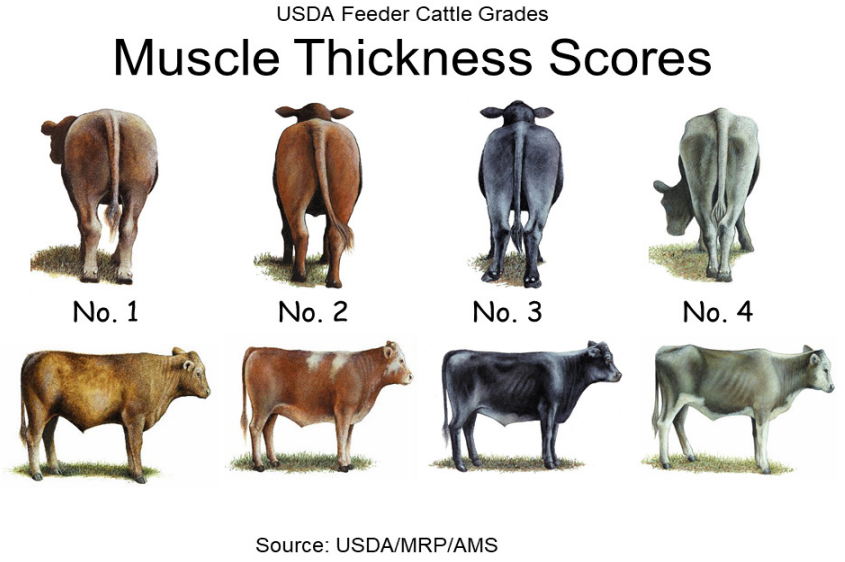


Figure 18. Feeder cattle muscle thickness scores

Frame Scores of Cattle

Frame scores in cattle are a way to evaluate skeletal size. Frame scores can be used to predict final mature weights of cattle, which will affect stocking rates and nutrient requirements for the cow herd.

To determine frame score, measure height of cattle over the hip (figure 19). Make sure the animal is standing level and naturally. You can purchase a frame score stick through a farm catalog. You must be able to get the stick close enough to the animal to read the measurement.

Another method is to use a sheet of plywood or piece of lumber at least 70 inches tall. Beginning 30 inches from the ground, mark each half-inch and inch increments until reaching 70 inches (or as tall as your tallest animal). Fasten the piece of plywood or lumber to the scale box or working chute ensuring that the bottom measurement matches the height from the bottom of the scale box or chute to that mark.

Weaning and yearling age are typical times to measure cattle for frame score. Mature cattle also can be measured. With appropriate nutrition, most animals should maintain the same frame score throughout their lifetimes. Frame scores can change if animals mature earlier or later than average.

To determine frame score, you also need the age and sex of the animal. Using the age of the animal, find the height measurement in the appropriate table and read the corresponding frame score. For example, if a heifer at 7 months of age has a hip height measurement of 45 inches, the heifer would have a frame score of 6.

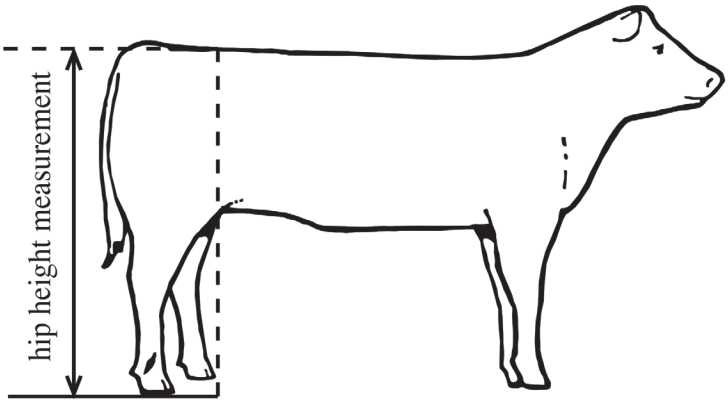


Figure 19. Measuring hip height to determine frame score

Table 25. Hip Heights and Associated Frame Scores for Growing Bulls

Age (months)	Hip Height (inches) and Associated Frame Scores for Growing Bulls								
	Frame Score								
	1	2	3	4	5	6	7	8	9
5	33.5	35.5	37.5	39.5	41.6	43.6	45.6	47.7	49.7
6	34.8	36.8	38.8	40.8	42.9	44.9	46.9	48.9	51.0
7	36.0	38.0	40.0	42.1	44.1	46.1	48.1	50.1	52.2
8	37.2	39.2	41.2	43.2	45.2	47.2	49.2	51.3	53.3
9	38.2	10.2	42.3	44.3	46.3	48.3	50.3	53.3	55.3
10	39.2	41.2	43.3	45.3	47.3	49.3	51.3	53.3	55.3
11	40.2	42.2	44.2	46.2	48.2	50.2	52.2	54.2	56.2
12	41.0	43.0	45.0	47.0	49.0	51.0	53.0	55.0	57.0
13	41.8	43.8	45.8	47.8	49.8	51.8	53.8	55.8	57.7
14	42.5	44.5	46.8	48.5	50.4	52.4	54.4	56.4	58.4
15	43.1	45.1	47.1	49.1	50.1	53.0	55.0	57.0	59.0
16	43.6	45.6	47.6	49.6	51.6	53.6	55.6	57.5	59.5
17	44.1	46.1	48.1	50.1	52.0	54.0	56.0	58.0	60.0

Adapted from *Guidelines for Uniform Beef Improvement Programs*, 9th edition, https://guidelines.beefimprovement.org/index.php/Hip_Height/Frame

Table 26. Hip Heights and Associated Frame Scores for Growing Heifers

Age (months)	Hip Heights (inches) and Associated Frame Scores for Growing Heifers								
	Frame Score								
	1	2	3	4	5	6	7	8	9
5	33.1	35.1	37.2	39.3	41.3	43.4	45.5	47.5	49.6
6	34.1	36.2	38.2	40.3	42.3	44.4	46.5	48.5	50.6
7	35.1	37.1	39.2	41.2	43.3	45.3	57.4	49.4	51.5
8	36.0	38.0	40.1	42.1	44.1	46.2	48.2	50.2	52.3
9	36.8	38.9	40.9	42.9	44.9	47.0	49.0	51.0	53.0
10	37.6	39.6	41.6	43.7	45.7	47.7	49.7	51.7	53.8
11	38.3	40.3	42.3	44.3	46.2	48.2	50.4	52.4	54.4
12	39.0	41.0	43.0	45.0	47.0	49.0	51.0	53.0	55.0
13	39.6	41.6	43.6	45.5	47.5	49.5	51.5	53.5	55.5
14	40.1	42.1	44.1	46.1	48.0	50.0	52.0	54.0	56.0
15	40.6	42.6	44.5	46.5	48.5	50.5	52.4	54.4	56.4
16	41.0	43.0	44.9	46.9	48.9	50.8	52.8	54.8	56.7
17	41.4	43.3	45.3	47.2	49.2	51.1	53.1	55.1	57.0

Adapted from *Guidelines for Uniform Beef Improvement Programs*, 9th edition, https://guidelines.beefimprovement.org/index.php/Hip_Height/Frame

Table 27. Hip Heights and Associated Frame Scores for Mature Bulls and Cows

Hip Heights (inches) and Associated Frame Scores for Mature Bulls									
Age (months)	Frame Score								
	1	2	3	4	5	6	7	8	9
24	46.4	48.3	50.3	52.3	53.9	56.0	58.0	60.0	62.0
30	57.3	49.3	51.3	53.2	54.9	57.0	59.0	61.0	63.0
36	48.0	50.0	51.9	53.8	55.5	57.5	59.5	61.5	63.5
48	48.5	50.4	52.3	54.1	55.9	58.0	60.0	62.0	63.9
Hip Heights (inches) and Associated Frame Scores for Mature Cows									
Age (months)	Frame Score								
	1	2	3	4	5	6	7	8	9
24	43.1	45.0	46.9	48.8	50.7	52.5	54.5	56.4	58.2
30	43.8	45.8	47.5	49.4	51.3	53.1	55.1	57.0	58.9
36	44.2	46.1	48.0	49.8	51.8	53.6	55.5	57.2	59.2
48	44.6	46.5	48.2	50.0	52.0	53.9	55.8	57.5	59.4

Approximate Harvest and Mature Weights (pounds) of Cattle Based on Frame Score						
Type of Animal	Frame Score					
	3	4	5	6	7	8
Steer harvest weight	1,010	1,105	1,200	1,295	1,390	1,485
Heifer harvest weight	860	940	1,020	1,100	1,180	1,260
Mature bull weight	1,590	1,740	1,890	2,040	2,190	2,340
Mature cow weight	1,010	1,105	1,200	1,295	1,390	1,485

Adapted from *Guidelines for Uniform Beef Improvement Programs*, 9th edition, https://guidelines.beefimprovement.org/index.php/Hip_Height/Frame

Measures of Performance

Performance records on beef cattle are essential for informed selection and culling decisions. Written records also may allow participation in beef alliances, source and age verification programs, or sales.

When using performance records for selection or culling decisions, make sure the genetics are matched with the environment. Maximization of traits generally does not match up well with environmental conditions. Set levels of performance to hit environmental limits and marketing targets without significant additional inputs. Fertility and reproductive rates generally are the first to suffer if production is exceeding the environment.

Keep written records in safe places to minimize loss. Records can be kept in many ways, such as in Red Books, notebooks, tablets, and computers.

The minimum information to record on each animal is individual identification, birth date, and dam and weaning weight. For many commercial producers, recording birth dates can be difficult. Birth dates can be recorded as actual birth dates, the first birth date that is used for all calves, or the first day the calf is seen. Purebred producers must record the actual birth date of the calf. Birth dates verify age of an animal and are useful in selecting replacements in a commercial operation.

Purebred producers are given a set of guidelines to follow in recording performance information. This includes individual identification guidelines and what traits to measure. National breed associations are the repositories for the information, and they generate adjusted weights, ratios, and expected progeny difference (EPD) values for a number of traits used by both purebred and commercial producers.

At the current time, commercial producers are in charge of deciding what traits to measure, how to record the information, and how to analyze and interpret the information from their herd. Performance records can be maintained by using the Integrated Resource Management (IRM) Red Book, worksheets, desktop or laptop computers, tablets, smart phones or other electronic devices, or a combination of these methods. Others use available programs, such as Alabama BCIA, for performance recordkeeping. Alabama BCIA provides a specialized commercial recordkeeping system and consultation. For more information, contact Alabama BCIA at www.albcia.com.

Calving Ease

Calving ease is recorded at birth for each calf born. It is an indication of how easily a calf can be born. This can be analyzed to help predict which bulls will produce daughters that calve easily. A five-point scale is used to record calving ease.

In a commercial herd in need of minimizing calving difficulty (dystocia), selection should be based on calving ease EPD values. While many producers are more comfortable using birth weight EPD values for selection of calving-ease bulls, birth weight is just an indicator of calving ease.

Table 28. Calving Ease Scores

Calving Ease Scores	
Score	**Description**
1	No difficulty or assistance
2	Minor difficulty, some assistance
3	Major difficulty, usually mechanical assistance
4	C-section
5	Abnormal presentation (breech, upside down, etc.)

Birth Weight

Measure and record birth weights within 24 hours of birth. Birth weight is an indication of calving difficulty. Birth weights should be adjusted for sex of calf and age of dam. In general, bull calves are 7 percent heavier than heifer calves. Also, calves born to young cows (younger than 5 years) are generally 3 to 8 pounds lighter than calves born to mature cows (5 to 10 years of age).

Using actual birth weights to select herd bulls will be the least accurate method of ensuring minimal calving difficulty. Birth weight EPD values are most effective in selecting bulls that will sire low birth weight calves if calving ease EPD values are not available for that breed.

Weaning Weight

Weaning weight of the calf is an indication of the preweaning growth of the calf and the milking ability of the dam. Weaning weights should be adjusted for the age and sex of the calf and age of the dam. Again, bull calves are generally heavier than heifer calves. Younger dams generally wean lighter calves because some nutrition is needed for growth in younger dams; this does not allow for maximum milk production to be expressed.

In a normal production environment, weigh calves between 160 and 240 days of age. This allows the weaning weight to be adjusted to a 205-day weight. Height measurements to determine frame score also can be taken. Calves do not need to be physically weaned at this time. They can remain with the cows until feed resources become limiting or 60 days before calving will begin again.

For calves to be correctly compared, it is best if all calves are weighed on the same day and the range of ages is between 160 and 240 days. If the age range is wider than this, break the weigh dates into two or more groups. Just make sure that the age range of each group is between 160 and 240 days. If calves come from multiple pastures, also record the pasture each calf was raised in.

In extreme drought or limited resources, wean calves early. Typically, an early weaned calf is physically weaned and weighed between 90 and 120 days of age. Early weaning means less feed resources are needed for the cow herd.

Adjusted 205-day weights and ratios are a good indication of cow production. In a commercial herd, these records can be useful in culling unproductive females.

Yearling Measurements

Yearling measurements are an indication of post-weaning growth of the individual. Typical yearling measurements include weight, height, scrotal circumference (in breeding bulls), and carcass ultrasound traits.

Take all yearling measurements between 330 and 400 days of age. Measure and record calves on the same day in the proper age range.

Yearling weights are adjusted for age of the calf with yearling and weaning adjustment factors. Besides ranking animals based on growth from weaning to yearling, yearling weights ensure that replacement heifers are on schedule to reach target breeding weight (65 percent of mature weight) at 15 months of age. Body condition scores also should be taken at yearling. Animals with good yearling weights but poor body condition scores probably indicate “hard-keepers” and should not be kept as replacements.

For formulas and age and dam adjustment factors for birth, weaning, or yearling weight, consult the Beef Improvement Federation’s *Guidelines for Uniform Beef Improvement Programs* at www.beefimprovement.org.

Yearling ultrasound measurements for carcass merit should be taken by a certified ultrasound technician. Measures include rump fat, twelfth rib fat, ribeye area, and percent intramuscular fat. Independent laboratories interpret the ultrasound images. Purebred cattle data are reported to the appropriate breed association for incorporation into EPD analyses. For commercial cattle, adjusted data and ratios are returned to the owner for selection/culling decisions.

Cattle should not be selected based on a single piece of information or trait. For the selection of purebred or composite bulls, EPD values in concert with the environmental conditions should be used in making selection decisions. For most producers, maximization of production traits (using weights, ratios, or EPDs) is not the solution. Performance information should be coupled with structural soundness and farm environment to arrive at a final selection or culling decision.

How to Effectively Use Expected Progeny Differences

Expected progeny differences, or EPDs, are genetic prediction tools beef producers can use when making breeding selection decisions. EPD values are the most effective tool currently available to identify individuals with superior genetics. EPDs are generated by breed associations to be used within the specific breed.

Each breed of beef cattle in the United States has an entire suite of EPD values for economically important traits for each individual animal. Each EPD is based on measures of performance from the individual, pedigree information, performance data of the individual's parents, siblings, grandparents and progeny, and the heritability of the trait. The more performance information known about an individual and its relatives for a particular trait, the more accurate the EPD value will be.

In recent years, many breeds have developed a breed-specific panel of genes that affect economically important traits. The genes are identified using the measures of performance submitted to breed associations on individual animals.

Beef producers can collect a tail hair or blood sample from an individual animal and submit it to a DNA company to obtain a molecular breeding value. The molecular breeding value is then added to the other data and pedigree information when predicting EPD values.

When molecular breeding value information is added, the EPD values published on that individual are designated as Genomically Enhanced EPDs. Accuracy values are higher for Genomically Enhanced EPDs because of the increased amount of available information. Breed-specific gene panels are constantly being improved as each breed changes genetically and is validated through continued submission of individual performance data to the breed associations.

Production goals should determine which traits are economically important for a cattle operation. For example, a producer who markets all calves after weaning and purchases bred replacement females should focus on growth traits, such as weaning and yearling weight EPD values. This producer benefits by marketing heavier calves, producing more pounds of beef. Another producer, who retains ownership of feeder calves to harvest, either through midwestern feedlots or local freezer beef marketing, will benefit on how carcasses grade and yield. This producer should focus on growth and carcass traits. A producer who develops and markets quality replacement heifers should focus more on maternal and fertility traits, while ensuring adequate growth and udder quality.

Each EPD value is published with a percentile rank. Percentile rank values range from 1 to 99 percent and indicate what percentage of the breed has a better EPD than the individual. When deciding which bulls to use, it is important to know whether improvement is needed and how much for a particular trait. For example, if calves do not meet growth expectations, purchasing or using bulls in the top

25 percentile rank or better for weaning, yearling, and carcass weight EPD values will improve growth. If maternal milk of the cowherd is ideal, purchasing or using bulls in the top 40 to 50 percentile rank for maternal milk will help maintain current milk production levels.

Care must be taken to balance EPD values with the environment. Poor environments, whether due to harsh environmental conditions or poor management, limit expression of genetic potential.

Improved management allows for more complete expression of genetic potential, such as increased weights or improved reproductive performance. In the case of particularly harsh environmental conditions, utilizing cattle breeds known to be adapted to that environment can be very beneficial.

Sire selection is a major management decision for a cattle operation, as sires are the genetic foundation of the herd. Selected sires have a direct effect on calving ease, calf growth and market weight, carcass quality, and more. When retaining replacement heifers, this impact increases, as the selected genetics also influence the cowherd long term. Therefore, informed and thorough herd bull selection makes a significant impact on the production level of the herd.

For most commercial producers, purchasing yearling or 2-year-old bulls as herd bulls is an economic reality. Bulls within this age range have lower EPD accuracies. Strategies in purchasing bulls can help to alleviate large potential changes in EPD values due to these lower accuracies.

A cattle producer can choose to purchase bulls with genetically enhanced EPDs for higher accuracies at a younger age, or purchase bulls who are half-siblings. Another management strategy is to use artificial insemination (AI). Proven AI sires represent some of the best genetics in the breed and have high accuracy EPD values. Ultimately, EPD values are the most accurate tool currently available in making genetic selection decisions.

Reproductive Management

General Reproductive Information

The success of a cow-calf operation depends upon the number of calves raised, weaned, and marketed each year. Following are some of the important production factors influencing profits in the cow-calf business:

- Calving and weaning percentages
- The percentage of cows and heifers that conceive early in the breeding season
- Proper growth and development of replacement heifers

Understanding the factors affecting reproductive performance in a cow herd can potentially increase productivity.

Table 29. General Reproductive Information

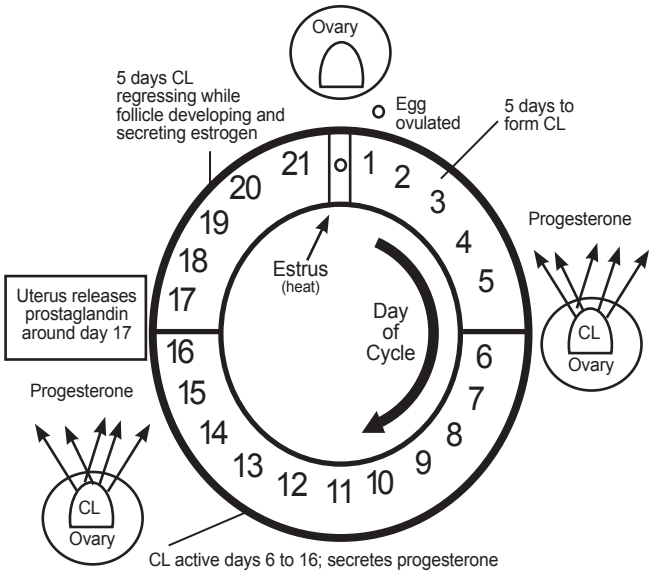
	Average	Range	Comments
Age at puberty	10–12 months	6–24 months	• Varies with breed • Brahmans and continental breeds usually reach puberty later than British breeds.
Gestation	283 days	273–290 days	• Bull calves are often carried slightly longer. • Brahman-type cattle often have longer gestation.
Length of estrous cycle	21 days	18–24 days	• Heifers often have slightly shorter cycles than cows.
Length of estrus (heat)	18 hours	6–30 hours	• Signs of estrus include restlessness, clear mucous vaginal discharge, and mounting other animals, but the main sign is “standing to be mounted.”
Interval to first heat after calving	45 days	16–90+ days	• Retained afterbirth and uterine infection delay onset. • Adequate body condition is critical.
Reproductive life	10 years	Up to 15 years (rarely longer)	• Management, death loss, culling, etc., play a large part in determining reproductive lifespan.

Normal Estrous Cycle

The average estrous cycle, from one standing heat (estrus) to the next, is 21 days in the cow (figure 20), with a range of 18 to 24 days. The cycle begins on day 1 when the egg is ovulated from a follicle on the ovary. The egg moves into the uterine tube where, if viable sperm from the bull are present, it is fertilized and moves into the uterus.

Regardless of whether the egg is fertilized, the site of ovulation on the ovary develops into a corpus luteum (CL) by approximately day 5. The CL is a gland that secretes the hormone progesterone into the cow's blood. While the CL is secreting progesterone, sometimes called the "hormone of pregnancy," the animal does not come into estrus.

Around day 17, if the animal is not pregnant, the uterus secretes the hormone prostaglandin F2 alpha (PGF2α) that causes the CL to regress in about 3 to 5 days. While the CL is regressing, a new egg-containing follicle is developing that secretes the hormone estrogen, causing the cow to come into standing heat on about day 20 or 21 of the estrous cycle.



Cows should be inseminated near the end of standing heat to provide enough time for the sperm to undergo a process called capacitation before they encounter the egg. Capacitation gives sperm the ability to fertilize the egg.

Cows ovulate approximately 4 to 16 hours after the end of standing heat.

Figure 20. Cyclicity is the normal 21-day cycle

See section on Timing of Artificial Insemination for maximum conception.

If a cow becomes pregnant, the embryo in the uterus prevents the release of PGF2α. When this happens, progesterone secretion by the CL continues, cycling ceases, and the pregnancy is maintained. If no problems occur during pregnancy, the embryo develops into a fetus, which is born as a calf about 283 days after the egg was fertilized.

Developing Replacement Heifers from Weaning to Breeding

Start of puberty is affected by age, weight, and breed. Of these three factors, weight is the one that producers can change. Determine your target weight at breeding. Sort replacement heifers by size, giving the most feed to heifers that need it the most.

Following is an example worksheet for calculating your required heifer gains before the start of the first breeding season.

	Alabama Example	**Your Herd**
Mature cow size	1,100 pounds	
Target weight at breeding (65% of mature weight)[1]	715 pounds	
Current weight	550 pounds	
Current date	August 1	
Start of breeding season	December 1	
Development period	120 days	
Total gain needed	162 pounds	
ADG needed	1.37 pounds/day	

[1]Calculate target weight based on your mature adult cow weight in the herd. Avoid underestimating the target weights for heifers.

Table 30. Recommended Height and Body Weight of Breeding Females

Frame Score	205 Days		426 Days		Maturity	
	Height[1]	Weight[2]	Height[1]	Weight[2]	Height[1]	Weight[2]
1	35	356	41	580	44	880
2	37	375	43	618	46	953
3	39	396	45	653	48	1,027
4	41	418	47	693	50	1,100
5	43	438	49	728	52	1,172
6	45	458	51	766	54	1,247
7	47	480	53	803	56	1,320
8	49	499	55	838	58	1,393
9	51	521	57	880	60	1,467

[1]Hip height (inches) based on Beef Improvement Federation standards

[2]Weights (pounds) are expected averages for flesh condition (body condition score 5).

Adapted from "Adjusting Nutrient Requirements of Beef Cattle for Animal and Environmental Variations," *Journal of Animal Science* 66 (1988):1475.

Breeding Soundness Evaluation of Replacement Heifers

Performing breeding soundness evaluations approximately 1 month before breeding allows for selection of heifers with the best reproductive potential. Heifers with poor reproductive potential can be culled before incurring additional costs associated with their maintenance. Heifers that conceive early during their first breeding season will calve earlier and wean older, heavier calves than heifers that conceive later in the breeding season. In addition, heifers that conceive and calve early with their first calf tend to continue to conceive and calve early throughout their productive lives.

Two important aspects of heifer breeding soundness examinations are reproductive tract scoring and pelvic area measurements. This is in addition to an overall physical assessment (conformation, physical soundness, body condition score, udder, etc.).

Reproductive Tract Scores

Reproductive tract scoring is a method for evaluating reproductive tract maturity and cyclicity in pubertal heifers. This evaluation is done via transrectal palpation or ultrasound to determine a heifer's reproductive tract development. Heifers are assigned a reproductive tract score (RTS) of 1 to 5 based on uterine size, uterine tone, ovarian size, and ovarian structures (table 31). Reproductive tract scores are moderately heritable.

Table 31. Heifer Reproductive Tract Scores

Heifer Reproductive Tract Scores					
		Ovaries (size and characteristics)			
Reproductive Tract Scores	**Uterine Horns Diameter (mm)**	**Length (mm)**	**Height (mm)**	**Width (mm)**	**Ovarian Structure**
1	Immature less than 20	15	10	8	No palpable follicles, no tone
2	20–25	18	12	10	8 mm follicle, no tone
3	25–30	22	15	10	8–10 mm follicle, slight tone
4	30	30	16	12	Greater than 10 mm follicle, good tone, corpus luteum possible
5	Greater than 30 mm	Greater than 32	20	15	Greater than 10 mm follicle, good tone, corpus luteum present

Adapted from Anderson et al., 1991. "The use of reproductive tract scoring in beef heifers." *Agri-Practice* 12, no. 4.

Pelvic Area Measurements

One of the potential reasons for calving difficulty (dystocia) in cows and heifers is disproportion between fetal size and heifer/cow pelvic area (i.e., the fetus is too large or the cow's pelvis is too small). Larger, heavier heifers do not always have the largest pelvic areas.

Measuring the pelvis before the breeding season allows selection of heifers with larger pelvic areas and culling of heifers with smaller pelvic areas. A 12-to-14-month-old heifer's pelvis will continue to grow. However, heifers with smaller pelvic areas during prebreeding soundness evaluations will continue to have proportionally smaller pelvic areas as cows.

The pelvis is measured transrectally with a pelvimeter. The pelvic area is then calculated in square centimeters (cm^2) by multiplying the width of the pelvis by the height of the pelvis.

Using a conversion factor (table 32) of the heifer's pelvic area measurement along with its age and weight are used to estimate the calf birth weight that the heifer should be able to deliver without difficulty. This does not estimate the birth weight of a heifer's calf, but rather provides an estimate of how big a calf she could safely deliver.

Following is an example of how to estimate the deliverable calf birth weight of a 12-month-old heifer that weighs 800 pounds:

- Measured pelvic height = 15 cm
- Measured pelvic width = 12 cm
- Calculated pelvic area = 15 cm × 12 cm = 180 cm^2
- Ratio from chart = 2.3
- Estimated deliverable calf weight = 180 ÷ 2.3 = 78 pounds

Table 32. Conversion Factors for Various Heifer Weights and Ages to Calculate an Estimated Deliverable Calf Birth Weight

Heifer Pelvic Measurement				
Heifer Weight (pounds)	**Heifer Age at Time of Measurement**			
	8–9 months	**12–13 months**	**18–19 months**	**22–23 months**
500	1.7	2.0		
600	1.8	2.1		
700	1.8	2.2	2.6	
800		2.3	2.7	3.1
900		2.4	2.8	3.2
1,000		2.5	2.9	3.3
1,100				3.4

Adapted from Deutscher GH, 1987. "Pelvic Measurements for Reducing Calving Difficulty." *NebGuide* G87-895, Nebraska Cooperative Extension Service.

Estrus Synchronization Programs

Artificial insemination (AI) is a reproductive tool that allows cattle producers to use sires with superior genetics at a more affordable price. Part of a successful AI program is estrus synchronization, which typically involves administering a series of hormones to induce a group of cows or heifers to be fertile at a chosen time period, which makes it easier to determine when the cows are in heat.

The majority of estrus (heat) synchronization programs use one or a combination of three basic methods that work with the physiology of the cow's normal estrous cycle.

- Prostaglandin (PGF2α) injections cause CL regression (see section on Normal Estrous Cycle) and standing heat in 1 to 5 days, unless the cow or heifer is in the first 5 to 7 days of her estrous cycle when her CL is not responsive to PGF2α.
- Progesterone or progestins, released from controlled internal drug release (CIDR) inserts or ingested in feed (MGA), respectively, mimic the effects of the cow's natural progesterone by preventing heat from occurring as long as they are present in the body. Once removed, the cow or heifer typically comes into heat in 1 to 3 days. These products are often used in conjunction with a PGF2α injection.
- Gonadotropin-releasing hormone (GnRH) injections promote and synchronize follicle growth and induce ovulation. A GnRH injection administered approximately 48 hours after a prostaglandin injection provides a more concise synchrony of ovulation.

To review recommended estrus synchronization protocols for both cows and heifers, refer to the Beef Reproduction Task Force at www.beefrepro.org/. Recommended protocols are updated frequently and provide a comparison of both cost and labor resources to help beef producers select the appropriate estrus synchronization protocol for their operations.

Federal law restricts the majority of reproductive hormones to use by or on the order of a licensed veterinarian. Contact your veterinarian to learn about specific recommendations and products for an estrus synchronization program.

There are two main reasons that estrus synchronization programs fail:

- The animals were not cycling. Cows must be in sufficient body condition at calving and have adequate nutrition available to begin cycling postpartum. Heifers must be at approximately 65 percent of their mature body weight to initiate cycling.
- The animals were cycling, but heat was not detected after injection of PGF2α or removal of progesterone/progestin. The signs of heat may have been present but just not detected. Cows are usually in estrus for only 12 to 24 hours and may show signs of standing heat only a few times. The cow or heifer did not respond to the PGF2α injection because she was in the first 5 to 7 days of her estrus cycle when her CL was not responsive to PGF2α. Observe for standing heat at least 30 minutes twice a day. Early morning and late afternoon are the best times for heat detection.

Handling of Reproductive Hormones

- Always be careful when handling reproductive hormones; they can be absorbed through the skin and affect humans.
- **Women of childbearing age, asthmatics, and people with bronchial or other respiratory problems should exercise extreme caution when handling reproductive hormones.**
- Always follow label directions and adhere to all other BQA guidelines.

Timing of Artificial Insemination for Maximum Conception

Figure 21 offers general guidelines for timing of artificial insemination (AI) based on observed standing heat (estrus). Actual times will vary depending on the length of standing heat, but the goal is to inseminate near the end of a heat period.

Cows ovulate approximately 4 to 16 hours after the end of standing heat. Inseminating near the end of heat provides time for the sperm to undergo capacitation before encountering the egg. The process of capacitation gives sperm the ability to fertilize the egg. In general, it is better to have the sperm waiting on the egg rather than the egg waiting on the sperm, because the egg has a shorter lifespan.

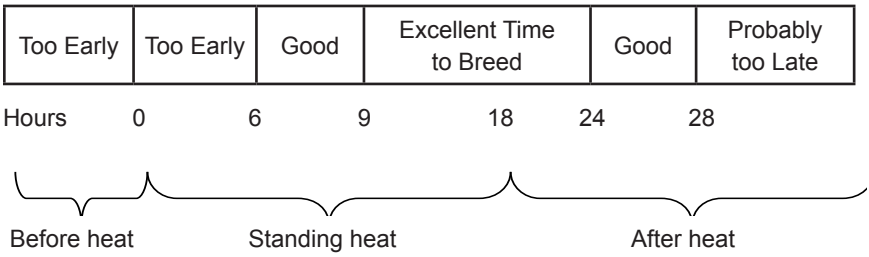


Figure 21. Timing of artificial insemination for maximum conception

Points to Consider

Good heat detection is critical for successful artificial insemination. Observe for standing heat at least 30 minutes twice a day. Early morning and late afternoon are the best times for heat detection.

Maximum conception rates for artificial insemination occur if animals are bred near the end of standing heat. Traditional artificial insemination follows the a.m.-p.m. rule. An animal first observed in heat in the a.m. should be inseminated that p.m. An animal first observed in heat in the p.m. should be inseminated the next a.m.

Some producers also may consider using fixed-timed AI (FTAI) in which insemination occurs at a predetermined time following an appropriate synchronization program. FTAI allows for a more regimented schedule. Recent improvements in FTAI and estrus synchronization protocols have increased pregnancy rates while allowing for easier scheduling of labor resources and less cattle handling. If an FTAI program is used with estrus synchronization, the need for heat detection can be eliminated.

Parturition

Observation of cows and heifers before and during the calving season is necessary to ensure a good calf crop. Cows should be checked at least daily during the calving season, and heifers should be checked more frequently (perhaps several times a day). Producers need to be familiar with the signs of impending parturition as well as the sequence of events associated with normal labor and delivery to determine if and when assistance is necessary.

Signs of Impending Parturition

- The udder and vulva often enlarge 1 to 3 weeks before parturition.
- Cows and heifers often become more nervous (restless) and isolate themselves from the rest of the herd just before parturition.
- Cows and heifers may show signs of abdominal discomfort by kicking at their bellies. They also may glance to the rear nervously.
- The tail-head appears raised as ligaments around the rump of the cow or heifer relax.

Assistance may be needed when parturition does not proceed as described. Early intervention is the key. Waiting too long to provide assistance unnecessarily risks the life of the cow or heifer and her calf. Seek the help of a veterinarian or experienced herdsman if you need assistance, and keep the following guidelines in mind:

- Calving takes time, and it often takes longer for heifers than for cows. So be patient, but don't wait too long. Progress should be steady and generally fit within the time frames mentioned in table 33. In other words, once the water sac (placental membrane) is seen protruding from the vulvar lips and breaks open, a cow should deliver her calf within an hour, and a heifer should deliver her calf in less than 1 to 2 hours. Once the delivery stage begins, a cow or heifer should make visible progress about every 15 to 20 minutes.

- Use the 2+1 rule to help determine when to call for help. Upon examination, two forelegs and one head (or two hind legs and one tail) should be felt or seen for a normal delivery to proceed. If adequate time has elapsed and 2+1 is still not seen or felt, assistance is necessary.
- If the cow or heifer becomes exhausted and quits trying to calve, assistance is necessary.
- No more than two strong people should pull on a calf at the same time. When pulling on a calf to assist with a delivery, try to pull only when the cow or heifer is actively contracting. This will facilitate progress and minimize the risk of uterine prolapse.

Table 33. Three Stages of Parturition

Stage	Duration	Comments
Stage I Preparatory	Cows (4–8 hours) Heifers (6–12 hours)	• Cow or heifer may become nervous and isolate herself from the rest of the herd. • Uterine contractions begin. • Colostrum/milk drops into the teats. • The fluid-filled placental membrane (water sac) appears toward the end of this stage. Stage II begins when the water sac breaks.
Stage II Delivery of the calf	Cows (less than 1 hour) Heifers (1–2 hours)	• Cow or heifer is now actively straining. • In normal parturition, the calf's forelegs and head protrude first about 70% of the time, and the hind legs and tail come first about 30% of the time. • The calf is delivered.
Stage III Expulsion of the placenta (afterbirth)	Cows (1–12 hours) Heifers (1–12 hours) This usually occurs within the first few hours.	• Cow or heifer straining decreases. • Uterine contractions continue and the placenta is expelled. • If the placenta is not expelled soon after birth, do NOT manually remove the placenta by pulling it out (see section on Retained Placenta).

Supplies Needed to Assist with Calf Delivery

- Obstetrical (OB) chains or ropes. Chains are preferred because they can be easily disinfected after use. OB chains and ropes are used for pulling on the calf's legs (figure 22). Never attach OB chains or ropes to the calf's jaw to pull on a calf, as the jaw will almost always fracture.
- OB handles for pulling on the chains or ropes.
- Mechanical calf puller, also known as a "calf jack." **USE WITH CAUTION, AND DO NOT APPLY EXCESSIVE FORCE**. Calf jacks can exert substantial force on the cow or heifer and the calf. When used improperly, the cow, heifer, and calf can be injured or killed. Never attempt to deliver a calf with any type of vehicle.
- OB lubricants
- Plastic gloves
- Buckets
- Towels and paper towels
- Iodine or other appropriate disinfectant/drying agent for the calf's navel

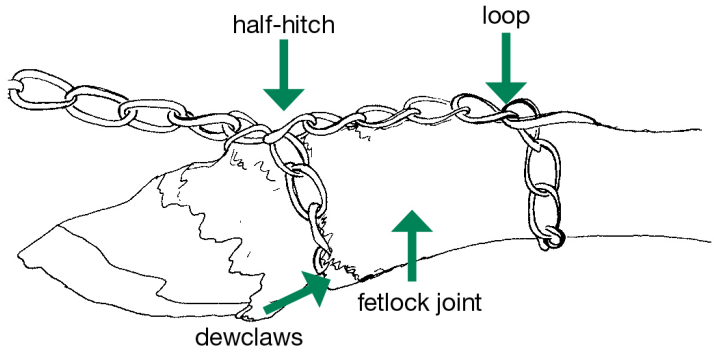
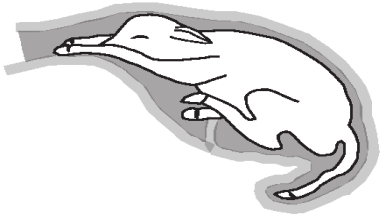


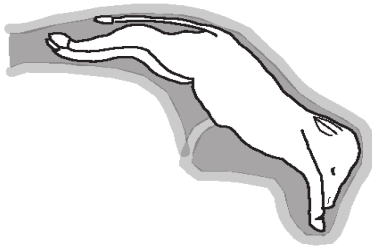
Figure 22. Place a loop above and a half-hitch below the fetlock joint with the connecting chain on the top of the leg.

Providing Assistance During Calving

The first step in providing assistance during parturition is assessing the problem. Several common situations encountered when delivering a calf are illustrated and described below.

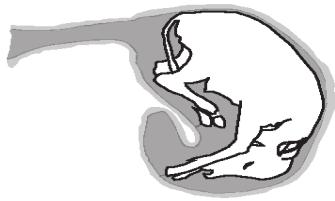
Normal delivery (pictured below). The calf's forelegs and head protrude first about 70 percent of the time. The hind legs and tail come first about 30 percent of the time. Always make sure the tail is protruding with the hind legs in this situation.

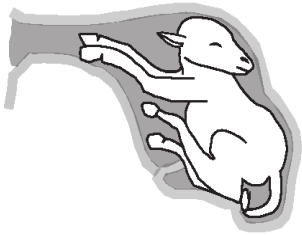




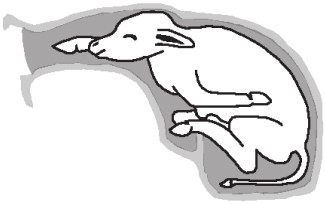
Calf too big (not illustrated). This is most frequently encountered in heifers, but it can occur in cows. Applying excessive force to attempt delivery of a calf that is too big is detrimental to the health of the heifer and the calf, and it wastes precious time. Call a veterinarian as soon as you decide the calf is too big. The calf can be saved if assistance is provided promptly. Even if the calf cannot be saved, a veterinarian can dismember the calf or perform a C-section to save the heifer.

Breech (pictured right). Hindquarters are first with both hind legs retained. Both hind legs and the tail must be straightened out and placed correctly within the birth canal for delivery to proceed.



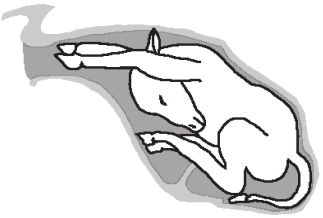


Head turned to the side (pictured left). The neck must be straightened out and the head placed on top of the forelegs for delivery to proceed.



Retained foreleg(s) (pictured left). Occasionally one or both forelegs are retained. If both forelegs are retained then only the head will be in the birth canal. The forelegs must be straightened out and delivered simultaneously with the head resting on top of the forelegs.

Head underneath both forelegs (pictured right). The head must be placed on top of the forelegs. Delivery can then proceed.



Reproductive Tract Prolapses

Vaginal and Cervical Prolapses

Prolapses usually occur prepartum (before calving) during the last half of pregnancy and occasionally occur postpartum (after calving). They usually occur in cows and occasionally in heifers. They are classified as follows:

- First degree is intermittent protrusion of the floor of the vagina. This type of prolapse occurs when the cow is lying down, and it corrects itself when the cow stands up.
- Second degree is continuous protrusion of the vagina.
- Third degree is continuous protrusion of the vagina and cervix (cervical prolapse).
- Fourth degree is a second- or third-degree prolapse that has been prolapsed for so long the tissue is becoming necrotic (dead).

Vaginal and cervical prolapses reoccur and are heritable; therefore, it is probably best to have your veterinarian temporarily fix the prolapse with the intent of eventually culling the cow and her heifer offspring.

Uterine Prolapse

Uterine prolapse always occurs postpartum and is an **emergency**. Cows with a uterine prolapse will die without prompt medical attention. Contact your veterinarian immediately.

Do not overly stress a cow with a uterine prolapse, and do not attempt to move her very far. A cow with a prolapsed uterus is often in shock and at great risk for fatal hemorrhaging. It is best to treat the cow on the farm if possible. If transport is necessary, be extremely cautious.

If the cow survives treatment, she likely will develop a temporary uterine infection and be slower to breed back. She is not at any greater risk for uterine prolapse in subsequent years.

This is not a heritable condition, and it is not likely to reoccur. Therefore, there is no need to cull the cow as long as she breeds back.

Differentiating Between Vaginal/Cervical and Uterine Prolapses

- If a reproductive tract prolapse occurs prepartum, it is a vaginal/cervical prolapse.
- If a reproductive tract prolapse occurs postpartum, it can be either a vaginal/cervical prolapse or a uterine prolapse, but it is most likely a uterine prolapse.
- If carnucles are present on the prolapsed tissue, the cow has a uterine prolapse. The carnucles are darker than the surrounding tissue, circular to oval in shape, and approximately 2 to 4 inches in diameter.

Retained Placenta

The bovine placenta, or afterbirth, is normally expelled within a few hours after calving. A “retained placenta” occurs if the afterbirth is not expelled within 12 hours. Retained placentas normally occur in a small percentage of all calvings. Closely evaluate your herd’s nutrition if you are experiencing frequent occurrence of retained placentas. Cows with retained placentas often will be slower to breed back.

Predisposing Factors for Retained Placenta

- Premature inducing of parturition (calving). This greatly increases incidence of retained placentas. Fortunately, there is rarely a need to induce parturition in cattle.
- Abortions or premature births. No retained placenta before 120 days of gestation; 15 percent if 121 to 150 days of gestation; > 50 percent if 240 to 270 days of gestation

- Dystocia (difficult births)
- Nutritional deficiencies, especially hypocalcemia (low blood calcium). Poor nutrition results in weak uterine contractions that are necessary to expel the placenta.

Treatment

Do not forcefully pull out the placenta. This often leaves pieces of the placenta in the uterus that will further delay the cow from rebreeding.

Give it time. The recommended treatment for a retained placenta is to let nature take its course; eventually the placenta will fall out. This may take up to a week (and will smell bad), but be patient. If the placenta is hanging extremely low, it may be advisable to twist the placenta into a knot around the cow's hocks to prevent her from stepping on it or catching it on some object. Watch the cow closely to ensure that she is eating, drinking, and feeling healthy.

When in doubt, call your veterinarian. Veterinarians occasionally prescribe hormonal treatment if indicated. Your veterinarian also will prescribe antibiotics if the cow becomes systemically ill.

Reproductive Measurements

You can only manage what you measure. Following are the most important measures of reproductive efficiency:

Pregnancy percent (PP) is a measure of the success of the breeding season. Make your calculations based on the number of cows exposed to breeding. To produce a marketable product, each cow must conceive and give birth each year.

PP = (number palpated pregnant ÷ number of cows exposed) × 100

Percent birth calf crop (PBCP) measures the collective results of the breeding and calving seasons. Not only must cows conceive, but they must give birth to live, healthy calves. If cows are losing calves between breeding and calving, there could be a problem with reproductive disease.

PBCP = (number of live calves ÷ number of cows exposed to breeding) × 100

Weaning percent (WP), also called "percent calf crop weaned," is the single most descriptive measure of reproductive performance of a cowherd.

WP = (number of live calves weaned ÷ number of cows exposed to bulls) × 100

Calving interval (CI) is the number of days between successive calving. CI is one measure of a cow's reproductive performance for the past year. Ideally, calving interval should be 365 days or less. A late-breeder cow with a long CI may sooner or later fail to rebreed during a controlled breeding season.

CI = (age [in days] at first calving – age at last calving + 365) ÷ number of calvings

General Causes of Poor Reproductive Performance

There are many causes of poor reproductive performance in cows and heifers, but in general all causes can be categorized as infectious or noninfectious.

Infectious causes of infertility or abortion include, among others, the following:

- Anaplasmosis
- Bovine viral diarrhea virus
- Brucellosis
- Infectious bovine rhinotracheitis (IBR)
- Leptospirosis
- Neosporosis
- Trichomoniasis
- Vibriosis (campylobacter)

Noninfectious causes of infertility or abortion include the following:

- Nutrition issues due to poor body condition score or improper mineral supplementation
- Heat stress
- Improper handling of frozen semen for artificial insemination (can occur during the thawing and insemination process or while the semen is stored in the liquid nitrogen tank)
- Improper artificial insemination technique
- Unobserved standing heats (estrus) due to poor heat detection, leading to poor artificial insemination results
- Insufficient bull power (i.e., not enough bulls) or subfertile bulls
- Nonpuberty in replacement heifers
- Toxins
- Fetal genetic defects

With so many causes of poor reproductive performance, it is often advisable to contact your herd health veterinarian or Extension agent for help. A herd check, including various diagnostic tests, may be necessary to determine the exact cause of poor reproductive performance.

If Abortion Occurs

- Contact your veterinarian.
- Keep other cattle away from the aborted tissues and the animal that aborted in case the cause of the abortion is infectious.
- Keep scavengers away from the aborted tissues so that your veterinarian can examine them for the cause of the abortion. Your veterinarian may also want to submit the aborted tissues to one of the Alabama Department of Agriculture and Industries veterinary diagnostic laboratories.
- Be careful if handling the aborted tissues. Some causes of abortion in cattle are also infectious to humans.

Consequences of Nutritional Mismanagement on Reproduction

- Increased age at puberty
- Lower conception rates
- Greater degree of calving difficulty
- Increased calf morbidity and mortality
- Calves born later in calving season
- Lighter weaning weights
- First-calf heifers with poor reproductive performance during rebreeding
- Later rebreeding of first-calf heifers
- Reductions in lifetime productivity
- Increased rate of culling

Fundamental Ingredients for Improving Reproductive Performance of Your Beef Herd

- Permanently identify cows and calves.
- Avoid an extended calving season. Establish a controlled breeding and calving season of 60 to 90 days.
- Ensure that every bred female weans a calf with acceptable weaning weight every year.
- Match breeding/calving seasons to nutritional resources based on what forages are available before and after breeding.
- Monitor body condition scores for rebreeding.

- Implement a breeding system that utilizes heterosis.
- Select and use superior bulls for traits important to you.
- Use bulls with appropriate calving ease or birth weight EPDs.
- Conduct breeding soundness exams for your bulls 60 days before the beginning of your breeding season.
- Select early born replacement heifers.
- Select replacement females based on performance.
- Develop replacement heifers to reach the target weight of 65 percent of their mature body weight before breeding.
- Breed replacement heifers 2 to 4 weeks before mature cows.
- Calve heifers at 2 years of age.
- Calculate average calving date, calving interval.
- Calculate pregnancy rate and weaning rate.
- Cull cows based on performance.
- Cull cows with significant structural, eye, tooth, or udder problems.
- Cull open cows and those with late calves or extended postpartum intervals.
- Develop an effective health program.

How to Optimize Breeding Performance of Your Bulls

- Select bulls that will complement the genetics of your herd in terms of growth, carcass, and maternal ability.
- Cull all bulls with structural problems, an inability to breed, an inadequate scrotal circumference, and poor semen quality.
- Sort bulls by age into breeding pastures to minimize the possibility of the dominant bull hurting or crippling a younger, less dominant bull in the pasture.
- Observe bulls at the start of the breeding season to determine that each bull has the ability to breed. Observe pastures for cows that have been bred earlier and are returning to heat.
- Use only bulls that pass an annual breeding soundness evaluation (BSE) 60 days before the start of the breeding season. Retest bulls that previously failed the examination. Cull bulls that fail the BSE. (See section on Breeding Soundness Evaluation.)
- Ensure that an appropriate herd health program is in place.
- Use an appropriate bull-to-cow ratio (table 34).

Table 34. Recommended Number of Females per Bull Based on Bull's Age for Single-Sire Units[1]

Bull's Age (months)	Number of Females
12–15	10–12
15–18	12–18
18–24	18–25
24 and older	25–35

[1]In multisire units, decrease the number of females by approximately half for each additional bull.

Bull Breeding Soundness Evaluation (BSE)

Failure to properly evaluate your bulls can result in huge economic losses, yet performing bull BSEs prior to the breeding season is often one of the most neglected reproductive management practices in cattle operations.

A bull's fertility can be considered fertile, subfertile, or sterile. Subfertile bulls may eventually get cows pregnant if left together for sufficient time, but they will take much longer to get cows pregnant than fertile bulls. As a result, calves will be born later and be younger and lighter at weaning.

Subfertile bulls also produce fewer calves during a breeding season, leading to fewer pounds at weaning. Fewer pounds at weaning equals fewer pounds to market, which translates to fewer dollars in your pocket.

A bull BSE is a uniform method of assessing a bull's likelihood of accomplishing pregnancy in an appropriate number of healthy, cycling cows or heifers during a defined breeding season.

The minimum requirements for scrotal circumference, sperm motility, and sperm morphology are outlined by the Society for Theriogenology. Additional factors influencing the number of cows a bull can breed in a season include pasture size and terrain, physical soundness, age of the bull, libido, and number of bulls in the group.

Components of a Bull Breeding Soundness Exam (BSE)

Physical exam evaluates the physical characteristics of the bull necessary for mobility and athleticism in the pasture; this includes structural soundness and overall internal and external reproductive development.

Scrotal circumference evaluates testicular size and health and estimates the bull's sperm-producing capacity. See table 35 for the minimum recommended scrotal circumference as outlined by the Society for Theriogenology. Bulls must meet minimum scrotal circumference measurements based on age in order to pass a BSE.

Sperm motility ensures that the bull is producing sufficient numbers of live sperm. Bulls must have at least 30 percent motility to pass a BSE.

Sperm morphology ensures that the bull is producing sperm that are properly shaped and capable of fertilization. Bulls must produce at least 70 percent normal sperm to pass a BSE.

Based on the results of the BSE, the bull is then assigned to one of three classifications:

- **Satisfactory potential breeder (fertile).** Indicates that the bull passed a physical exam, met the minimum requirements for scrotal circumference, has at least 30 percent sperm motility, and produces at least 70 percent normal sperm.
- **Unsatisfactory potential breeder (subfertile or sterile).** Indicates that the bull did not pass at least one of the four components of the BSE.
- **Deferred.** Indicates that the bull did not pass at least one of the four components of the BSE due to a condition that may resolve with time. A deferred bull should be rechecked at a later date.

A BSE does not evaluate a bull's libido, nor does it ensure that a bull will remain a satisfactory potential breeder the entire breeding season. If a bull suffers injuries to his feet, legs, or reproductive tract, such an injury may render him incapable of breeding your cows; therefore, it is extremely important to observe your bulls regularly to ensure that they are doing their job.

A BSE also does not guarantee that bulls are free of infectious diseases. Consult your veterinarian on what diagnostic tests may be appropriate for your bull. The extra pounds of beef per exposed cow will more than pay for the BSE, so contact your veterinarian for a bull BSE prior to next breeding season.

Table 35. Minimum Recommended Scrotal Circumference (SC)

Minimum Recommended Scrotal Circumference (SC)	
Age (months)	**SC (cm)**
≤ 15	30
> 15 ≤ 18	31
> 18 ≤ 21	32
> 21 ≤ 24	33
> 24	34

Adapted from "Bull Breeding Soundness Evaluation," Society for Theriogenology.

Measuring Scrotal Circumference

- Safely restrain bull in a squeeze chute.
- Testicles must be descended into the scrotum. Hold testicles to the bottom of the scrotal sack by placing your fingers on the side of the scrotum and above the testicles (figure 23). Do not place fingers between the testicles.
- Slip the loop formed by the scrotal tape over the scrotum around the widest point.
- Pull tape up snugly.
- Take circumference reading in centimeters at the index formed by the small stainless-steel crossbar on the scrotal circumference tape thumb piece.

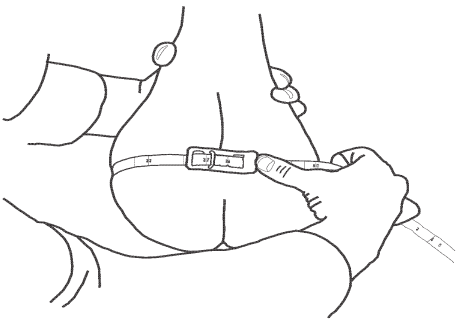


Figure 23. Proper method for measuring scrotal circumference

Management and Marketing Economics

Introduction

Beef cattle production in Alabama is primarily a system that produces feeder calves that will be shipped to feedlots for finishing. Alabama's large cow-calf industry helps to provide calves that produce either heavyweight feeders that move directly to feedlots or lighter weight calves that have weight added by utilizing forages (stockering) before moving to the feedlot.

While the majority of Alabama operations fall under the umbrella of conventional production, there are producers who have successfully filled specialty or niche markets, such as seedstock producers, locally finished producers, and organic producers. The long growing seasons, variety of forages, and abundant moisture in the state give producers an excellent opportunity to attain profitability by utilizing these competitive advantages.

Beef cattle production is a business, and, just as in other businesses, proper planning, management, and evaluation are necessary to ensure sustainability. Successful beef cattle producers do the following:

- Have a business plan in place with long- and short-term objectives
- Use tools such as budgets to evaluate current and future business options
- Use production and financial record-keeping systems to monitor both physical and fiscal health of their operation

The beef cattle management and marketing economic tables and figures featured here are provided to help you make wise economic decisions.

Costs and Budgeting

Fixed and Variable Costs

We often hear about fixed and variable costs, but what are they and why are they important to beef cattle producers?

Variable costs are what typically come to mind when a producer is asked to consider his or her costs. These are the costs for which you receive a bill at some point during the year; they are directly associated with production (cattle, forage, etc.). Variable costs change as the quantity of production changes. Fertilizer, seed, chemicals, medicines, and feed are all examples of variable costs. These costs are incurred only if you undertake production.

Many producers assume that if they make profit above variable costs they are sustainable or profitable in the long term. However, if they don't account for their fixed costs in the evaluation process, this will not be the case. Producers must account for aging equipment, aging facilities, and the fact that there is an inherent value for assets that could be claimed if they were not using the assets to farm.

Fixed costs refer to the costs that do not change (at least in the short term) whether you produce or not. Examples of fixed costs are land, equipment, taxes, and building/facilities. If you own land, you have an expense whether you farm it or not. Land payments, taxes, and opportunity costs are all costs of owning land.

Why is the concept of fixed cost important? If you still owe for the land, there are considerations that must be made to pay the long-term note. In addition, there are opportunity costs associated with farming your own land.

Opportunity cost is an economic term that refers to the value you could be receiving for an asset if you weren't using it as you currently are. Could you be making more money from the land if you rented it out rather than farmed it yourself? These are costs to consider when making production decisions.

Another consideration with fixed costs is the depreciation associated with the asset. Depreciation refers to the fact that many of our fixed costs (facilities, equipment) have a useful lifespan, after which they become obsolete or are no longer functional. (You don't calculate depreciation on land; it doesn't have a definable usable lifespan.) Factoring depreciation into your budget can help you plan for future investment (or reinvestment) in assets.

Table 36. Beef Enterprise Investment for 100 Cow Herd (Owned Real Estate)

Item	Number	Units	Dollars/ Unit	Percent Charged	Total Dollars	Dollars/ Cow	Dollars/ Acre
Land	200	Acres	2,230.00	100	446,000.00	4,460.00	2,230.00
Well and pump	1	Each	7,320.00	100	7,320.00	73.20	36.60
Water trough pad (concrete)	4	Each	1,206.00	100	4,824.00	48.24	24.12
Water pipeline	2,500	Feet	1.60	100	4,000.00	40.00	20.00
Water troughs	4	Each	286.00	100	1,144.00	11.44	5.72
Cows	100	Head	500.00	100	150,000.00	1,500.00	750.00
Bulls	3	Head	4,500.00	100	13,500.00	135.00	22.50
Commodity barn	1	Each	7,500.00	100	7,500.00	75.00	37.50
Equipment barn	1	Each	5,199.00	100	5,199.00	51.99	26.00
Tractor and implements	1	Each	55,000.00	100	55,000.00	550.00	275.00
Pickup	1	Each	39,031.00	50	19,515.50	195.16	97.58
Fences	4	Miles	15,682.00	100	62,728.00	627.28	313.64
Corral	1	Each	20,400.00	100	20,400.00	204.00	102.00
Total Beef Enterprise Investment Cost					**797,130.50**	**7,971.31**	**3,940.65**

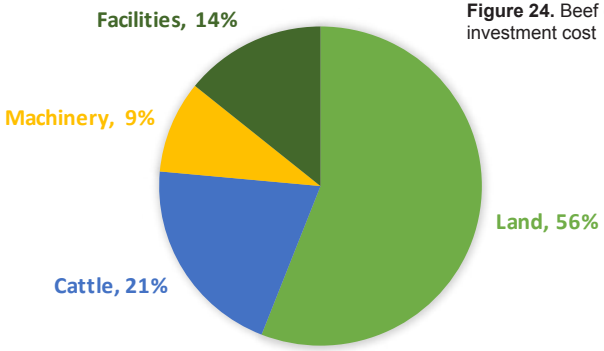


Figure 24. Beef enterprise investment cost

Table 37. 2017 Cow-Calf Budget (30 Brood Cows, 1 Bull, Grazing 60 Acres)

Cow-Calf Enterprise Sensitivity Budget Weaning 625 lb. versus 750 lb. Calf		
Returns Per Cow Per Year, lb.	**625**	**750**
Average calf weight, lb./calf	625	750
Weaning percent	90	90
Total calf weight, lb.	16,875	20,250
Average calf weight, lb./cow-unit	563	675
Average calf price, $/lb.	2.64	2.34
Total cull cow weight, lb.	4,620	4,620
Average cull cow weight, lb./cow	1,100	1,100
Average cull cow weight, lb./cow-unit	154	154
Average cull cow price, $/lb.	1.25	1.25
Gross returns, total $	50,325.00	53,160.00
Average calf return, $/cow-unit	1,485.00	1,579.00
Average cull cow return, $/cow-unit	192.50	192.50
Gross returns, $/cow-unit	1,677.50	1,772.00

Table 38. 2017 Cow-Calf Budget (30 Brood Cows, 1 Bull, Grazing 60 Acres) (cont.)

Cost Per Cow Per Year		
Variable Costs, $	**625 lb.**	**750 lb.**
Pasture	674.33	674.33
Purchased feed	256.21	256.21
Animal health	38.32	38.32
Management	20.00	20.00
Labor	6.25	6.25
Custom hire	16.00	16.00
Farm records	5.00	5.00
Professional fees	13.33	13.33
Utilities	12.17	12.17
Marketing fees	67.10	70.88
Supplies	-	-
Replacement heifer capital cost	170.00	170.00
Insurance and tax on breeding stock	-	-
Interest on operating costs	72.03	72.19
Fixed Costs, $		
Machinery and equipment	149.33	149.33
Buildings/improvements/facilities-DIRT	58.33	58.33
Buildings/improvements/facilities-interest	33.33	33.33
Annual bull cost depreciation	31.67	31.67
Interest on breeding stock capital	143.37	143.37
Total cost per cow per year (var. and fixed)	1,766.78	1,770.72
Returns Over Costs Per Cow Per Year, $		
Returns over variable costs per cow per year	326.76	417.32
Returns over total costs per cow per year	(89.28)	1.28
Average Feeder Calf Price Needed Per Cwt.		
To cover feed costs, $/cwt.	165.43	137.86
To cover total costs, $/cwt.	279.87	233.81
Asset turnover ratio (A/Investment), %	67	71
Net return on investment, %	6	10

Feed Costs

Pasture establishment and maintenance along with purchased feed costs are some of the largest costs for cattle producers, often ranging from 40 to 60 percent of total per-cow costs. Managed forage production can cut down on purchased feed costs. Although pasture maintenance is costly, producers must evaluate the costs and benefits of various practices.

For pasture-based operations in Alabama, a lack of adequate rainfall can be very costly. Producers may have to purchase more feed than anticipated and could lose investments they have made in pasture establishment or maintenance. The USDA Risk Management Agency offers an insurance product that helps insure cattle producers against low rainfall. For more information, see the Rainfall Index Insurance for Pasture, Rangeland, and Forage at www.rma.usda.gov/policies/pasturerangeforage.

Table 39. Estimated Establishment Costs per Acre Fescue for Grazing (Novel Endophyte)

Item	Unit	Quantity	Price or Cost/Unit	Total/Acre
Variable Costs				
Soil test	Acre	1.00	1.00	1.00
Seed	Pound	15.00	4.00	60.00
Fertilizer				
Nitrogen	Pound	80.00	0.86	68.80
Phosphate	Pound	50.00	0.56	28.00
Potash	Pound	50.00	0.44	22.00
Lime	Tons	1.00	60.00	60.00
Herbicide*	Acre	2.00	10.00	20.00
Labor (wages and fringe)	Hour	6.1875	14.00	86.63
Land rent	Acre	1.00	-	-
Tractors and equipment	Acre	1.00	27.21	27.21
Interest on op. cap.	Dollar	186.8175	8%	14.95
Total variable cost				**388.58**
Fixed Costs				
Tractor and equipment	Acre	1.00	27.74	27.74
General overhead	Dollar	388.58	0.07	27.20
Total fixed cost				**54.94**
Total costs of all specified expenses				**443.52**

Following Best Management Practices, Alabama 2017–2018. Fertilizer rates used (80-50-50) based on medium level of soil fertility. **These estimates should be used as guides for planning purposes only.**

*The conversion of an existing toxic endophyte tall fescue pasture to a novel endophyte (nontoxic, friendly) tall fescue pasture will require two broadcast applications of a nonselective herbicide to kill the existing fescue and other plants present and/or the addition of a summer annual cover crop to smother the existing stand (either spray-spray-plant or spray-smother-spray-plant techniques are both acceptable methods to eliminate existing stands). The production of seed by toxic endophyte plants should be prevented during the season prior to planting a novel-endophyte stand in the fall. The dry matter yield of any newly established tall fescue stand will be significantly less during the establishment year.

Table 40. Estimated Annual Costs Per Acre Fescue for Grazing

Item	Unit	Quantity	Price or Cost/Unit	Total/Acre
Variable Costs				
Soil test	Acre	0.33	1.00	0.33
Fertilizer				
Nitrogen	Pound	120.00	0.86	103.20
Phosphate	Pound	50.00	0.56	28.00
Potash	Pound	50.00	0.44	22.00
Lime (prorated)	Tons	0.33	60.00	19.80
Herbicide	Acre	0.33	10.00	3.33
Labor (wages and fringe)	Hour	2.47	14.00	34.64
Land rent	Acre	1.00	-	-
Tractors and equipment	Acre	1.00	6.25	6.25
Interest on op. cap.	Dollar	108.78	0.08	8.70
Total variable cost				**226.26**
Fixed Costs				
Tractor and equipment	Acre	1.00	4.79	4.79
Prorated established costs	Dollar	388.58	0.10	38.86
General overhead	Dollar	226.26	0.07	15.84
Total fixed cost				**59.48**
Total costs of all specified expenses				**285.74**

Following recommended best management practices, Alabama 2017–2018. Fertilizer rates: 120 to 50 based on medium level of soil. Fertility: nitrogen applied in split applications (60 pounds fall and 60 pounds spring). These estimates should be used as guides for planning purposes only.

Marketing

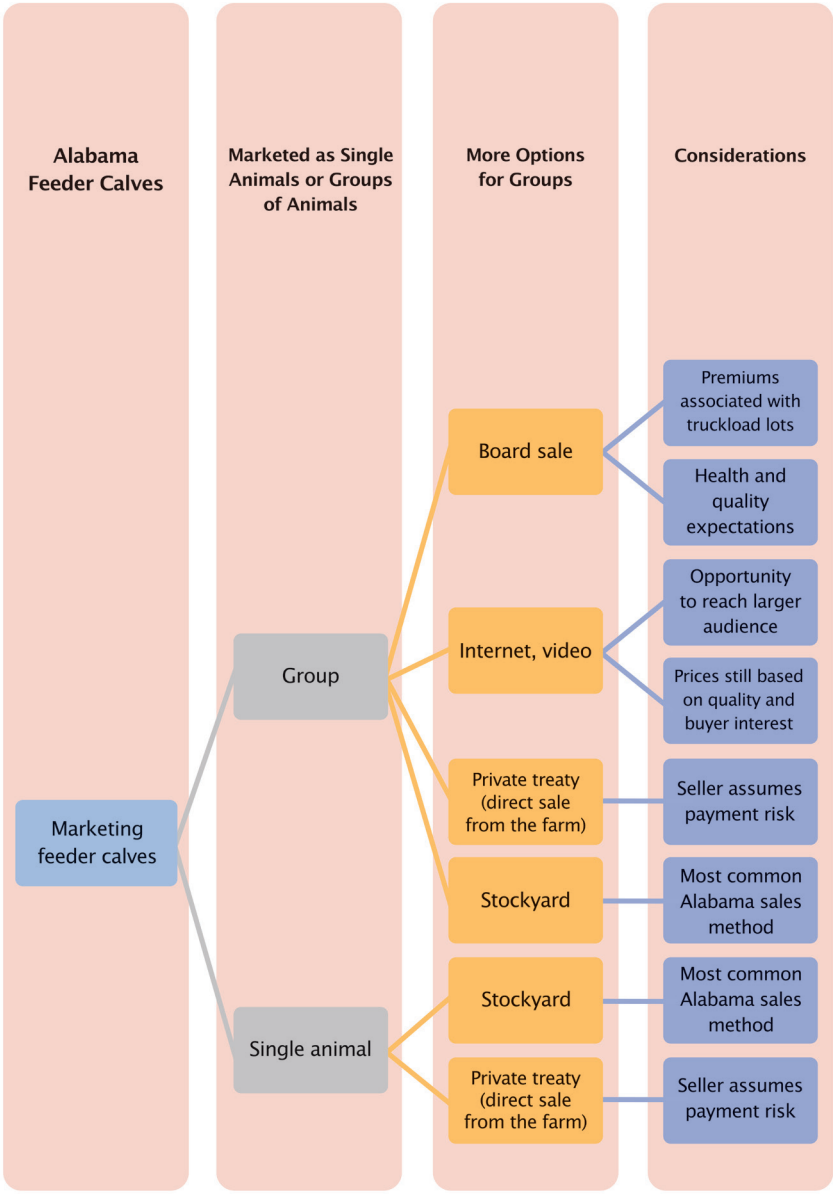


Figure 25. Marketing avenues for Alabama feeder calves

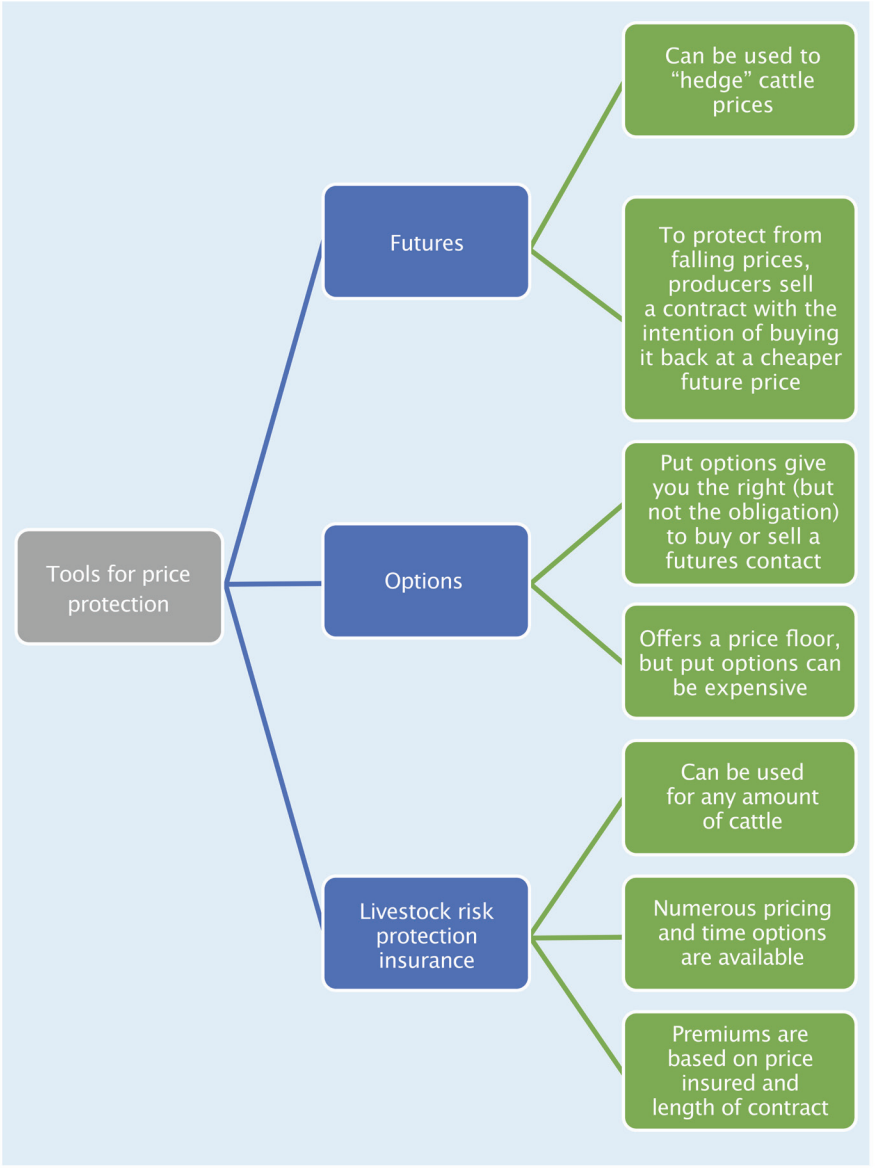


Figure 26. Tools for cattle market price protection

Marketing Terminology

Futures Contracts

A futures contract is an agreement to buy or sell a commodity at a certain time in the future at a certain price. The quality and sizes of futures contracts are standardized for convenience and transparency. For example, a feeder cattle futures contract traded on the Chicago Mercantile Exchange is 50,000 pounds of cattle based on a sample of steers of specific weight and grades.

A percentage of the value of the futures contracts must be deposited and maintained in a **margin account** when trading futures. Margin accounts can be prohibitive for small producers.

Options Contracts

Options contracts give you the right, but not the obligation, to buy or sell a commodity by a certain date for a certain price. There are two types of options contracts:

- **Put option** gives the holder a right to sell at a certain price.
- **Call option** gives the holder a right to buy at a certain price.

The price in the options contract is known as the **strike price**. The right to buy or sell comes at a cost, so an up-front price must be paid for an option, known as the **option premium**.

Options contracts are standardized in the same way as futures contracts. Options contracts can be used to set a minimum selling price for the commodity you are producing or a maximum buying price for an input to commodity production that you must purchase.

Hedging

A hedge is a strategy that involves having a commodity position (producing or buying) and taking a futures position to reduce price risk. There are two basic types of hedges:

- **Short hedge** is appropriate when a producer owns a commodity that will be sold at a later date.
- **Long hedge** is appropriate when a producer will buy a commodity at a later date.

Short hedges are what most cattle producers in Alabama use. Following is an example:

In January, cattle producer John knows that he will have feeder cattle ready for market in April, and he is concerned about what the cash price will be at that time.

On January 15, John sells one feeder cattle futures contract for delivery in April at $145/cwt.

On April 15, John sells his feeder cattle on the cash market for $125/cwt. Also on April 15, John buys an April feeder cattle futures contract at $135/cwt to cancel out his futures position.

John's futures market profit = price sold – price bought:

- $145/cwt – $135/cwt = $10/cwt

John's feeder cattle price after hedge = cash price + futures profit:

- $125/cwt + $10/cwt = $135/cwt

If the market had moved in the opposite direction with rising prices, John's futures profit would have been negative, so his ending cash price would have been lower than the actual cash price he received. Short hedges set a minimum price when markets take a downturn, but limit gains when markets are favorable.

Interpreting Cattle Market Reports

Market reports contain valuable information for Alabama cattle producers. To use this information, it is essential to know how to interpret prices based on the different classifications of cattle. Below are basics of market reporting for cull cows and bulls and feeder cattle.

Cull Cows

Cull cows, also called slaughter cows, are graded on the approximate dressing percent and body condition score (BCS). High dressing designation leads to more available products to sell and results in a higher price per pound than the low dressing designation. Table 41 shows the marketing class specifications for cull cows.

Cull Bulls

Cull bulls are graded similarly to beef cows based on the estimated amount of retail cuts that can be made from the carcass, otherwise known as yield grading. Yield grades range from 1 to 5 with 1 having the highest amount of salable beef.

Feeder Cattle

Feeder cattle are classified into twelve grades based on frame size (small, medium, and large) and muscle thickness, from thickest to thinnest: 1, 2, 3, and 4. These combinations of frame size and muscle thickness provide buyers with expectations regarding how the cattle will translate in yield and quality grades for carcasses and ultimately how they will affect the prices feeder producers receive.

Table 41. Approximate Associations between Cull Cow Marketing Classification, Carcass Quality Grade, and Cow Body Condition Score for Young Cows

Marketing Class	Red Meat Yield %	Dressing Percentage	Approximate Carcass Quality Grade*	Body Condition Score
Breaker	75–80	High Average Low	Commercial Commercial Commercial/utility	8–9 8 7–8
Boner	80–85	High Average Low	Utility Utility Utility	6–7 6 5.5–6
Lean	85–90	High Average Low	Utility/cutter Cutter Cutter	4.5–5.5 4–4.5 3–4
Light	75–90	High Average Low	Cutter Cutter/canner Canner	2–3 2 1–2

*Quality grade depends on maturity. Grades presented in the table are approximately correct for young cows and would likely be lower for old cows.

Source: *Cull Cow Grazing and Marketing Opportunities*, Division of Agricultural Sciences and Natural Resources, Oklahoma State University, 2008.

Cattle Marketing Options

- Alabama livestock markets: www.aces.edu
- Livestock Risk Protection insurance program: www.rma.usda.gov
- Livestock futures and options contract quotes: www.cmegroup.com
- Cattle market reports: www.ams.usda.gov

Cattle Cycle

The cattle cycle refers to price fluctuations that happen within the domestic (and international) cattle markets. Cattle cycles are influenced by a number of factors, with supply and demand being the primary drivers. Other factors affecting cattle cycles include natural disasters, trade issues, animal health issues, and perceived food safety issues.

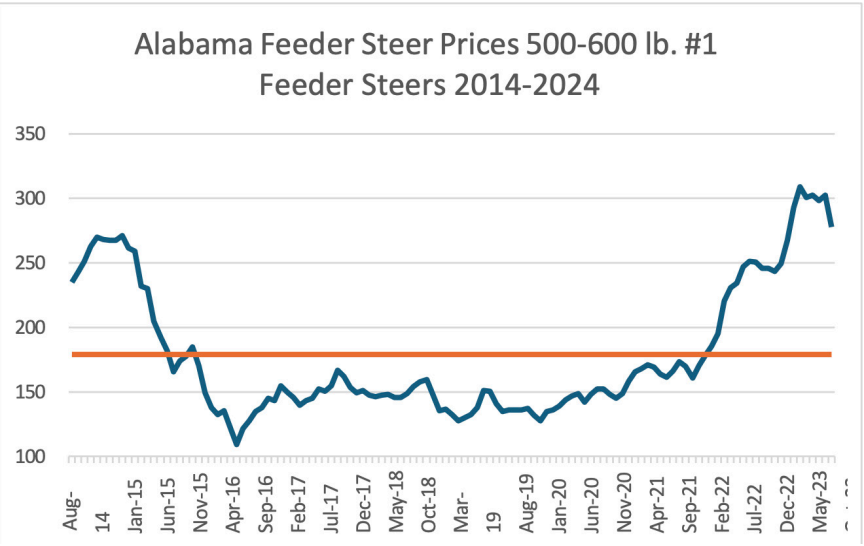


Figure 27. Alabama cattle cycle 2014–2024

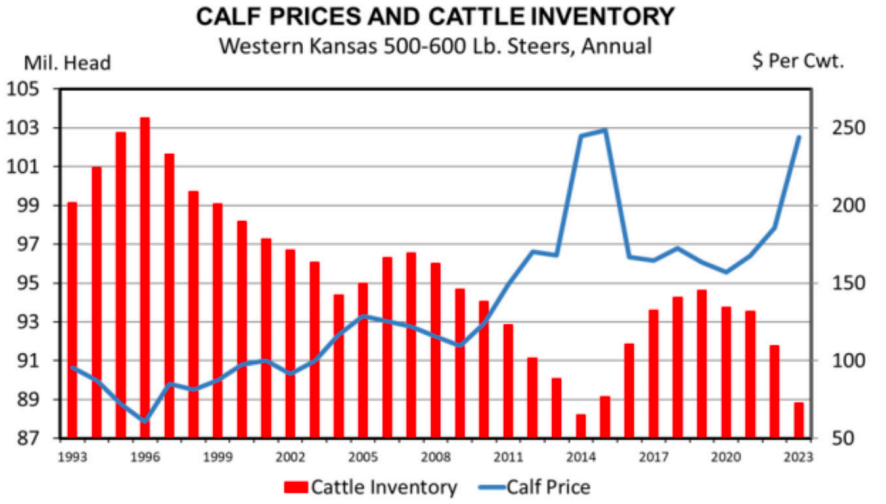


Figure 28. Calf prices in comparison to cattle inventory 1993–2023

Price Seasonality

Price seasonality refers to the fluctuations that happen yearly in feeder cattle markets. Price seasonality, like the cattle cycle, is greatly influenced by supply and demand.

Feeder cattle supplies are often highest in the fall due to both calving season decisions and the natural grouping of calves related to environmental conditions. Prices in Alabama tend to increase from December to March as feeders are needed in the feedlots and stocker operations to meet the demand from summer grilling season. Prices tend to decrease from May to October as the demand for stockers and feeders diminishes seasonally.

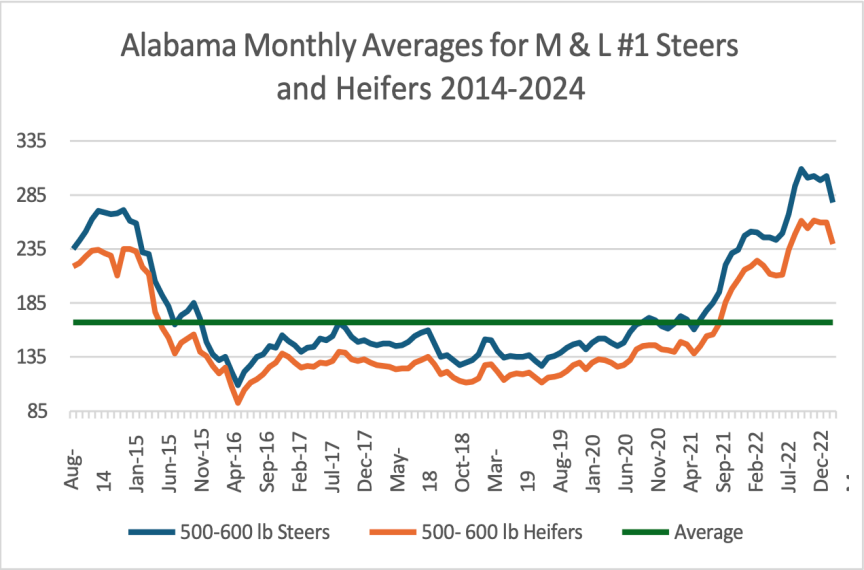


Figure 29. Alabama feeder price seasonality (10-year average 2014–2024)

Meat Yield, Quality, and Value

Demand for locally grown beef has increased in recent years and provides an opportunity for cattle producers to market directly to consumers. There are many practical considerations when evaluating this option for the first time:

- Herd genetics that dictate mature size, growth, and marbling ability
- Processing plant location and available processing dates
- Length of the finishing phase
- Available feed resources and cost
- Grain-fed versus grass-fed finishing phase
- Neosporosis
- Opportunity cost of freezer beef versus income at weaning
- Time involved in dealing with potential customers
- Price point for the finished animal at the desired profit level

Freezer Beef Requirements

Many producers may consider growing and harvesting home-raised calves for beef. The following provides some guidelines on potential diets, animal gain goals, and adaptation of calves to finishing diets for beef.

Grower Diets: Goals and Guidelines

Calf weaned at 7 to 9 months of age (550 pounds)

Goal: Average gain of 2 to 2¼ pounds per day until 800 pounds

Diet composition: Commonly 60 percent grain/concentrate and 40 percent roughage

Feeding guidelines: 1½ percent of body weight per day of an 85 percent cracked or rolled corn and 15 percent protein supplement. Protein supplement (such as cottonseed meal, dried distillers grain, etc.) should be a minimum of 20 percent crude protein.

Choose a diet of (1) moderate-to-high-quality long-stem hay-fed free choice **or** (2) 2½ percent of body weight per day of 50:50 soyhulls/corn gluten feed mix with moderate-to-high-quality long-stem hay-fed free choice.

To start calves on this second mixture, gradually increase the amount of concentrate mixture being fed by 1 to 2 pounds every 2 to 3 days until on full feed. Feed two times per day. Make sure calves clean up feeding troughs before providing additional grain/concentrate mix.

Finishing Diets: Goals and Guidelines

Goal: Average gain of > 3 pounds per day until 1,100 pounds

Diet composition: Commonly 80 percent grain/concentrate and 20 percent roughage

Feeding guidelines: 2 to 2¼ percent of body weight per day of cracked or rolled corn (may consider adding 5 to 10 percent cottonseed hulls to improve texture and palatability)

Feed at least 1/2 percent of body weight per day in moderate-to-good-quality long-stem hay. Increase amount of grain in diet by 3 to 4 pounds every 3 days until on full feed. Providing long-stem roughage during this period is critical for proper digestive system function and animal health.

Requirements Prior to Slaughter

Documentation of age. Research has shown that animals older than 30 months of age at harvest are at risk of carrying bovine spongiform encephalopathy (BSE). As a result, packing plants must remove all specified risk material, such as spinal column, brain, and nerve ganglia of undocumented cattle and cattle older than 30 months.

Large packers have a qualified person to age animals by oral dentition. Small packers require only a signed affidavit stating that the producer knows the animals are younger than 30 months of age.

Withdrawal times for medications. Most packing plants require a signed affidavit stating that all withdrawal times have been followed and no residuals should be present since label directions were followed.

Management and nutritional requirements to ensure meat quality. Withdraw feed (but not water) 12 to 24 hours before harvest. Minimizing gut fill reduces the chance of gut rupture during dressing and of contamination to the carcass.

Minimize stress on the animal during transport and handling. Longer-term stress from excessive transport can cause cattle to use energy stores in the muscle, resulting in a condition called “dark cutter,” which causes a large price discount to the carcass.

Document feed and feed additives. Documentation of everything included in an animal’s diet is essential for proper tracing to contamination sources.

Dressing and Dressing Percentages

Dressing is the process of removing the hide, head, feet, and internal organs during harvest (slaughter). What is left is the carcass, which contains the bones, muscle, meat, and fat. The first measure of yield is calculated as a dressing percentage:

Dressing percentage = (hot carcass weight ÷ live weight) × 100

Hot carcass weight (HCW) is the weight of the carcass after removal of the items listed above. Live weight is the weight of the animal just prior to harvest. The more weight on the carcass, the higher the dressing percentage. Table 42 provides estimates of dressing percentages.

Table 42. Estimates of Dressing Percentages

Animal	Factor	Typical Dressing Percentage
Cull cow	Low amount of muscle/fat	47–50
Grass fed/short fed	Low amount of fat	58–62
Typical YG3 feedlot steer	Mostly fat	62–64
Overly fat (YG percent)/ double muscled	High amount of muscle/fat	63–67
Bulls	High muscle	65–69

Grading Beef Carcasses

In the United States, beef carcasses are typically graded in commercial processing plants for both yield and quality. The standards for each type of grading provide assurance in commerce that the product meets the specifications for the grade. Grading is not commonly done in small-scale custom plants. It is important to understand grading basics to evaluate the end product against industry standards.

Quality Grading

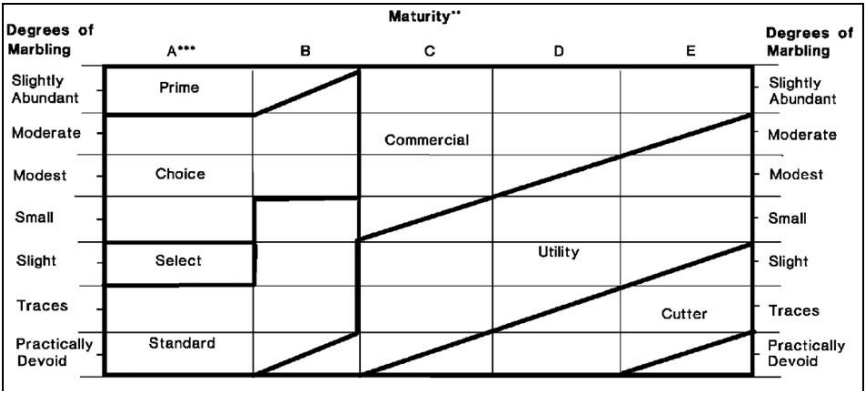
There are two factors used to determine quality grade: marbling and maturity. The combination of these two factors has a direct impact on tenderness, juiciness, and flavor of the beef.

Marbling is the amount of intramuscular fat dispersed within the lean muscle. Maturity refers to the age of the animal in months and is evaluated in the carcass based on certain physiological characteristics.

There are four quality grades assigned to finished cattle: standard, select, choice, and prime. To qualify for these grades, cattle must be under 42 months of age. Cull breeding stock and other animals that are more than 42 months can also be graded into a different set of grades, but they typically are not.

Cattle must be young to qualify for the four quality grades, because meat becomes less tender as animals age. During the aging process, muscles begin to create more and more connective tissue between the muscle fibers. These cross bridges make the meat more difficult to chew. This even affects young cattle. Cattle in the A maturity group (9 to 30 months of age) can have less marbling to reach the same quality grade as cattle in the B maturity group (30 to 42 months of age).

The other half of quality grading is marbling. Marbling scores are determined by looking at the face of the ribeye where it is exposed after the carcass is ribbed between the twelfth and thirteenth ribs. USDA graders compare the marbling present at that surface to marbling standards and assign a marbling score. These scores range from “practically devoid of marbling” to “abundant marbling.” Once a marbling score and an age are determined, the USDA grader uses a quality grading chart to assign a grade (figure 30).



Assumes that firmness of lean is comparably developed with the degrees of marbling
**Maturity increase from left to right in the chart (A to E)
***The A maturity portion is the only section applicable to bullock carcasses.

Figure 30. USDA quality grading chart

Yield Grading

Unlike quality grading, which determines eating quality, USDA yield grading measures the quantity of meat expected from a carcass. It is expressed as the yield of boneless, closely trimmed retail cuts (BCTRC) from the round, loin, rib, and chuck. Yield grading is calculated as follows:

2.5 + (0.0038 × HCW) + (2.5 × fat) + (0.2 × percent KPH)
– (0.32 × rib eye area)

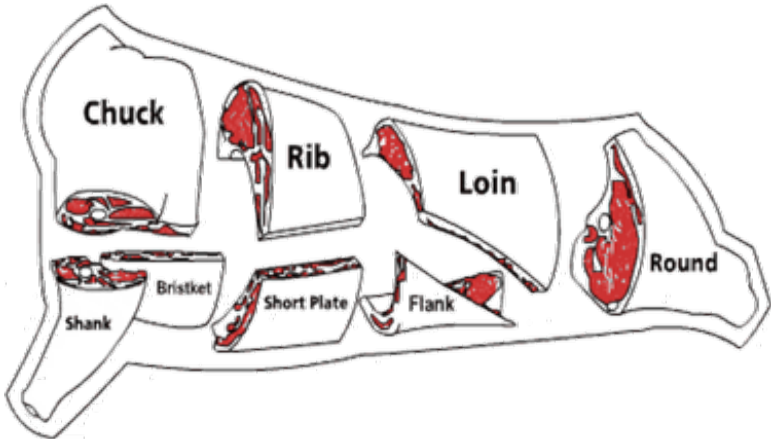
HCW = hot carcass weight; fat = subcutaneous fat measured opposite the ribeye at the twelfth rib; KPH = kidney, pelvic, and heart fat as a percentage of the HCW; ribeye area = the area of the longissimus muscle at the twelfth rib in square inches

The result of the above equation is expressed as a number rounded to the nearest tenth and is expressed on a scale of 1 to 5.

Freezer Size Guidelines

When deciding to purchase an animal for harvest, keep in mind the space you have available for safe and effective storage. A quarter of beef takes an approximately 4.5 cubic feet of freezer chest or a 5.5 cubic feet upright freezer. A side (half) requires around 8 cubic feet of space, while a whole beef will need 16 cubic feet.

Relative Yield and Value of Meats



Subprimals	Percentage of Carcass by Weight[1]	Percentage of Carcass by Value[2]
Chuck	29	26
Rib	9	16
Loin	16	23
Round	22	19
Shank, brisket, plate, and flank	19	16
Miscellaneous (kidney, fat, etc.)	5	0

[1]Based on a 1,300-pound Choice yield-grade 3 steer
[2]Based on Choice cutout values from USDA-AMS

Figure 31. Relative yield of various cuts

Environmental Stewardship in Beef Cattle Production

Beef cattle production ranks second after poultry in cash receipts in Alabama. According to the Alabama Agriculture Statistics Service, there are 1.17 million head of cattle and calves on Alabama farms (January 2024 inventory).

Producers have utilized better nutrition, improved genetics, and proven grazing management to make their farms more efficient and sustainable. Protecting the environment and preserving water quality are priorities on farms across the state. This demonstrates the commitment beef producers have to environmental stewardship. The beef production system is vital to feeding a growing population, both here in Alabama and around the world.

Because of increasing pressure on our natural resources, such as water, land, and air, it is increasingly important to protect our environment and prevent it from degradation. For example, when soil nutrients, such as nitrogen and phosphorus, leave the farm via runoff or leaching and enter into creeks or underground water systems, they stimulate algae blooms (figure 32). These algal blooms create a barrier preventing sunshine from reaching aquatic life under the surface of the water; this leads to a condition known as eutrophication.

The eutrophication of water is a threat to our livelihood and directly affects our bottom line as it degrades our clean and dwindling supply of water. The environmental impacts vary with individual operations and depend on factors such as stocking rates, grazing intensity, soil and terrain, weather, and management practices.

To learn more about Alabama environmental laws and regulations related to manure application, visit https://adem.alabama.gov/programs/water/cafo.cnt.

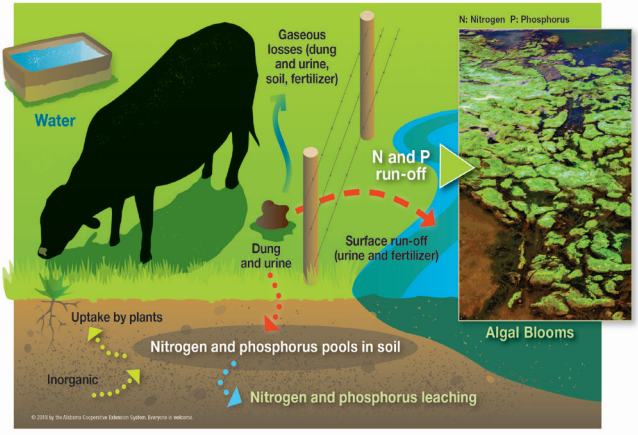


Figure 32. Nitrogen and phosphorus runoff into water systems trigger algal blooms.

To become a better steward of the environment, cattle producers should consider the following stewardship practices:

Store and manage manure in a way that effectively prevents contamination of waterways (creeks, rivers, or streams) on your farm (figure 33). For example, keep manure in a covered area and protect it from washing away during rainfall events. If manure continuously enters the waterways, the waterways become a point source discharge and could be scrutinized by regulatory agencies. Store litter on surfaces that prevent leaching of nutrients into groundwater.

Figure 33. Manure storage in covered system

Do not allow animals to have direct access to waterways. Fencing keeps cattle away from waterways (figure 34). This is especially important to prevent fecal or urine contamination. Install self-watering systems or an alternative water supply, which can prevent direct access to waterways.

Maintain a grassed waterway and filter strips along riparian areas to control effluent running into waterways (figure 34).

Remove buildup from animal heavy-use areas, such as hay rings, shade, or watering areas; these do not maintain dense vegetation and often accumulate manure. If manure is not removed routinely from these areas, it can emit dust and odor and attract flies and other disease-carrying vectors (figure 35). Heavy-use areas should be maintained correctly by removing organic matter buildup annually and land as it applies.

Implement rotation-based grazing systems to prevent overgrazing and allow adequate grass cover. This is important because it prevents runoff to surface water (figure 36).

Figure 34. Fencing prevents animals from having direct access to waterways and prevents fecal or urine contamination into the waterways.

Send soil and manure/chicken litter for testing to a state-certified laboratory on a regular basis, and use the reports for planning manure application on pasture lands (figure 37).

Figure 35. Animal heavy-use areas tend to accumulate manure and attract flies and other disease-carrying vectors.

Monitor the amount of manure applied to each field. Overapplication as well as annual application of manure, especially chicken litter, can result in phosphorus accumulation in the soil. Once the phosphorus-holding capacity of soil is exhausted, additional manure application can result in phosphorus movement to creeks and waterways via erosion and runoff, thereby polluting the water bodies. If the soil phosphorus falls under high or extremely high test categories, use of manure should be stopped. Instead, use commercially available fertilizers to supply nitrogen and potassium.

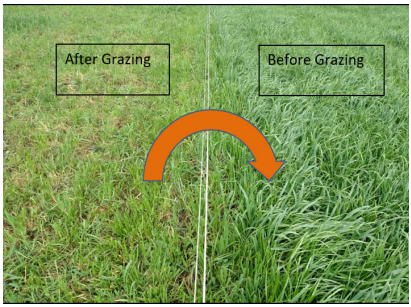


Figure 36. Rotation-based grazing systems prevent overgrazing and allow grass regrowth.

Figure 37. The first step in planning manure application is soil sampling and testing.

Base manure applications on the soil test recommendation for nitrogen, phosphorus, and potassium. It is important to apply at the correct rate and time to ensure the forages are actively growing and can utilize the nutrients. Avoid winter application of manure since high-intensity rain increases the risk of nutrient losses.

Keep good records in order to make wise management decisions. Manure application rates, dates, storage activities, and crop yield are some basic records to maintain annually. Also develop an emergency plan for cattle in case of flash flood or extreme rainfall events.

Maintain manure application setbacks (table 43). Identify environmentally sensitive areas. Do not apply manure within 200 feet of an active private or public water supply or outstanding national resource water. Similarly, do not apply manure within the channel of a nonvegetated concentrated water flow area, such as a swale, gully, or ditch.

Test your farm's well water or cattle drinking water sources for the presence of pathogenic bacteria (total coliform bacteria) and nitrate. Use clean plastic bottles to collect water from the pump or water storage area and keep it cool until you return the bottle to the closest certified laboratory. Call ahead to the lab and notify them. Sometimes the lab will send you collection bottles for coliform bacteria and nitrates. If the water tests positive, discontinue using the water and work on corrective action. After following a disinfection procedure, retest the water treatment to ensure that water returns to safe levels.

Table 43. Manure Application Setbacks

	Setbacks for Land Application for Animal Feeding Operation
Property line	Cannot cross property line
Public use area or nonowner existing occupied dwelling, church, school, hospital, or park	100 feet for dry waste 200 feet for liquid waste 500 feet for spray
Water or sinkholes	50 feet from surface water 200 feet from public supply water 200 feet from outstanding water
Well	100 feet from nonpotable well or water supply 200 feet from potable well or water supply
Road	Cannot be applied in road

Match forage production with nutrient removal rates. Good pasture management is considered good environmental management, since a good stand of forages prevents erosion and nutrient runoff. Applying fertilizer as recommended by a soil test report or crop removal rate will help maintain a quality pasture and eliminate overapplication of fertilizer. To calculate the plant nutrient removal rate, multiply the dry matter yield with percent nutrient contained in the crop. See table 44 for typical nutrient removal rates.

Table 44. Nutrient Removal Rates of Major Forage or Silage Crops

	Yield (lb. or tons/acre)	Nutrient Percent	Total Removal by Crop (lb./acre)
Alfalfa	4 (tons/ac.)	N = 2.25 P = 0.22 K = 1.87	180 N 40 P2O5 180 K2O
Corn silage	200 (bu./ac.)	N = 1.61 P = 0.28 K = 0.40	180 N 72 P2O5 54 K2O
Bahiagrass	3 (tons/ac.)	N = 1.27 P = 0.13 K = 1.73	76 N 18 P2O5 125 K2O
Bermudagrass	8 (tons/ac.)	N = 2.31 P = 0.58 K = 2.50	370 N 92 P2O5 400 K2O
Tall fescue	3.5 (tons/ac.)	N = 1.97 P = 0.20 K = 2.0	138 N 32 P2O5 168 K2O
Ryegrass	5 (tons/ac.)	N = 1.67 P = 0.27 K = 1.42	167 N 62 P2O5 170 K2O
Red clover	2.5 (tons/ac.)	N = 2.0 P = 0.22 K = 1.66	100 N 25 P2O5 100 K2O

Appendixes

Appendix A. Alabama Beef Cattle Website Resources

Alabama Beef Cattle Improvement Association

www.albcia.org
Contact: Michelle Elmore, Coordinator
Phone: (205) 646-0115

Alabama Cooperative Extension System

www.aces.edu/directory
Animal Science and Forage Extension Team–Regional Agent Directory

Alabama Beef Systems Extension Program

www.alabamabeefsystems.com
Contact: Kim Mullenix
Phone: (334) 844-1546

Alabama Beef Quality Assurance Program

Contact: Soren Rodning, Extension Veterinarian
Phone: (334) 844-1521

Alabama Forage Focus Extension Program

www.alabamaforages.com
Contact: Leanne Dillard
Phone: (334) 844-7514

Alabama Department of Agriculture and Industries

www.agi.alabama.gov/

Resources:

- Livestock Market News
- Livestock Theft Division
- State Veterinarian
- Alabama Hay Directory

Alabama Cattlemen's Association

www.bamabeef.org
Phone: (334) 265-1867

Alabama Farmer's Federation

www.alfafarmers.org
Phone: (334) 288-3900

USDA Natural Resources Conservation Service–Alabama

www.nrcs.usda.gov/wps/portal/nrcs/site/al/home/
Phone: (334) 887-4500

USDA Farm Service Agency–Alabama

www.fsa.usda.gov/state-offices/Alabama/index
Phone: (334) 279-3500

Alabama Department of Agriculture Veterinary Diagnostic Laboratories

- Thompson-Bishop-Sparks State Diagnostic Laboratory–Auburn
  Phone: (334) 884-4987
- Michem-Sparks State Diagnostic Laboratory–Boaz
  Phone: (256) 593-2995
- J. B. Taylor Veterinary Diagnostic Laboratory–Elba
  Phone: (334) 897-6340
- Hinton Michem Poultry Diagnostic Laboratory–Hanceville
  Phone: (256) 352-8036

Appendix B. Comparison of Common Fences

Types	Strands	Wire Gauge	Height (inches)	Stay Spacing (inches)	Fence Life (years)[1]	Upkeep
Permanent Materials						
Barbed wire, 2-point	3	12.5		4	33	High
	4	12.5		4	33	High
	5	12.5		4	33	High
	3	14		4	18	High
Barbed wire, 4-point	3	12.5		5	33	High
	4	12.5		5	33	High
	5	12.5		5	33	High
Woven wire, lightweight	Top	11	26	6	19	High
	Bottom					
	Filler	14.5	32	6	19	High
Woven wire, medium weight	Top	10	26	6	30	Medium
	Bottom					
	Filler	12.5	32	6	30	Medium
	Filler	12.5	39	6	30	Medium
	Filler	12.5	47	6	30	Medium
Woven wire, heavy weight	Top	9	26	6	40	Low
	Bottom					
	Filler	11	32	6	40	Low
	Filler	11	39	6	40	Low
	Filler	11	47	6	40	Low
High tensile wire	3	12.5			30	Medium
	4	12.5			30	Medium
	5	12.5			30	Medium
	8	12.5			30	Medium
Temporary Materials						
High tensile wire	2	12.5			30	Medium
	1	12.5			30	Medium
Polywire/tape					7–10	Medium

[1]Fence life based on combination of post and wire life expectancy in humid climates

Source: University of Tennessee Extension

Appendix C. Fence Post Characteristics

Post Type	Bending Strength	Expected Life (years)	Initial Cost	Fire Resistance	Maintenance
Steel-T, concrete	Fair	25–30	Medium	Good	Low
Steel rod, 3/8 in. diameter	Poor	15–20	Low	Good	Medium
Fiberglass rod, 1 in. or greater	Fair (flexible)	25–30	High	Poor	Low
Fiberglass rod, 7/8 in. or less	Fair (flexible)	25–30	Medium	Poor	Low
Plastic, step in	Fair (flexible)	7–10	Low	Poor	Medium
Pressure-treated wood	Good	30–35	High	Poor	Very low
Untreated wood	Good	7–15	Medium	Poor	High

Source: University of Tennessee Extension

Appendix D. Recommended Post Spacings

Fence	Spacing (feet)
Woven wire	12–14
Barbed wire	12–14
Electric	20–75
High tensile wire[1]	16–60
Board	8

[1]Depending on terrain, use battens (stays). Can be single-strand, woven wire, and/or electric.
Source: University of Tennessee Extension

Appendix E. Suggested Wire Spacing for Permanent or Temporary Fences

Cattle Type	Distance from Ground for Wire Number (inches)				
	No. 1	No. 2	No. 3	No. 4	No. 5
Cows	30				
Cows and calves	17	38			
Hard-to-hold cattle	17	27	38		
Boundary fence	5	10	17	27	38

Source: University of Tennessee Extension

Appendix F. Minimum Trailer Space Requirement for Hauling Cattle

Average Weight (pounds)	Number of Cattle Per Running Foot of Truck Floor (92 inches truck width)
300	1.5
350	1.3
400	1.1
450	1.0
500	0.9
600	0.8
700	0.7
800	0.6
1,000 to 1,200	0.5/0.4

Adapted from *Livestock Trucking Guide*, 2001.

Appendix G. Expected Shrink Loss During Handling and Transport

Conditions	Percent Shrink
8-hour dry lot stand	3.3
16-hour dry lot stand	6.2
24-hour dry lot stand	6.6
8 hours in moving truck	5.5
16 hours in moving truck	7.9
24 hours in moving truck	8.9

Appendix H. Stand Measurements

Length

- Inch = 0.083 feet
- Foot = 12 inches
- Yard = 36 inches = 3 feet
- Mile = 1,760 yards = 5,280 feet

Area

- Square inch = 0.007 square foot
- Square foot = 144 square inches
- Square yard = 9 square feet
- Acre = 4,940 square yards = 43,560 square feet
- Square mile = 640 acres = 1 section

Liquid

- Teaspoon = 0.1667 fluid ounces
- Tablespoon = 3 teaspoons = 0.5 fluid ounces
- Fluid ounce = 2 tablespoons
- Pint = 2 cups = 16 fluid ounces
- Quart = 4 cups = 2 pints = 32 fluid ounces
- Liter = 2.113 pints = 1.057 quarts
- Gallon = 4 quarts = 8 pints = 128 fluid ounces
- Acre inch of water = 27,154 gallons = 3,630 cubic feet

Volume

- Cubic inch = 0.00058 cubic feet
- Cubic foot = 1,728 cubic inches = 0.037 cubic yards
- Cubic yard = 27 cubic feet

Weight

- Gram = 1,000 milligrams
- Ounce = 28.35 grams
- Pound = 16 ounces = 454 grams
- Kilogram = 1,000 grams = 2.205 pounds
- Ton (long) = 2,240 pounds

Appendix I. 283-Day Gestation Table

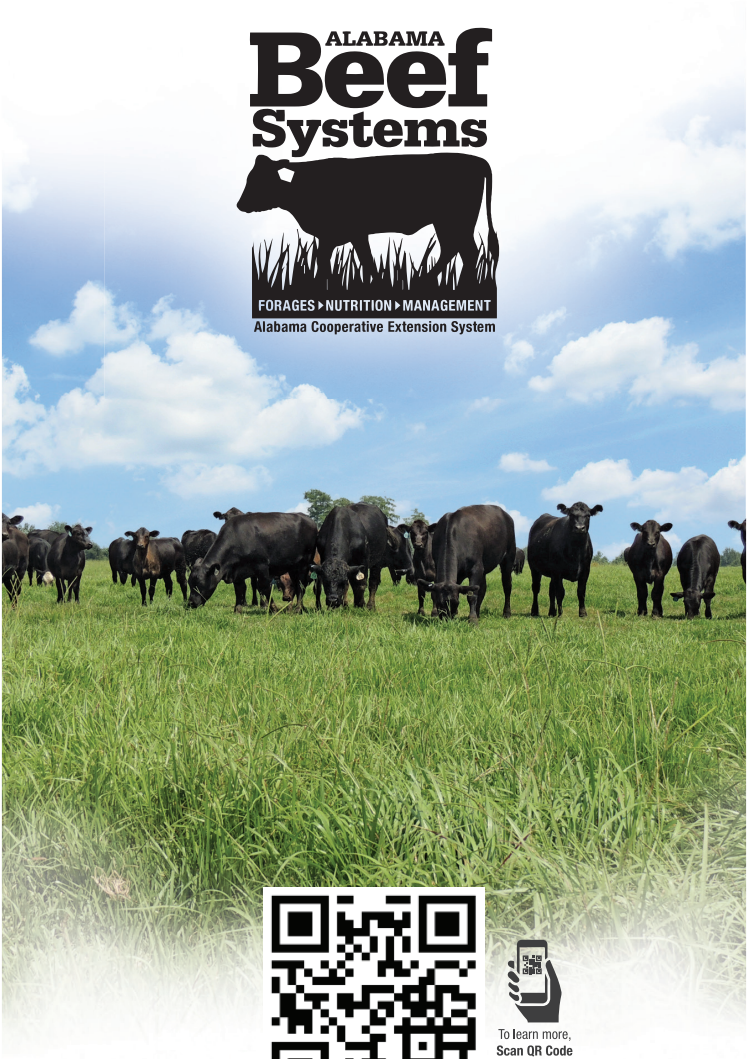
Date of Service	Calf Due	Date of Service	Calf Due	Date of Service	Calf Due	Date of Service	Calf Due	Date of Service	Calf Due	Date of Service	Calf Due
1-Jan	10-Oct	1-Feb	10-Nov	1-Mar	8-Dec	1-Apr	8-Jan	1-May	7-Feb	1-Jun	10-Mar
2-Jan	11-Oct	2-Feb	11-Nov	2-Mar	9-Dec	2-Apr	9-Jan	2-May	8-Feb	2-Jun	11-Mar
3-Jan	12-Oct	3-Feb	12-Nov	3-Mar	10-Dec	3-Apr	10-Jan	3-May	9-Feb	3-Jun	12-Mar
4-Jan	13-Oct	4-Feb	13-Nov	4-Mar	11-Dec	4-Apr	11-Jan	4-May	10-Feb	4-Jun	13-Mar
5-Jan	14-Oct	5-Feb	14-Nov	5-Mar	12-Dec	5-Apr	12-Jan	5-May	11-Feb	5-Jun	14-Mar
6-Jan	15-Oct	6-Feb	15-Nov	6-Mar	13-Dec	6-Apr	13-Jan	6-May	12-Feb	6-Jun	15-Mar
7-Jan	16-Oct	7-Feb	16-Nov	7-Mar	14-Dec	7-Apr	14-Jan	7-May	13-Feb	7-Jun	16-Mar
8-Jan	17-Oct	8-Feb	17-Nov	8-Mar	15-Dec	8-Apr	15-Jan	8-May	14-Feb	8-Jun	17-Mar
9-Jan	18-Oct	9-Feb	18-Nov	9-Mar	16-Dec	9-Apr	16-Jan	9-May	15-Feb	9-Jun	18-Mar
10-Jan	19-Oct	10-Feb	19-Nov	10-Mar	17-Dec	10-Apr	17-Jan	10-May	16-Feb	10-Jun	19-Mar
11-Jan	20-Oct	11-Feb	20-Nov	11-Mar	18-Dec	11-Apr	18-Jan	11-May	17-Feb	11-Jun	20-Mar
12-Jan	21-Oct	12-Feb	21-Nov	12-Mar	19-Dec	12-Apr	19-Jan	12-May	18-Feb	12-Jun	21-Mar
13-Jan	22-Oct	13-Feb	22-Nov	13-Mar	20-Dec	13-Apr	20-Jan	13-May	19-Feb	13-Jun	22-Mar
14-Jan	23-Oct	14-Feb	23-Nov	14-Mar	21-Dec	14-Apr	21-Jan	14-May	20-Feb	14-Jun	23-Mar
15-Jan	24-Oct	15-Feb	24-Nov	15-Mar	22-Dec	15-Apr	22-Jan	15-May	21-Feb	15-Jun	24-Mar
16-Jan	25-Oct	16-Feb	25-Nov	16-Mar	23-Dec	16-Apr	23-Jan	16-May	22-Feb	16-Jun	25-Mar
17-Jan	26-Oct	17-Feb	26-Nov	17-Mar	24-Dec	17-Apr	24-Jan	17-May	23-Feb	17-Jun	26-Mar
18-Jan	27-Oct	18-Feb	27-Nov	18-Mar	25-Dec	18-Apr	25-Jan	18-May	24-Feb	18-Jun	27-Mar
19-Jan	28-Oct	19-Feb	28-Nov	19-Mar	26-Dec	19-Apr	26-Jan	19-May	25-Feb	19-Jun	28-Mar
20-Jan	29-Oct	20-Feb	29-Nov	20-Mar	27-Dec	20-Apr	27-Jan	20-May	26-Feb	20-Jun	29-Mar
21-Jan	30-Oct	21-Feb	30-Nov	21-Mar	28-Dec	21-Apr	28-Jan	21-May	27-Feb	21-Jun	30-Mar
22-Jan	31-Oct	22-Feb	1-Dec	22-Mar	29-Dec	22-Apr	29-Jan	22-May	28-Feb	22-Jun	31-Mar
23-Jan	1-Nov	23-Feb	2-Dec	23-Mar	30-Dec	23-Apr	30-Jan	23-May	1-Mar	23-Jun	1-Apr
24-Jan	2-Nov	24-Feb	3-Dec	24-Mar	31-Dec	24-Apr	31-Jan	24-May	2-Mar	24-Jun	2-Apr
25-Jan	3-Nov	25-Feb	4-Dec	25-Mar	1-Jan	25-Apr	1-Feb	25-May	3-Mar	25-Jun	3-Apr
26-Jan	4-Nov	26-Feb	5-Dec	26-Mar	2-Jan	26-Apr	2-Feb	26-May	4-Mar	26-Jun	4-Apr
27-Jan	5-Nov	27-Feb	6-Dec	27-Mar	3-Jan	27-Apr	3-Feb	27-May	5-Mar	27-Jun	5-Apr
28-Jan	6-Nov	28-Feb	7-Dec	28-Mar	4-Jan	28-Apr	4-Feb	28-May	6-Mar	28-Jun	6-Apr
29-Jan	7-Nov			29-Mar	5-Jan	29-Apr	5-Feb	29-May	7-Mar	29-Jun	7-Apr
30-Jan	8-Nov			30-Mar	6-Jan	30-Apr	6-Feb	30-May	8-Mar	30-Jun	8-Apr
31-Jan	9-Nov			31-Mar	7-Jan			31-May	9-Mar		

Revised August 2025, ANR-1323

www.aces.edu

AUBURN | extension
ALABAMA A&M and AUBURN UNIVERSITIES

@ACESBeef /AlabamaBeefSystems



www.AlabamaBeefSystems.com