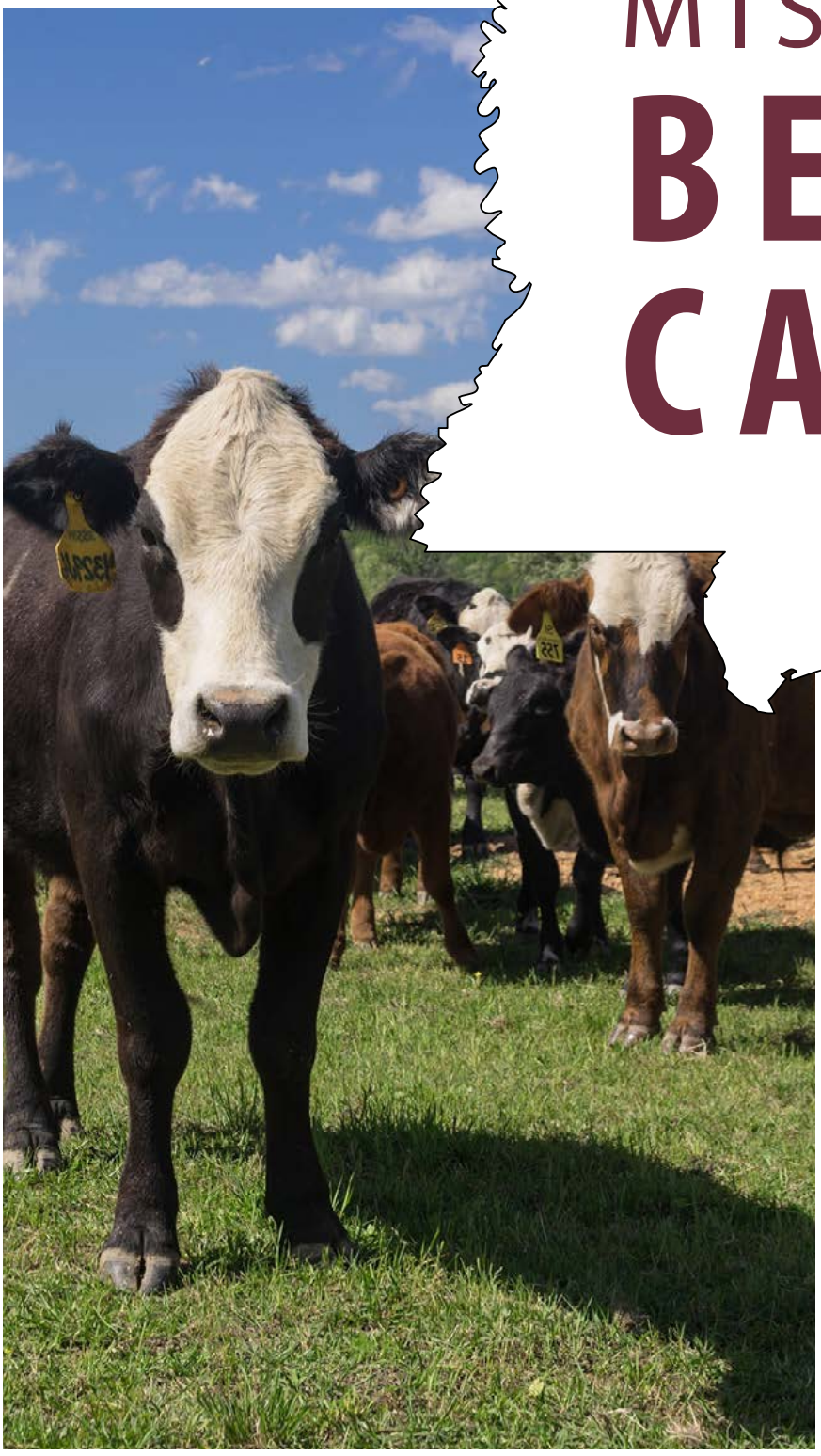
MISSISSIPPI STATE UNIVERSITY™

EXTENSION



MISSISSIPPI BEEF CATTLE

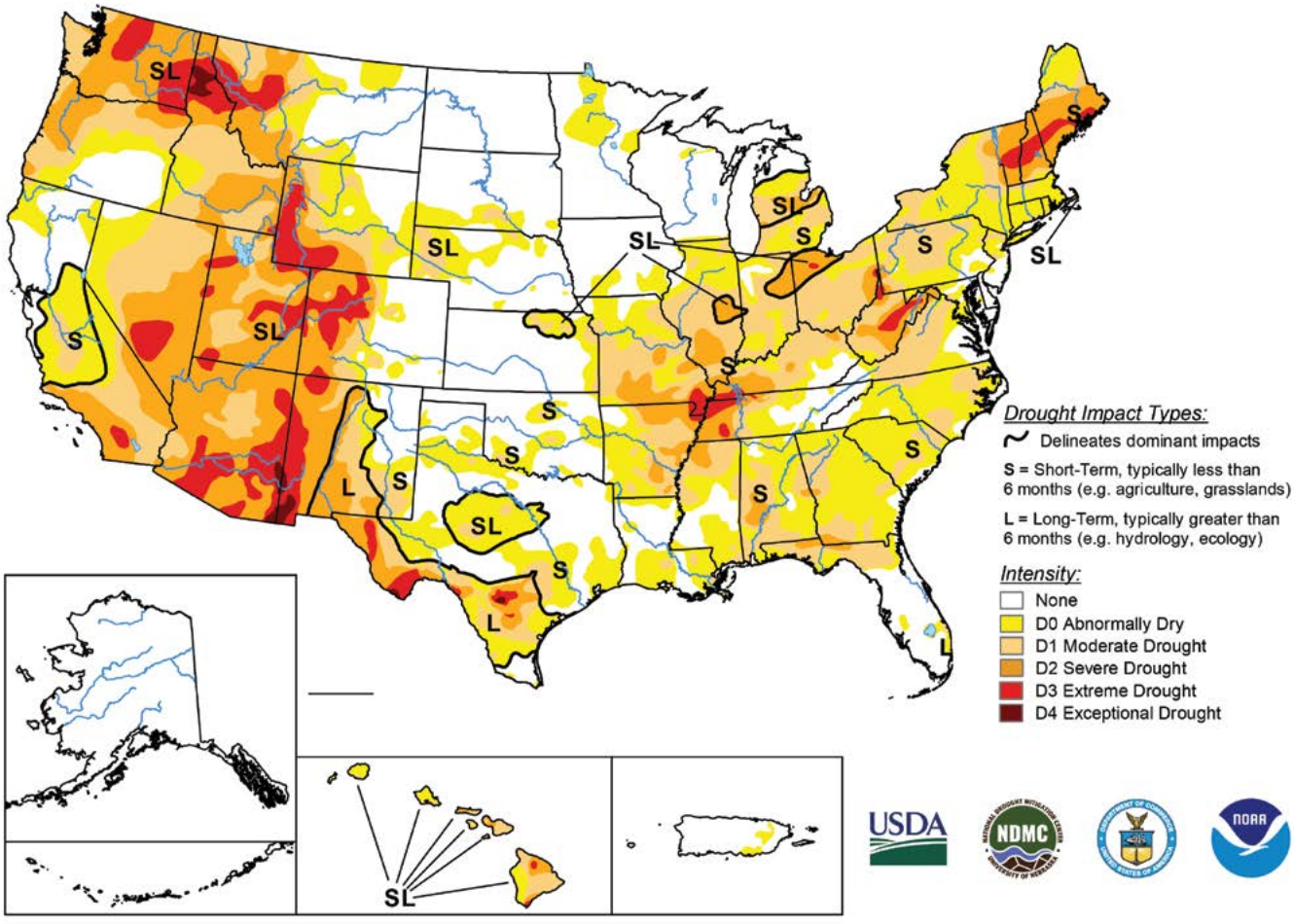
Producer Guide to Coping with Drought Conditions

Drought on Mississippi Cattle Operations

Beef production is a significant component of Mississippi agriculture. The total value of production of cattle and calves in Mississippi is estimated at $482 million for 2024. Total cattle inventory in Mississippi on January 1, 2025, was 810,000 head, including 430,000 cows and heifers that have calved. The calf crop for the full year of 2024 was 345,000 head. This remains the same from January 1, 2024. There were 13,631 beef cattle farms in 2024. Stocker cattle production is also very prominent with 400,000+ head of stocker cattle residing in the state annually.

This publication was written to give Mississippi beef producers information on drought-coping options and related knowledge to assist them in making profitable production and marketing decisions. Drought can be expected as part of normal production cycles. The overall cattle operation management plan should include drought preparation and coping plans. Extended periods of dry weather create management challenges for both cow-calf and stocker operations. Droughty conditions greatly impact pasture and hay land productivity, as well. Because most Mississippi beef operations are heavily dependent on forage-based nutritional programs, nutritional concerns often become a focal point of cattle production systems during periods of drought-induced poor forage productivity and supplies.

The Mississippi office of the National Agricultural Statistics Service publishes a weekly weather crop report. This report details pasture and hay conditions as excellent, good, fair, poor, or very poor with percentages of the state crop rated in each of these categories. This report provides an overall summary of statewide pasture and hay conditions, yet local conditions can vary dramatically across the state. While the local precipitation situation is of most concern to individual producers, statewide, regional, and even national precipitation, soil moisture, and crop conditions impact supply and demand for inputs and marketing from Mississippi beef operations. The U.S. Drought Monitor tracks current drought conditions and impacts on a national scale.



U.S. Drought Monitor map, September 25, 2025. The U.S. Drought Monitor is jointly produced by the National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration. Map courtesy of NDMC.

Widespread drought has a number of implications for the cattle market. First of all, the intensity of a drought in major cattle-producing states like Texas and Oklahoma makes it difficult to expand the national beef herd. Many producers find it difficult to maintain the herd they have, much less consider increasing cattle numbers. The drought may not halt herd expansion altogether, but it will, at the very least, slow the pace of expansion, thus affecting the level of beef production further down the road. Longer term, a reduction in beef production will be supportive of cattle prices. In the short run, forced sales of increasing numbers of cattle will not be good for prices, certainly not at the local market level.

Looking more specifically at stocker and feeder cattle markets, a current drought could affect both supply and demand for calves. On the demand side, drought impacts on winter grazing in key areas can impact demand for calves. On the supply side, poor pasture conditions often lead to large numbers of early sales of calves as producers pull calves as early as possible in order to reduce the nutritional requirements of the cow herd. Many times, these calves move through market channels well before the typical marketing seasons. Supply and demand changes resulting from a widespread drought can add some additional uncertainty to upcoming calf markets.

Dry weather can affect feed markets, as well. Scarce hay supplies and/or poor grazing conditions are red flags for winter feeding programs. Producers facing these circumstances should immediately look at and compare the costs of alternative feedstuffs. A number of by-product feeds are available around the state. It is often the case that by-product feed prices will increase some along with hay prices due to drought effects on supply and demand of these commodity feeds, but in many instances, these feedstuffs may still be a lower-cost feeding alternative than traditional hay feeding systems. Availability of alternative feedstuffs also can become an issue, and timeliness of feed booking may be critical to secure supplies and reasonable prices.

Drought conditions are always difficult to deal with. Localized drought creates a variety of management challenges for beef cattle producers. More widespread drought even has the potential to affect national markets. In these situations, producers should, in evaluating all management and marketing decisions, focus on the long-run sustainability and survivability of the operation.

Planning for and Dealing with Drought

- Drought can be expected as part of normal production cycles.
- Overall management plan should include drought preparation and coping plans.
- Drought creates management challenges for both cow-calf and stocker operations.
- Widespread drought can impact markets.
- Focus on operational long-run sustainability and survival.

Where to Start

Inventory Ranch Resources

One of the first things Mississippi cattle producers should do when faced with drought conditions is to assess herd, nutritional, and other resources. The usefulness of different management and marketing options varies based on ranch resources, management, and marketing systems. Assessments of cattle nutrient needs, pasture production, stored feed resources (hay, baleage, commodity feeds, etc.), labor resources, facilities (particularly covered feed or hay storage capabilities), and other operational inputs (fertilizer, seed, fuel, etc.) need to be closely quantified. Any shortfalls in nutrient supplies and cattle nutrient needs, for example, must be planned for in a very timely manner.

Resource Inventory

- Evaluate pasture and hay quality and supply.
- Determine cattle nutrient needs.
- Estimate supplemental feed requirements.

Cattle Nutritional Programs

Nutrient Requirements of Beef Cattle

Cost-efficient drought survival depends heavily upon close matching of nutritional programs and cattle requirements. Overfeeding wastes resources and funds, and underfeeding hurts production levels. Priority should be placed on determining nutrient needs of the cattle herd. The best time to improve cow body condition in preparation for calving and breeding is in the months right after weaning. Daily dry matter intake needs approach 2 percent of body weight for mature cows immediately after calves are weaned.

As calving nears, dry matter intake needs will increase; after calving, daily dry matter intake levels should be closer to 2.5 percent of body weight. Growing cattle can require closer to 3 percent of body weight in daily dry matter intake. If hay quality/supply appear short and grazing plans cannot provide adequate levels of nutrients for the herd, then supplemental feed may become necessary. For practical purposes, beef cattle dietary requirements and feed formulations presented in this publication primarily consider total digestible nutrients (TDN) and crude protein (CP) levels on a dry matter basis. Mineral, fat, and effective fiber contents of forages and feeds also are important in balancing the overall diet.

For more efficient use of nutritional resources, cattle can be divided into feeding groups based on nutrient needs (Tables 1 to 6). As a general rule, lactating cows have higher nutrient requirements than dry cows, and first-calf heifers have higher nutrient requirements than mature cows. Young growing cattle tend to require higher percentages of dietary nutrients but lower total dietary pounds of nutrients per day. Heifers can be separated by weight after weaning into feeding groups for more efficient feeding. The better-quality forages and feeds should go to the feeding groups with higher nutrient needs. Another approach is to allocate higher-quality grazing paddocks to the feeding groups with higher nutrient demands.

Efficient Herd Nutritional Programs

- Divide cattle into feeding groups based on nutrient needs.
- Allocate forage/feed supplies to each group to closely match animal requirements.

Table 1. Growing steer and heifer nutrient requirements (1,100 pounds at finishing).

Body weight (lb)	ADG (lb)	Dry matter intake (lb per day)	TDN (% dry matter)	CP (% dry matter)	TDN (lb per animal per day)	CP (lb per animal per day)
300	0.5	7.9	54	9.2	4.3	0.73
	1.0	8.4	59	11.4	5.0	0.95
	1.5	8.6	64	13.6	5.5	1.17
	2.0	8.6	69	16.2	5.9	1.39
	2.5	8.5	75	18.9	6.4	1.61
	3.0	8.2	83	22.2	6.8	1.83
400	0.5	9.8	54	8.7	5.3	0.85
	1.0	10.4	59	10.4	6.1	1.08
	1.5	10.7	64	12.1	6.8	1.30
	2.0	10.7	69	14.1	7.4	1.51
	2.5	10.6	75	16.3	8.0	1.72
	3.0	10.2	83	19.0	8.5	1.94
500	0.5	11.6	54	8.4	6.3	0.97
	1.0	12.2	59	9.8	7.2	1.19
	1.5	12.6	64	11.2	8.1	1.41
	2.0	12.7	69	12.8	8.8	1.63
	2.5	12.5	75	14.7	9.4	1.84
	3.0	12.1	83	16.9	10.0	2.05
600	0.5	13.2	54	8.2	7.1	1.08
	1.0	14.0	59	9.4	8.3	1.31
	1.5	14.4	64	10.6	9.2	1.53
	2.0	14.6	69	11.9	10.1	1.74
	2.5	14.4	75	13.6	10.8	1.95
	3.0	13.8	83	15.7	11.5	2.17
700	0.5	14.9	54	8.0	8.0	1.19
	1.0	15.8	59	9.0	9.3	1.42
	1.5	16.2	64	10.1	10.4	1.64
	2.0	16.3	69	11.4	11.2	1.85
	2.5	16.1	75	12.8	12.1	2.06
	3.0	15.5	83	14.6	12.9	2.27

Table 2. Growing steer and heifer nutrient requirements (1,200 pounds at finishing).

Body weight (lb)	ADG (lb)	Dry matter intake (lb per day)	TDN (% dry matter)	CP (% dry matter)	TDN (lb per animal per day)	CP (lb per animal per day)
300	0.5	7.8	54	9.4	4.2	0.73
	1.0	8.3	58	11.5	4.8	0.95
	1.5	8.6	63	13.7	5.4	1.17
	2.0	8.6	68	16.2	5.8	1.40
	2.5	8.6	73	18.7	6.3	1.61
	3.0	8.3	80	22.0	6.6	1.83
400	0.5	9.7	54	8.8	5.2	0.85
	1.0	10.3	58	10.4	6.0	1.07
	1.5	10.6	63	12.2	6.7	1.30
	2.0	10.7	68	14.1	7.3	1.51
	2.5	10.7	73	16.1	7.8	1.72
	3.0	10.4	80	18.7	8.3	1.94
500	0.5	11.5	54	8.4	6.2	0.97
	1.0	12.2	58	9.8	7.1	1.19
	1.5	12.6	63	11.2	7.9	1.41
	2.0	12.6	68	12.9	8.6	1.63
	2.5	12.6	73	14.6	9.2	1.84
	3.0	12.2	80	16.8	9.8	2.05
600	0.5	13.2	54	8.2	7.1	1.08
	1.0	14.0	58	9.3	8.1	1.31
	1.5	14.4	63	10.6	9.1	1.52
	2.0	14.4	68	12.1	9.8	1.74
	2.5	14.4	73	13.5	10.5	1.95
	3.0	14.0	80	15.4	11.2	2.16
700	0.5	14.8	54	8.0	8.0	1.18
	1.0	15.7	58	9.0	9.1	1.42
	1.5	16.2	63	10.1	10.2	1.64
	2.0	16.3	68	11.3	11.1	1.85
	2.5	16.2	73	12.7	11.8	2.05
	3.0	15.8	80	14.4	12.6	2.27

Table 3. Two-year-old lactating first-calf heifer nutrient requirements.

Mature body weight (lb)	Months after calving	Dry matter intake (lb per day)	TDN (% dry matter)	CP (% dry matter)	TDN (lb per animal per day)	CP (lb per animal per day)
1,000	1	20.4	61.0	10.6	12.4	2.16
	2	21.2	62.1	11.1	13.2	2.36
	3	21.8	59.8	10.4	13.0	2.26
	4	21.2	58.5	9.7	12.4	2.06
	5	20.7	57.1	9.0	11.8	1.87
	6	20.3	56.0	8.4	11.4	1.71
1,200	1	22.9	60.4	10.2	13.8	2.34
	2	23.8	61.4	10.7	14.6	2.55
	3	24.5	59.2	10.0	14.5	2.44
	4	24.0	58.0	9.4	13.9	2.25
	5	23.4	56.8	8.8	13.3	2.05
	6	23.0	55.8	8.3	12.8	1.90
1,400	1	25.3	60.0	10.0	15.2	2.52
	2	26.2	60.9	10.4	16.0	2.72
	3	27.1	58.7	9.7	15.9	2.62
	4	26.6	57.6	9.1	15.3	2.43
	5	26.1	56.5	8.5	14.7	2.23
	6	25.7	55.7	8.1	14.3	2.08

Table 4. Two-year-old dry (non-lactating) first-calf heifer nutrient requirements.

Mature body weight (lb)	Months after calving	Dry matter intake (lb per day)	TDN (% dry matter)	CP (% dry matter)	TDN (lb per animal per day)	CP (lb per animal per day)
1,000	7	18.8	48.6	6.9	9.1	1.29
	8	18.9	49.4	7.0	9.3	1.33
	9	19.1	50.7	7.3	9.7	1.39
	10	19.4	52.7	7.7	10.2	1.50
	11	19.9	55.5	8.3	11.0	1.66
	12	20.6	59.1	9.3	12.2	1.92
1,200	7	21.5	48.9	6.9	10.5	1.48
	8	21.7	49.7	7.1	10.8	1.53
	9	22.0	51.0	7.3	11.2	1.61
	10	22.3	53.1	7.8	11.8	1.73
	11	22.8	55.9	8.5	12.7	1.93
	12	23.7	59.7	9.4	14.1	2.23
1,400	7	24.2	49.1	6.9	11.9	1.67
	8	24.4	49.9	7.0	12.2	1.72
	9	24.7	51.3	7.3	12.7	1.81
	10	25.1	53.4	7.8	13.4	1.96
	11	25.7	56.4	8.5	14.5	2.19
	12	26.7	60.2	9.5	16.1	2.54

Table 5. Mature lactating cow nutrient requirements (20 lb/day peak milk production).

Body weight (lb)	Months after calving	Dry matter intake (lb per day)	TDN (% dry matter)	CP (% dry matter)	TDN (lb per animal per day)	CP (lb per animal per day)
1,000	1	24.0	59.6	10.5	14.3	2.53
	2	25.0	60.9	11.2	15.2	2.79
	3	25.4	58.6	10.4	14.9	2.64
	4	24.4	57.0	9.7	13.9	2.36
	5	23.5	55.4	8.9	13.0	2.08
	6	22.7	54.0	8.2	12.3	1.85
1,200	1	26.8	58.7	10.1	15.7	2.71
	2	27.8	59.9	10.7	16.7	2.97
	3	28.4	57.6	9.9	16.4	2.82
	4	27.4	56.2	9.3	15.4	2.54
	5	26.5	54.7	8.5	14.5	2.26
	6	25.7	53.4	7.9	13.7	2.04
1,400	1	29.5	58.0	9.8	17.1	2.88
	2	30.5	59.1	10.3	18.0	3.14
	3	31.3	56.8	9.6	17.8	2.99
	4	30.3	55.5	8.9	16.8	2.70
	5	29.4	54.1	8.3	15.9	2.44
	6	28.6	53.0	7.7	15.2	2.21

Table 6. Mature dry (non-lactating) cow nutrient requirements.

Body weight (lb)	Months after calving	Dry matter intake (lb per day)	TDN (% dry matter)	CP (% dry matter)	TDN (lb per animal per day)	CP (lb per animal per day)
1,000	7	19.5	46.8	6.5	9.1	1.26
	8	19.8	47.2	6.6	9.3	1.30
	9	20.3	47.9	6.7	9.7	1.35
	10	21.1	48.9	6.9	10.3	1.45
	11	21.0	52.1	7.7	10.9	1.61
	12	21.4	55.9	8.7	12.0	1.86
1,200	7	22.4	46.9	6.5	10.5	1.45
	8	22.8	47.3	6.5	10.8	1.49
	9	23.3	47.9	6.7	11.2	1.56
	10	24.3	49.0	6.9	11.9	1.67
	11	24.1	52.3	7.7	12.6	1.86
	12	24.6	56.2	8.8	13.8	2.16
1,400	7	25.2	46.9	6.5	11.8	1.63
	8	25.6	47.3	6.5	12.1	1.67
	9	26.2	48.0	6.7	12.6	1.75
	10	27.3	49.1	6.9	13.4	1.89
	11	27.0	52.6	7.8	14.2	2.11
	12	27.6	56.6	8.9	15.6	2.45

Bull Nutrition

Proper post-weaning development of beef bulls is important for their future effectiveness as herd sires. Bulls should be separated and managed according to age groups (weanling bull calves, yearling bulls, highly fitted or gain-tested bulls, 2-year-old bulls, mature bulls). Separating younger and older bulls can be particularly important in preventing injuries. Dividing bulls into management groups also allows the different nutritional needs of the different groups to be better met. Yearling bulls still have lots of growth and development ahead of them and should be managed differently than older bulls.

As bulls mature, their nutritional requirements change. Younger bulls require less quantity but higher quality diets. For example, daily nutrient requirements for a 700-pound bull gaining 2 pounds per day are approximately 16 pounds of dry matter intake with 11.4 percent crude protein and 65 percent total digestible nutrients on a dry matter basis, while a 1,500-pound bull gaining 2 pounds per day needs approximately 34.5 pounds of dry matter intake with 6.1 percent crude protein and 63 percent TDN on a dry matter basis. While daily dry matter intake generally increases with increasing body weight, a bull's crude protein requirement declines as a percentage of dry matter intake with advancing age and body size. Younger bulls require higher protein percentages for the rapid lean muscle growth that is occurring during early development.

Increased physical activity of bulls during the breeding season can result in body condition loss. Adequate bull body condition is important for effective breeding performance. Since it often can be difficult to supplement bulls separately from the remainder of the breeding herd, bulls should be fed to go into the breeding season in at least good body condition without being excessively fat. A body condition score of 6 (where 1 is extremely thin and 9 is obese) is a good goal for bulls at the start of breeding.

Yearling bulls can lose significant amounts of weight during their first breeding season. They must gain this weight back and continue to grow before the next breeding season to remain effective herd sires. It is important to observe growing bulls closely for changes in body condition. Adjustments to bull feeding programs then can be made in a timely manner. A good target is for a 2-year-old bull to weigh approximately 75 percent of his expected mature weight. For example, if a bull's expected mature weight is 2,000 pounds, he should weigh approximately 1,500 pounds (2,000 × .75 = 1,500) at 2 years of age.

Bull Nutrition Basics

- Younger bulls need less quantity but higher quality diets.
- Bulls should begin breeding season in a body condition score of 6.
- Breeding season activity can reduce body condition.
- Target 75 percent of expected mature weight for 2-year-old bulls.

Using Body Condition Scoring to Assess Herd Nutritional Status

Doing nothing to address the nutritional needs of cattle on drought-stressed pastures can dramatically impact production and profit levels. Thin cows and lightweight calves are a likely result if nutrient demands of the herd are not met. If cows are allowed to decline to a state of poor condition, then additional nutrients will be required to regain lost body condition. Research has consistently shown that reproductive rates of thin beef females are lower than those of cattle in moderate to high body condition.

Dramatic declines in pregnancy rates occur when cows fall below a body condition score of 5 on the 1 to 9 scale for beef cattle (see Beef Cattle Body Condition Scoring Guide on page 12). A change of 1 body condition score on this system equals an approximately 75- to 80-pound change in body weight on a 1,100-pound cow. Although there is added expense in supplemental feed, the cost of having thin cattle that do not rebreed or calves that do not grow like they should can hurt profitability even more. In addition, dramatically reduced weaning weights for calves from inadequate nutrition can hurt profitability.

Body condition scoring is a management tool that can be used to evaluate the nutritional status of beef cattle. Body condition is an indication of the energy reserves of a beef animal and is important in beef production

because it influences subsequent reproductive and growth performance. Over-conditioning is expensive and can result in calving problems and lower dry matter intake early in lactation.

Body condition is dependent upon nutritional requirements and past nutrient intake. Nutritional programs should be designed to avoid wild variations in body condition scores. Recommended body condition score at calving is 5 for mature cows. Because heifers are still growing, their nutritional requirements in terms of nutrient percentages are higher than later in life. Therefore, heifers should be managed to calve in a body condition score of 6.

Cows and heifers in thin body condition at calving time—

- Rebreed slower.
- Produce less colostrum.
- May not have sufficient nutrient reserves for maximum milk production.
- Are less likely to wean a live calf.

Recommended Times to Body Condition Score the Herd

Body condition scores of females in the breeding herd should fall within a range of 5 to 7 from the beginning of the calving season throughout the breeding season. To properly plan and adjust forage and feeding programs to ensure adequate body condition for optimum reproductive performance, cows and heifers should be condition scored in the following instances:

- When faced with limited forage supplies
- When calves are weaned
- Sixty days before calving
- At calving
- At the beginning of the breeding season

Key Places to Look for Body Condition

There are several key places to assess body condition in beef cattle. Overall body fat should be evaluated along with fat cover over the tailhead, ribs, and shoulder, and in the brisket. Muscling should be evaluated to determine if muscle has been broken down for energy and cattle are at the low end of the body condition scoring scale. Visible and palpable bone structure is another essential part of body condition scoring and includes the ribs, backbone, spinous processes, transverse processes, hooks (hips), and pins.

Palpation of the animal's condition over the ribs, along the backbone, and over the tailhead is useful in assigning body condition scores. Fat (condition) will be spongy to the touch. Bone structure with little or no fat cover will feel sharp to the touch. Palpation of body condition is particularly beneficial when loose hide or thick hair coat makes visual appraisal of body condition more difficult.

Beef Cattle Body Condition Scoring Guide

BCS 1 = Emaciated

No palpable fat is detectable over the spinous processes, transverse processes, ribs, or hooks. The tailhead and ribs appear very prominent.

BCS 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.

BCS 3 = Thin

Individual ribs, including foreribs, are easily identified but not quite as sharp to the touch. Some fat can be felt along the spine and over the tailhead. Some tissue cover is present over the ribs toward the top of the back.

BCS 5 =Moderate

Overall appearance is generally good. Fat cover over ribs feels spongy. Palpable fat cover is present on either side of the tailhead.

BCS 4 = Borderline

Individual ribs may not be visually obvious. Individual spinous processes can be felt when palpated but feel rounded rather than sharp. Some fat cover is present over the ribs, transverse processes, and hooks.

BCS 6 = High moderate

A high degree of palpable fat exists over the ribs and around the tailhead. Firm pressure is needed to feel the spinous processes.

BCS 7 = Good

Considerable fat cover is present with a fleshy overall appearance. Fat cover over the ribs and around the tailhead is very spongy. Fat "pones" may be forming along the tailhead.

BCS 8 = Fat

The animal is very fleshy and appears over-conditioned. Palpation of the spinous processes is nearly impossible. Large fat deposits are present over the ribs and around the tailhead. Fat pones around the tailhead are obvious.

BCS 9 = Extremely fat

The overall appearance is blocky with extremely wastey and patchy fat cover. The tailhead and hooks are buried in fatty tissue with fat pones protruding. Bone structure is no longer visible and barely palpable. Large fatty deposits may even impair animal mobility.

Alternative Feeds for Beef Cattle

Stored forages and feeds should be located, evaluated for nutrient value and price, and purchased or forward-contracted. Many hay suppliers fill orders to a regular customer base first before marketing to new customers, especially when hay supplies are tight relative to hay demand. Word of mouth is a common way of locating hay supplies. The Mississippi Market Bulletin and online hay directories also are potentially useful sources of information on hay suppliers.

Mississippi Hay Directory

https://extension.msstate.edu/mississippi-hay-directory

Mississippi Market Bulletin

https://agnet.mdac.ms.gov/mdac_mmb_public

By-product commodities are a viable feed alternative to commercially mixed supplements. Take time to evaluate both commodity feeds and commercial supplements to determine what ingredients price in as the most cost-effective to achieve target production levels. It is useful to reevaluate diets over time as feed prices and availability change to make sure that the cost of the current nutritional program is reasonable in comparison with other feeding options. Two useful resources for regularly updated commodity price information are the Oklahoma State University Feed Commodity Bulletin and the Missouri By-Product Feed Prices & Value page.

Commodity Feed Price Trends

By-product commodity prices for many common ingredients in beef cattle diets often follow seasonal price trends. Dried distillers' grains usually reach seasonal lows around early autumn. Whole cottonseed prices, on the other hand, tend to start falling after June and usually reach annual lows in October and November. Cottonseed hull prices tend to climb in November and December over September and October prices and then drop again in January and February. The best prices on soybean hulls are typically in early summer, with soybean hull prices often rising after August before starting to decline again after January. Prices of wheat midds are generally lowest in May and reach their peak in December. Price trends in the current year can always buck the traditional seasonal trend, however, so it is important to stay up-to-date on current commodity prices. Pool resources with neighbors when possible. Purchasing feed in bulk often can reduce cost per unit.

Nutritional Value of Selected Feedstuffs

Just because certain by-products are inexpensive does not necessarily mean they are a good value. The nutritional makeup of feeds and what they will contribute to beef cattle performance determine their true value (Table 7). Some feeds can be fed free-choice in self-feeders, while others require daily hand-feeding. Because each feed has its own unique feeding advantages and limitations, it is worth the time to visit with someone who is competent in formulating beef cattle diets to avoid any potential nutritional problems or disorders in the herd.

Table 7. Nutrient content of selected beef cattle feeds on a dry matter basis. The nutrient values presented are intended as a general guide to nutrient qualities of feedstuffs. Significant variation in nutrient values exists among different feed sources.

Feed	Feed type	Dry matter %	Total digestive nutrients %	Crude protein %	Crude fiber %	Crude fat %	Calcium %	Phosphorus %
Whole shelled corn	Energy	90	90	9	2	4	0.03	0.32
Hominy feed	Energy	90	91	11	7	8	0.06	0.58
Soybean hulls	Energy	90	80	12	39	2	0.60	0.17
Wheat midds	Energy	89	77	18	9	5	0.15	1.00
Rice bran	Energy	90	70	16	12	15	0.10	1.73
Cane molasses	Energy	74	72	6	1	0	0.01	0.10
Citrus pulp	Energy	90	80	6.5	13	4	1.90	0.13
Corn gluten feed	Protein	90	83	24	10	4	0.07	0.95
Whole cottonseed	Protein	93	90	24	22	18	0.20	0.73
Cottonseed meal	Protein	92	76	41	13	3	0.18	1.21
Soybean meal	Protein	90	84	48	7	2	0.34	0.70
Peanut meal	Protein	88	77	53	2	2	0.32	0.66
Dried distillers' grains	Protein	92	86	27	12	10	0.26	0.83
Brewers' grains	Protein	24	69	26	15	11	0.30	0.57
Cottonseed hulls	Roughage	91	42	4	48	2	0.10	0.07
Cotton gin trash	Roughage	92	46	8	38		0.60	0.20
Peanut hay	Roughage	91	48	11	33		1.20	0.15
Peanut hulls	Roughage	91	22	9	63		0.20	0.07
Corn stalks	Roughage	85	50	6.6	34	2	0.50	0.10
Soybean stubble	Roughage	88	40	5	44		1.00	0.06
Wheat straw	Roughage	92	40	4	42	2	0.17	0.04

Economic Replacement Value of Feedstuffs

The relative value of feeds can be compared in terms of dollar value for TDN and CP content as compared to whole shelled corn and soybean meal-based feeds. Table 8 shows prices at which selected by-product feeds would be relatively equivalent to corn and soybean meal at the given prices. Being able to purchase by-product feeds for less than these relative values would be a good deal compared to feeding corn and soybean meal-based diets at the given prices. This does not account for roughage levels needed in the diet or other feeding considerations but can be useful in quick overall comparisons of feed prices and nutrient replacement values.

Table 8. Relative value of by-product feeds with selected corn and soybean meal prices. Top values ([1]) are estimated based on soybean meal costing $150/ton. Bottom values ([2])are estimated based on soybean meal costing $200/ton.

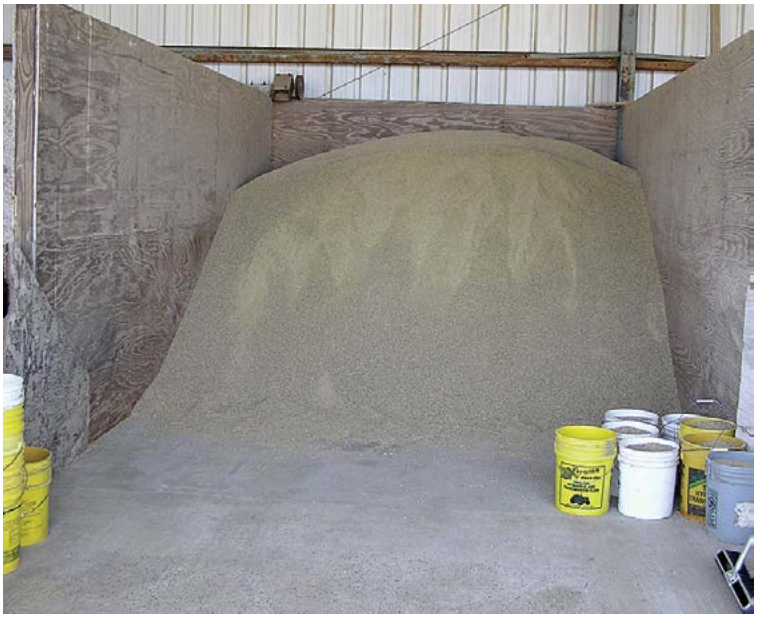
Feed	70 tons	80 tons	90 tons	100 tons	110 tons	120 tons
Whole cottonseed[1]	$105.22	$113.25	$121.28	$129.31	$137.34	$145.37
Whole cottonseed[2]	$121.56	$129.59	$137.62	$145.65	$153.68	$161.71
Cottonseed hulls[1]	$37.71	$42.91	$48.12	$53.32	$58.53	$63.74
Cottonseed hulls[2]	$38.13	$43.34	$48.54	$53.75	$58.95	$64.16
Soybean hulls[1]	$71.29	$79.36	$87.42	$95.48	$103.55	$111.61
Soybean hulls[2]	$76.24	$84.30	$92.37	$100.43	$108.49	$116.56
Corn gluten feed[1]	$95.39	$101.33	$107.27	$113.21	$119.15	$125.09
Corn gluten feed[2]	$113.33	$119.27	$125.21	$131.15	$137.09	$143.03
Hominy feed[1]	$76.76	$86.78	$96.81	$106.83	$116.85	$126.88
Hominy feed[2]	$78.96	$88.98	$99.01	$109.03	$119.05	$129.08
Dried distillers' grains[1]	$110.79	$116.80	$122.80	$128.80	$134.80	$140.80
Dried distillers' grains[2]	$133.72	$139.72	$145.72	$151.73	$157.73	$163.73
Wheat midds[1]	$87.17	$94.15	$101.14	$108.12	$115.11	$122.09
Wheat midds[2]	$99.93	$106.91	$113.90	$120.88	$127.87	$134.85
Rice bran[1]	$70.42	$76.78	$83.14	$89.49	$95.85	$102.21
Rice bran[2]	$79.06	$85.42	$91.78	$98.13	$104.49	$110.85
Cane molasses[1]	$47.54	$55.55	$63.57	$71.58	$79.60	$87.62
Cane molasses[2]	$44.68	$52.70	$60.71	$68.73	$76.74	$84.76

Feed Storage and Handling Considerations

Farm feed storage (Table 9), mixing, handling, and feeding capabilities also determine the feasibility of using different ingredients and diets for the herd. Specific feeds can have characteristics that require special handling considerations, as in the case of the flowability limitations associated with fuzzy whole cottonseed. However, a cornstarch coating process for whole cottonseed shows promise for alleviating this handling problem. Sacking feeds is useful for feeding and storage in many cases but typically costs extra.

Table 9. Feed storage requirements for selected beef cattle feedstuffs.

Feedstuff	lb/bushel	lb/ft^3	ft^3/ton
Whole corn	56	45	42
Corn silage		35	57
Soybean hulls	18	14	142
Soybean meal	53	42	48
Corn gluten feed	41	33	61
Hominy feed	35	28	72
Whole cottonseed	25	20	100
Cottonseed hulls	19	15	134
Cottonseed meal	48	38	53
Cotton gin trash		7	286
Wheat midds	25	20	100
Wet brewers' grains	82	65	30
Dried brewers' grains	19	15	134
Dried distillers' grains	19	15	134
Rice bran	25	20	100



Corn

Corn is typically considered the gold standard energy feed for beef cattle and is heavily used in beef cattle diets, including finishing diets.

- Extremely high-energy feed.
- Quite palatable to cattle.
- Contains low calcium, high phosphorus levels like most feed grains.

Soybean Hulls

Soybean hulls are by-products of the soybean oil milling process.

- Very palatable and digestible feed.
- Good energy source, particularly on forage-based diets.
- Roughly equal to corn as a supplement at 0.5 percent of body weight or less on high-forage diets.
- Decent protein source but can vary widely from load to load.
- High fiber content not effective fiber; adequate roughage source also needed.
- Can be fed in self-feeders along with hay or pasture.
- Conducive to bloat when fed at high levels (over 7 pounds per day).
- Bulky, dusty; best when pelleted or mixed with silage or molasses to reduce dust.
- Good source of calcium but low in phosphorus.
- Widely used ingredient in Mississippi beef cattle diets.

Soybean Meal

Soybean meal is another by-product of the soybean oil milling process. It is an excellent source of protein.

Corn Gluten Feed

Corn gluten feed is a by-product of the corn milling process, which produces high-fructose corn syrup that is used as a sweetener. It consists primarily of the bran and meal remains from the grain after starch removal.

- Good protein content but protein quality too low for poultry and swine diets.
- Works as a protein and energy supplement.
- At 0.5 percent of body weight or less on high-forage diets, TDN value about equal to corn.
- Often prices in as a cost-effective feed ingredient.
- Should not make up more than 50 percent of daily dry matter intake.
- Can be fed in self-feeders along with hay or pasture, but caking is possible in humid conditions.
- Excessive processing or heating lowers feed value and palatability and darkens color.
- Wet form use only practical in areas relatively close to mills.
- Low in calcium.
- Can contain high sulfur levels that necessitates mixing with other feeds in the diet.

Hominy Feed

Hominy feed is made up of the corn bran, germ, and part of the starchy portion of the corn kernel from degermed corn meal production.

- Roughly equal to ground corn in feeding value.
- Very palatable to cattle.
- Higher protein levels than corn grains.
- Fat content normally 6 percent or more.
- Low-fat form has less energy.
- Finely ground product suitable for mixing with other feeds.
- Can be stored, handled, and fed similarly to ground corn.
- Best to use up supplies in 1 month or less to avoid stale smell.

Whole Cottonseed

Whole cottonseed is a major by-product of the cotton ginning process.

- Excellent beef cattle feed; good energy and protein levels.
- Two pounds cottonseed roughly equal to 1 pound each of corn and cottonseed meal.
- Readily available in cotton-producing areas.
- High fat content limits use levels to 25 percent or less of total dry matter intake.
- Feed no more than 5 to 6 pounds per head per day to mature cattle.
- Feed no more than 2 to 3 pounds per head per day to weaned calves.
- Do not feed at more than 20 percent of the diet for cattle in stocker or finishing programs.
- Must be hand-fed.
- Flow limitations in feeding bins and equipment; difficult to auger or gravity flow.

Cottonseed Hulls

Cottonseed hulls are by-products of the cotton industry.

- Extremely palatable.
- High in crude fiber; low digestibility.
- Can be used as the sole roughage source in cattle diets.
- Good hay-replacer diet ingredient or alternative to chopped hay in mixed feeds.
- Bulky with excellent mixing qualities at low levels in concentrate diets.
- Should not exceed 10 to 25 percent of diet for growing or finishing cattle.
- Often expensive.

Cottonseed Meal

Cottonseed meal is a by-product of the cottonseed oil milling process.

- Excellent locally available protein source.
- Works well in a hot mix (mixed with salt and offered free-choice).

Cotton Gin Trash

Cotton gin trash is a by-product of the cotton ginning process. Gin trash contains boll residues, leaves, stems, and lint.

- Bulky.
- Unpalatable, high-fiber, low-energy feed.
- Inexpensive feed with limited uses.
- Practical use is in hay-replacer diets when mixed with other feeds.

Cotton Mote

Cotton mote is the cotton extracted by a gin's lint cleaner during the cotton ginning process.

- High-fiber, low-energy feed.
- Palatability usually not a problem.
- Most baled into 4-by-4-by-5-foot bales.
- Can be handled and fed with same equipment used for large, round hay bales.
- Practical use is in hay-replacer diets with other supplemental feeds.

Wheat Middlings (Midds)

Wheat midds result from the wheat milling process.

- Good energy and protein content.
- Available as loose meal or pellets.
- Pelleted form cannot be stored for any length of time during hot, humid weather.
- Practical use in Mississippi only during winter.
- Should be combined with other ingredients to reduce risk of founder and bloat.
- Limit to 50 percent or less of total dry matter intake.
- Moderately palatable.
- High phosphorus levels relative to calcium levels.

Wheat

- Should be mixed with other ingredients to reduce risk of acidosis.
- Feed at no more than 0.5 percent of animal body weight.
- Coarsely cracked or rolled wheat is more digestible than whole grain wheat.
- Not commonly used as a feed grain in Mississippi.

Peanut Hay

Peanut hay is composed of the vines and leaves of peanut plants after the peanuts are harvested.

- Protein content is fair to good; energy content is low.
- Extremely palatable to cattle.
- Highly susceptible to spoilage and losses unless stored under wrap or cover.
- Can be used as the primary forage in cattle diets when supplemented properly.
- Make sure that no unapproved pesticide or other chemical residue is present before feeding.

Peanut Hulls

Peanut hulls are by-products of the peanut shelling process.

- Extremely bulky and difficult to handle.
- High in fiber; extremely low in energy and protein.
- Availability depends upon proximity to shelling plant.
- Uses in hay-replacer diets and as an extender in stocker concentrate diets.
- Do not use finely ground or pelleted peanut hulls (health risk to cattle).

Peanut Skins

Peanut skins are the result of skin removal from the peanut kernel.

- Very limited potential in beef cattle diets.
- Difficult to handle; light, bulky; flow problems; can be blown by wind.
- Moderate protein and energy levels.
- High tannin levels that reduce protein digestibility and decrease palatability.
- Do not use at levels of more than 10 percent of dietary dry matter.

Raw Peanuts

Raw, whole peanuts are typically valued higher for uses other than as cattle feed.

- Very good energy and protein levels; high fat content limits feeding levels.
- Maximum of 4 pounds per day should be fed to mature cattle.
- Must be introduced to cattle gradually.
- Check aflatoxin levels before feeding (do not exceed 200 parts per billion in cattle diets).

Rice Bran

Rice bran is a by-product of the rice milling process.

- Finely ground material; handling and storage in bins is difficult; blending improves flow.
- Moderate protein levels.
- High fat content unless defatted; limit to no more than one-third of diet.
- Substantially less energy than soybean hulls even with high fat levels.
- High-fat rice bran less palatable and susceptible to rancidity in warm weather.
- High phosphorus content.

Rice Millfeed

Rice millfeed is a by-product of the rice milling process.

- Finely ground material.
- Combination of rice hulls and rice bran.
- Often highly variable in composition.
- Founder is possible when fed at high levels.
- Handling characteristics similar to rice bran.
- Typically less expensive and longer storage life than rice bran.

Rice Hulls

Rice hulls are by-products of the rice milling process. They have extremely low nutritional value in beef cattle diets.

Brewers' Grains

Brewers' grains are by-products of beer production.

- With wet brewers' grains, 75 percent of product transported is water.
- Shelf life is a concern with wet feed.
- Should be stored in anaerobic conditions or stacked and fed rapidly.
- Good protein content.
- Usefulness limited due to high water content.

Dried Distillers' Grains

Distillers' grains are by-products of the fermentation of grain to produce alcohol (e.g., ethanol).

- Availability generally limited to areas near distilleries and ethanol plants.
- Excellent source of protein and energy.
- Can be fed as a majority of the total diet.
- Drying facilitates storage, transportation, and handling.

Cane Molasses

Cane molasses is a by-product of sugar manufacturing.

- Extremely palatable.
- Excellent energy source.
- Commonly blended with vitamins and minerals.

Citrus Pulp

Citrus pulp is made by shredding, liming, pressing, and drying the peel, pulp, and seed residues from citrus fruit.

- Availability and cost-effectiveness for use in Mississippi is limited.
- Good energy supplement.
- Very digestible, low-protein, high-fiber feed.
- Excellent feed if acquired; best deals usually in midwinter.
- Should be limited to one-third or less of the diet for growing beef cattle.
- Initial palatability problems with calves quickly overcome.
- Often pelleted to facilitate transportation.
- Darkening toward a black color indicates overheating.

Ionophores and Implants

Using ionophores (monensin or lasalocid) in cattle diets can improve gains on high-roughage diets and efficiency of high-grain diets. Consider incorporating ionophores into beef cattle nutritional programs. However, be cautious about using these products where other classes of livestock such as horses are relying on the same feeding areas or equipment because ionophore ingestion in small quantities can be fatal to these animals. Growth-promoting implants also may be good options for improved growth rates and efficiency if adequate nutrition is supplied to support targeted gains. Be careful to read implant labels to determine proper use.

Calcium and Phosphorus

Dicalcium phosphate is 22 percent calcium and 19.3 percent phosphorus and is added to beef cattle diets to balance the calcium-to-phosphorus ratio. It adds both calcium and phosphorus to the diet. Limestone is 34 percent calcium and is added to beef cattle diets to increase the calcium levels of the diet. The calcium-to-phosphorus ratio ideally should be close to 1.6:1 and should be within the range of 1:1 to 2:1. Complete mineral supplements, including needed trace minerals and vitamins should be available to cattle at all times.

Hay-Replacer and Supplementation Diets

Hay-Replacer Diets

Hay-replacer diets are formulated with high levels of roughage to make up for forage shortfalls. Growing cattle require different dietary nutrient levels than mature cattle. The diets listed in Table 10 are intended for mature cattle.

Table 10. Hay-replacer diet alternatives for mature cattle.

Ingredient	Diet 1 (lb/ton)	Diet 2 (lb/ton)	Diet 3 (lb/ton)	Diet 4 (lb/ton)	Diet 5 (lb/ton)
Corn		730		325	
Cottonseed hulls	887	950	546	1,300	700
Cottonseed meal		295	152	150	100
Soybean hulls			1,283		
Corn gluten feed	1,089				
Oats					1,180
Cane molasses				175	
Limestone	13	14	6		
Dicalcium phosphate			2	10	
Urea				20	
Trace mineral salt	9	9	9	20	20
Vitamin ADE premix	4 million IU vitamin A	4 million IU vitamin A	4 million IU vitamin A	4 million IU vitamin A	4 million IU vitamin A

Supplementation Programs for Forage

Forage is an important component of beef cattle nutritional programs in Mississippi. With shorter hay supplies resulting from drought conditions, it is critical that hay is used properly. Available hay should be evaluated for quality and then matched with an adequate supplementation program to meet body condition and growth targets (Table 11).

Table 11. Daily cottonseed meal (CSM) and shelled corn supplementation schedule with various quality forages.

Forage analysis results			*Replacement heifers*[1]		*Dry cows*[2]		*Lactating cows*[3]	
Forage quality	**Crude protein %**	**Total digestible nutrients %**	**Lb CSM**	**Lb corn**	**Lb CSM**	**Lb corn**	**Lb CSM**	**Lb corn**
Excellent	>11.2	>56	0	2.5	0	0	0	0
Good	9.5–11.1	>56	0	2.5	0	0	1.0	0
		53–56	0	2.75	0	0.5	1.0	1.0
		50–53	0	3.25	0	1.0	1.0	2.5
Fair	8.2–9.5	54–56	0.5	2.25	0	0.5	2.0	0
		51–54	0.5	2.5	0	1.0	2.0	1.5
		<50	0.5	3.0	0	2.0	2.0	2.5
Poor	7.3–8.2	53–55	1.0	2.5	0	0.5	2.5	0.5
		51–53	1.0	2.75	0	1.0	2.5	1.0
		<50	1.0	3.25	0	2.0	2.5	2.0
Very poor	<7.3	<48	1.5–2.0	2.0–5.0	1.0	2.0	3.0	3.0

[1] Heifers weighing 550 pounds targeted to gain 1.25 pounds per day at this rate of supplementation.
[2] Dry cows weighing 900–1,100 pounds during last 3 months of pregnancy.
[3] Superior milking cows weighing 900–1,100 pounds during first 3 months of lactation.

For mature, lactating cows, other supplementation options for good-quality hay might include:

1. protein blocks
2. liquid protein
3. 2.5 pounds of low-fiber range cubes
4. 2.5 pounds of whole cottonseed

Additional supplementation options for fair-quality hay might include:

1. protein blocks designed for 3 to 4 pounds daily consumption
2. 4.5 pounds of low-fiber range cubes
3. 4.5 pounds of whole cottonseed

Alternative supplementation options for poor-quality hay might include:

1. 6.5 pounds of low-fiber range cubes
2. 6 pounds of whole cottonseed

Cows on very poor-quality hay could be supplemented with 7.5 pounds of low-fiber range cubes.

In situations where pastures are short or grazed off and stored forage must be fed, supplementation alternatives can be as described in the following paragraphs.

Pregnant, Dry Cows

- **Option 1.** Feed hay free-choice. If hay is poor quality, then
  1. feed 1 pound cottonseed or soybean meal per head daily or every other day at double the amount
  2. provide 30 to 35 percent protein liquid supplement or protein blocks free-choice
  3. feed 2 to 3 pounds of 20 percent protein range cubes per head daily
  4. provide a hot mix of 25 percent plain salt and 75 percent cottonseed meal free-choice
- **Option 2.** Limit feed corn or sorghum silage to 40 pounds per head per day plus 1 pound of cottonseed meal, soybean meal, or free-choice liquid supplement or protein blocks.
- **Option 3.** Limit-grazing of winter annual pastures up to 2 hours every other day to supplement free-choice hay or silage feeding programs. Stocking rate should be between two to four cows per acre depending on forage availability.

Lactating Cows

- **Option 1.** Provide good-quality hay free-choice. Supplement hay with one of the following protein and energy combinations:
  1. 4 to 5 pounds of whole cottonseed
  2. 1 to 1.5 pounds cottonseed meal or soybean meal plus 2 pounds corn (can be via range meal mix)
  3. free-choice liquid supplement or protein blocks plus 2 pounds corn. Poor-quality hay will require additional protein and energy supplements above what liquid supplements and blocks can provide
- **Option 2.** Feed 50 to 60 pounds corn silage per head or offer free-choice. Provide additional protein with one of the following:
  1. 1.5 to 2 pounds of cottonseed meal or soybean meal (can be via range meal mix)
  2. 4 to 5 pounds of range cubes
- **Option 3.** Feed 50 to 60 pounds sorghum silage per head or offer free-choice. Provide additional protein with one of the following:
  1. 2 to 2.5 pounds of cottonseed meal or soybean meal (can be via range meal mix)
  2. 5 pounds of whole cottonseed
  3. 6 to 7 pounds of range cubes
- **Option 4.** Limit-grazing of winter annual pastures to 2 to 4 hours per day or 4 to 6 hours every other day to supplement free-choice hay feeding programs. Stocking rate should be between two to three cows per acre depending on forage availability.

Replacement Heifers

- **Option 1.** Provide 10 to 14 pounds good-quality hay fed free-choice along with 1 pound cottonseed meal or soybean meal and 3 pounds corn (can be via range meal mix). Add 1 to 2 pounds of corn if hay quality is fair or poor.
- **Option 2.** Provide 25 to 30 pounds corn silage fed free-choice along with 1.5 pounds cottonseed meal or soybean meal (can be via range meal mix).
- **Option 3.** Provide winter grazing free-choice plus 2 to 4 pounds of hay per day. Stocking rate should be between one to two heifers per acre depending on forage availability.
- **Option 4.** Provide winter grazing or corn silage free-choice. Stocking rate should be between one to two heifers per acre depending on forage availability.

Stocker Cattle

Because stocker cattle must gain weight at moderate or higher rates to be profitable and have different nutrient requirements than mature breeding cattle, separate nutritional programs must be established for stockers. Like cow-calf nutritional programs, stocker cattle nutritional programs can take advantage of by-product feedstuffs when economical. Example stocker cattle diets using common by-product feeds appear in Table 12.

Table 12. Stocker cattle diet alternatives using by-product feedstuffs.[1]

Ingredient	Diet 1 (lb/ton)	Diet 2 (lb/ton)	Diet 3 (lb/ton)	Diet 4 (lb/ton)
Corn[2]	750	990	1,150	850
Fiber[3]	800	685	700	350
Whole cottonseed	450			
Soybean hulls				700
Corn gluten feed		325		
Cottonseed meal			150	100

[1] These diet formulations are designed to achieve approximately 2 pounds of gain per day. All diets should be supplemented with vitamin A to provide at least 100,000 IU vitamin A per pound of mineral or by adding 3 million units per ton of feed. Provide a mineral containing approximately 9 to 12 percent calcium and 6 to 9 percent phosphorus.

[2] Substitute up to 50 percent of corn as wheat, milo, cookie meal, or other starch source if economics dictate.

[3] Fiber source can be cottonseed hulls, cotton gin trash, ground hay, or peanut hulls. Hay should be provided free-choice, as well.

Limit Feeding

- **Weaned Calves**—Limit feeding is an intensive management strategy that can be used in times of limited roughage source availability. This strategy involves growing cattle at moderate rates of gain using a limited amount of high-concentrate ration. This can be an economical approach to stockering calves during a drought, but skilled management is required. Adequate bunk space must be available to allow all calves to eat at once. Small pens work best for ensuring that calves gather around the feed troughs. Feed must be weighed out daily. Roughage feeds must be available to work cattle up to the limit-fed diet. Once cattle are on full feed of a traditional diet, the roughage level can be gradually reduced until cattle are consuming the desired amount of the high-concentrate ration (Table 13). The limit-fed ration offered is increased slightly every 2 weeks to account for increasing calf weights. Small quantities of high concentrate rations can be used to achieve moderate rates of gain in this system. Cattle managers must carefully observe cattle when using this intensively managed feeding program.
- **Mature Cows**—Hay can be limit-fed to the cow herd to improve efficiency of hay use. Part of the increased efficiency is likely due to less hay waste and part is due to increased digestibility of the forage when limit-fed. One caution before trying this strategy is that limited access time to hay will decrease dry matter intake and can result in reduced weight gain, particularly in young cattle. Strategic supplementation may be needed to maintain adequate body condition in cattle with limited forage access.

Limiting Feed Intake

Hand-feeding is an effective means of limiting feed intake by limiting and controlling feed offering. Labor requirements may make this a less attractive option to some producers compared to the use of self-feeders. Intake-limiting ingredients can be added to beef cattle diets when using self-feeder systems. Salt is the most used feed-intake limiter. Mature beef cattle require less than 1 ounce per head per day of salt but tend to voluntarily consume levels above requirements.

There are practical limits to the amount of salt cattle consume, and it can be used to restrict the consumption of highly palatable feeds such as grains. Particle size must be similar for all ingredients in the diet for uniform salt distribution. A useful rule of thumb is that daily voluntary intake of salt will be about 0.1 pounds of salt per 100 pounds of body weight for most classes of cattle. It is important to keep plenty of water out for cattle consuming salt. There is notable variation in the amounts of salt individual animals will eat, so salt is not a precise regulator of intake.

Salt also can contribute to corrosion of metal feeders, hastening the need for feeder repair and replacement. Some commercially available feeds are premixed with an intake limiter other than salt. There is often a trade-off between feeding convenience and price with these feeds. Cattle may over-consume hot mixes or salt-limiting supplements during periods of low forage availability such as drought. Supplemental forage must be provided to avoid this situation.

Table 13a. Limit-feeding high concentrate calf diet example ingredients (total 2,000 lb/ton).

Ingredient	Diet (lb/ton)
Alfalfa pellets	157.6
Corn	1,318.4
Cottonseed meal	269.4
Cottonseed hulls	99.6
Cane molasses	83.6
Soybean meal 48	47.6
Limestone	17.4
Trace mineral salt	5.6
Vitamin A-30	0.4
Bovatec 68	0.4

Table 13b. Limit-feeding high concentrate calf diet example nutrients.

Nutrient	Diet (% dry matter)
TDN	80.8
Crude protein	15.8
Crude fiber	8.3
Crude fat	3.5
Calcium	0.54
Phosphorus	0.42

Forage-Related Options and Concerns

Stockpiling Late-Summer and Early-Fall Forage

When summer hay and grazing production is severely impacted in a drought, it is vital to use any late-summer or early-fall moisture to "stockpile" excess pasture growth for use during the winter. The stockpiling of forage can save on the costs associated with hay production and feeding and will help take the pressure off limited hay stocks during the early winter period. Bermudagrass, bahiagrass, and tall fescue all can be stockpiled during early fall and late winter.

Stockpiling Bermudagrass and Bahiagrass

Stockpiling warm-season grasses usually involves accumulating extra growth in August, September, and early October for grazing during the late fall and winter. This can be an effective way to bridge the gap between the end of warm-season growth and the time when there will hopefully be enough cool-season forage to graze. The amount of stockpiled bermudagrass needed to achieve this will depend on the length of the "gap" in forage growth.

In south Mississippi, the use of annual ryegrass as the major source of cool-season forage means that bermudagrass might have to be grazed longer into the winter to give the annual ryegrass time to get established and grow enough forage for grazing. However, the growing season of bermudagrass is also longer in south Mississippi, so the overall time spent grazing the stockpiled bermudagrass may be as short as 2 months. In north Mississippi, cool-season grasses such as tall fescue can generally be used much earlier in the fall, so there is often less need for stockpiled bermudagrass. In fact, in north Mississippi, tall fescue offers a better option for stockpiling forage for the winter than bermudagrass does.

Some preparation is required for areas where bermudagrass will be stockpiled. Quality of the stockpiled forage will be much better if old forage growth is removed beforehand and the pasture is fertilized to promote fresh growth. Fields that were harvested for hay in mid- to late August are ideal for stockpiling. Applying 50 to 100 pounds of nitrogen per acre in late August will promote fresh forage growth through September and October. Depending on climatic conditions, this should be between 2,000 and 3,000 pounds of stockpiled forage dry matter per acre by November.

Nutrient levels in bermudagrass will vary depending on the amount of growth accumulated, fertility, and the weather during and after stockpiling. Bermudagrass will not typically hold its quality during the winter as well as tall fescue will, as the plant tissue is dead and more prone to weathering. It is always a good idea to forage-test your stockpiled grass to determine whether additional supplementation is

required. The need for supplementation may become more likely the longer stockpiled forage is grazed into winter. Stockpiled bermudagrass will generally be above 10 percent crude protein and between 47 and 55 percent TDN during November and December, which is more than adequate to graze gestating beef cattle.

With forage use of 70 to 80 percent, an acre with 3,000 pounds of stockpiled bermudagrass could hold 25 gestating cows for a week. This would mean that about 15 to 20 acres would be needed to graze these 25 cows from November 1 through the end of January with minimal hay required (or 0.6 to 0.8 acres per cow). To ensure good forage use, it is important to reduce the potential for wastage by not giving the animals any more than 2 weeks' worth of grazing at a time. Using the 25-cow example above, do not allow cattle to graze an area greater than 2 acres at any one time (or 12.5 cows per acre). Strip grazing behind a temporary electric fence is the best way to ensure good forage use.

Stockpiling Tall Fescue

Producers in the northern half of Mississippi who are growing tall fescue in their pastures have a great opportunity to accumulate forage for winter feeding. Tall fescue is one of the best forages for stockpiling, as it maintains its nutritional value better than other grasses during cold, frosty weather. Depending on the availability of moisture, tall fescue will start to grow again in September and will continue to grow through December in many places. Therefore, significant amounts of forage can be accumulated during this time for feeding during January and February when hay feeding requirements are generally at their greatest.

Unlike annual ryegrass, tall fescue is a perennial forage. Tall fescue fields established this fall need to be pampered during establishment and not grazed until next spring. Therefore, do not plan for acreage established this fall into tall fescue to be part of the stockpiling or winter feeding plan for this year. Instead, it should be considered a component of a long-term winter feeding plan where additional cool-season forage production is desired.

To prepare for stockpiling established tall fescue acreage, clip pastures to remove any old growth, weeds, or seedheads in early to mid-September. Much of the soluble nitrogen will have been removed from the soil during the summer. Therefore, an application of 50 to 80 pounds of nitrogen per acre in mid-September is recommended to give tall fescue a boost and ensure that stockpiling potential is not limited by nutrient levels. Where clover is a 20 to 30 percent component of the tall fescue pasture, the nitrogen application can be cut back to 30 pounds per acre.

If a producer started stockpiling tall fescue in September, 2,000 to 3,000 pounds of dry matter per acre could be accumulated by December. This could hold one dry cow per acre for 2 to 3 months with minimal supplementation required. As with bermudagrass, strip grazing with temporary electric fencing is the best means of ensuring high utilization levels (greater than 70 to 80 percent). The nutritional quality of stockpiled tall fescue is generally around 12 to 16 percent crude protein and 58 to 65 percent TDN, which is better than most hay will be at a fraction of the cost.

Annual Ryegrass

Plan cool-season grazing to limit the amount of hay and supplemental feed needed. Cool-season forage production is often a significant limiting factor in Mississippi beef cattle operations, but it is even more so when hay stocks are reduced after a drought. Tall fescue can be used in the northern half of the state, but the most common winter forage used in Mississippi is annual ryegrass. Annual ryegrass is a reliable forage in most years, yet there are times when fall production is too low to offer any grazing. The primary seeding times for annual ryegrass (September through November) are also historically the driest times of the year in Mississippi, which can impact the success of these plantings. Early plantings of annual ryegrass are also susceptible to damage from blast, a fungal disease. There are other cool-season annual forage crops that can be used as an alternative or in combination with annual ryegrass to obtain more early growth and help spread the risk. These include the small grains and forage brassicas.

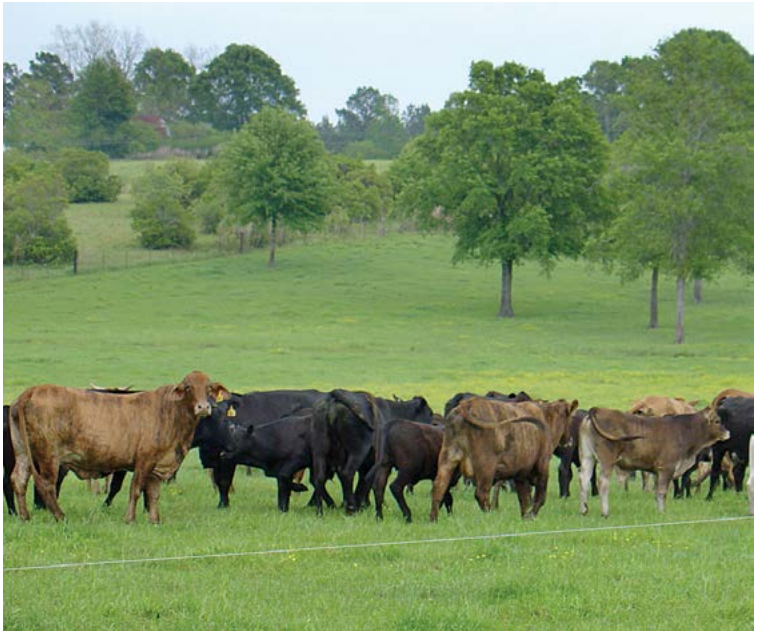
Small Grains

Small grains, or cereals, include rye, wheat, and oats. These crops are commonly used as grain crops but also are valuable as a forage crop with nutritional quality similar to annual ryegrass.

The small grain crops typically have a shorter growing season during the spring than annual ryegrass, and total annual yield may be slightly lower than annual ryegrass. However, the small grain crops are often faster out of the ground and can provide better early-fall and winter growth. The small grains typically are more tolerant of wet and cold weather than annual ryegrass and are resistant to the fungal disease blast, which can devastate annual ryegrass pastures.

Which Small Grain Is Best?

There are some differences in the suitability of different small grain crops for different soil and climatic conditions. In general, cereal rye is more tolerant of acidic soils than wheat and oats, whereas wheat is more tolerant of wet, heavy soils than cereal rye or oats. Oats may also be less tolerant of winter freezing and may suffer significant winterkill in the northern end of the state. Given the wet soils and/or low pH problems in Mississippi, cereal rye and/or wheat are likely to be the most productive.



Establishing a Small Grain Forage Crop

The methods for establishing small grain crops are much the same as annual ryegrass. While a prepared seedbed and grain drill will provide the best chance of a good stand, small grains can also be successfully broadcast over perennial summer pastures. Although there are some differences in the seed sizes of small grains, a general seeding rate of 90 to 120 pounds per acre is recommended. When using conventional tillage and a seed drill, the lighter rate of 90 pounds per acre can be used, as seed placement is generally better for germination and establishment. Ideally the seed should be sown at a depth of 1 to 2 inches. Where seed is broadcast either on a prepared seedbed or overseeded in existing summer pasture, the higher rate of 120 pounds per acre will result in a better stand.

As with annual ryegrass, it is important to maximize seed-soil contact by clipping or grazing pastures as close as possible. It may be necessary to scratch up the ground with a light disking where the bermudagrass or bahiagrass sod is too thick for the seed to fall to the soil. Sometimes animals can be used to tread the seed into the ground while keeping the summer pasture short enough to remove competition. However, make sure that the animals are removed before or shortly after germination to allow the crop to establish. Seeding at the correct time is another important factor in establishing a small grain crop. Recommended seeding dates for small grains used as a forage crop are usually 3 to 4 weeks earlier than seeding dates for grain production, or 4 to 8 weeks before the average first frost date. Table 14 shows different recommended seeding dates for small grain crops in Mississippi.

While small grains are effective as a pure crop, they also can be used effectively in a mix with annual ryegrass and/or annual clovers. Mixing with annual ryegrass will extend the growth season of the crop through May and will act as an insurance policy if the annual ryegrass is affected by blast in the fall. When seeding with annual ryegrass, use 60 to 90 pounds per acre of small grain seed mixed with 20 to 30 pounds per acre of annual ryegrass seed.

Table 14. Mississippi seeding dates for small grain crops used as forage. Adapted from Larson, 2005.

Region	Seeding dates
North and Central Mississippi	August 15 to September 15
Delta	August 20 to September 25
South Mississippi	September 1 to October 1
Coastal Mississippi	September 15 to October 15

Fertilization of Small Grain Forage Crops

As with any forage crop, it is important to soil-test and follow the solid test recommendations for lime, phosphate, and potash applications. Like most cool-season grasses, the small grain crops are very responsive to nitrogen, with linear yield responses up to 200 pounds of actual nitrogen per acre. Split fall (2 weeks after establishment) and early spring (February) applications—totaling 150 units of nitrogen per acre—are usually more than enough to achieve good forage yields.

Grazing Management of Small Grains

The management principles for small grain crops are much the same as for all cool-season grasses. The aim should be to maximize use and regrowth potential by careful rotational or strip grazing. The first grazing should occur when the plants are at least 8 to 12 inches tall and firmly anchored in the ground (test this by pulling a handful of leaves to make sure that the leaves tear off before the plants are uprooted). Post-grazing residuals should not be less than 3 to 4 inches to encourage regrowth, and the rotation length will vary from 14 to 28 days depending on growth rate (i.e., each section of pasture will get 7 to 14 days' rest before being grazed again). With some small amount of supplemental feeding and good fertility, an acre of small grains should provide enough nutrients for two lactating cows, four dry cows, or three 500-pound stocker cattle if good grazing management is employed.

If the winter is particularly cold and the plants stop growing, the rotation will need to be slowed to 50 to 80 days. The level of supplemental feeding also should be increased to take the pressure off the forage crop. During times of slow

growth, the small grain crops can be limit-grazed for 2 to 3 hours a day, which will ensure a longer use period of the crop and can help lessen trampling damage if pastures become wet. In spring, it will be difficult to keep on top of the rapid forage growth, and a fast rotation or continuous stocking will be necessary to prevent the plants from maturing and setting seed. It may be necessary to section off an area to accumulate the excess growth for hay or silage production. Small grains should be harvested for hay or silage at the boot or early head stage, and the quality is generally similar to annual ryegrass.

Crop Residues

Crop residues harvested for hay typically are low in nutrient content. However, during periods of drought, the quantity of dry forage that can be baled makes them an attractive haying option. Anhydrous ammonia treatment of corn stalks and wheat straw greatly improves harvested forage quality. Grazing crop residues is also an option that may best fit when coping with reduced grazing and hay supplies due to drought conditions.

It may be tempting to salvage drought-stressed dryland corn by grazing. **Get a nitrate test first!** Drought-stressed corn is a prime candidate for nitrate accumulation at levels that may be toxic to cattle. The highest risk typically occurs 1 to 3 days after a rain. There is some evidence that ensiling can reduce nitrate levels in drought-stressed corn. However, nitrates will not be eliminated, so test nitrate levels before feeding and use extreme caution when diluting with other feeds.

Do not offer cattle a supplement containing urea or non-protein nitrogen when feeding or grazing soybean stubble. Check labels on range cubes, liquid protein supplements, and protein blocks to determine urea content. Raw soybeans contain urease. The combination of raw soybeans and urea in cattle diets can result in animal illness or even death. Soybeans should also not be fed to swine or horses. High fat content of raw soybeans can scour cattle if not slowly introduced into the diet. If raw, whole soybeans are fed, limit them to 25 percent of the daily dry matter intake (5 to 6 pounds for mature cows and 4 to 5 pounds for yearling cattle). Do not let young calves consume soybeans. Rancidity problems can occur in hot weather with cracked or rolled soybeans. Do not store more than a 1- to 2-week supply, and do not feed moldy beans to cattle without first having a mycotoxin analysis performed. In addition, soybean stubble harvested for hay makes a loose bale and should be stored under cover to minimize losses.

Forage Brassicas

Common forage brassicas include turnips, rape, kale, and turnip × rape hybrids. While these crops may be more commonly associated with human food and wildlife food plots, they also can provide excellent livestock feed. The brassicas are high in crude protein (20 to 30 percent) and very digestible (greater than 80 percent). Brassicas are not very drought tolerant, but they can use late-summer moisture, and their rapid establishment can provide forage before the drier months of fall arrive. Turnips, rape, and the hybrids are the best options for fall forage production in the South. These brassicas can be planted during August through October and can be ready to graze in 40 to 60 days. Kale needs to be planted later in the fall and takes longer to mature (100-plus days), so it is not likely to provide the early forage needed. Many seed companies now market brassica varieties bred specifically for forage production. 'Pasja' rape hybrid and 'Appin' turnip have been tested in small plots at Mississippi State University and found to be very productive in the fall when planted in August. These varieties were bred for multiple grazings (good regrowth potential) and will provide forage throughout the fall and winter if managed properly.

Brassica Seeding Rates and Establishment

Brassicas can be used to overseed summer pastures, or they can be seeded on a prepared seedbed. Seeding rates for brassica crops are between 3 to 5 pounds per acre, and the seed can be either broadcast or planted with a seed drill (use a clover box if available) at a seeding depth of 0.5 to 1 inch. Brassicas prefer a pH close to 6 and adequate soil phosphate and potassium. Brassicas are not legumes, so they need nitrogen fertilization similar to annual ryegrass (30 pounds per acre after emergence and then additional 30 to 50 pounds per acre applications after each grazing). Turnips and the hybrids also can be sown with annual ryegrass and/or the small grains. Use a two-thirds seeding rate for the grasses and the full seeding rate for the brassicas.

Grazing Management of Brassica Crops

Brassicas are strictly grazing crops and can be used to make hay or silage. The new turnip, rape, and hybrids are bred for regrowth. Therefore, they require some form of rotational or strip grazing in order to avoid overgrazing and allow regrowth. Start to graze the brassicas when they are 12 to 20 inches tall, and try to leave 3 to 4 inches of stubble after grazing. Turnips have a "bulb" under the ground that cattle will also eat. Rape and hybrids do not have bulbs.

Due to the high nutritive quality of brassica crops, it is recommended to introduce animals to them slowly by limit-grazing (1 to 3 hours per day) for a week or so and then increasing the time spent grazing. Brassicas should not make up more than 75 percent of the diet because the high digestibility can cause rumen problems. Feed hay or give animals access to stockpiled grass while grazing brassica crops. Sowing the brassica crops with annual ryegrass and/or small grains also can add much needed fiber to the diet and stretch out the growing season.

Stretching Forage Supplies

Forage Quality Evaluation

Knowing forage quality in terms of nutrient contribution to beef cattle diets is critical to planning an accurate and efficient nutritional program. Forage testing is highly recommended to determine forage quality (Table 15).

Forage test samples from Mississippi producers can be sent to either the Mississippi State Chemical Laboratory or the Louisiana State University AgCenter Forage Quality Lab.

Table 15. Forage quality standards for beef cattle diets.

Forage type	Standard	Total digestible nutrients[1]	Crude protein[1]	Moisture	pH
Silage[2]	Excellent	65% or above	8% or above	70% or below	4.2 or below
	Good	60 to 64%	7 to 8%	71 to 74%	4.3 to 4.7
	Fair	55 to 59%	6 to 7%	75% and above	4.8 to 5.1
	Poor	below 55%	below 6%	75% and above	5.2 or above
Grass hay[3]	Excellent	58% or above	12% or above		
	Good	55 to 57%	10 to 11%		
	Fair	52 to 54%	8 to 9%		
	Poor	below 52%	below 8%		
Legume hay[3]	Excellent	64% or above	18% or above		
	Good	60 to 63%	16 to 17%		
	Fair	57 to 59%	14 to 15%		
	Poor	below 57%	below 14%		

[1] Dry matter basis.
[2] Determine silage quality by total digestible nutrients rating. If silage does not meet either crude protein or moisture requirement for quality, lower one standard.
[3] Determine hay quality by total digestible nutrients rating. If hay does not meet crude protein requirement or is less than 83 percent dry matter, lower one standard.

Rotational Grazing

Rotational grazing is a good method for managing forage use, particularly during a drought. Do not overgraze pastures. While this might sound difficult with low forage growth rates, try to keep at least 3 inches of post-grazing residual on pastures. Water loss through evaporation is much greater on bare ground than where a good plant cover is present. To avoid overgrazing, try to limit-graze animals for a few hours a day and then move them to an area where hay or other supplemental feeds can be fed. Pastures that are not overgrazed also will retain more water and recover more quickly once moisture does arrive. Simple electric fencing systems can be useful for rotational, limit, or strip grazing.

Forage Availability

Forage availability is the most important factor affecting forage intake on pasture. Intake is restricted when insufficient forage is available such as during a drought. On good-quality pasture, intake is adequate when available forage is 1,000 to 1,500 pounds per acre dry forage. Cattle harvest forages with their tongues, so very short forage height can limit bite size. With low levels of available forage, the amount that can be collected with each bite is small and the animal will have to walk farther to take more bites, thus allowing less time for chewing and ruminating.

The proportion of leaf to stem can greatly affect the bite size as the animal seeks out leaves. Higher proportions of

stems effectively reduce bite size even though total forage available is adequate. When stocking rate is high, cattle on rotationally stocked pastures may be forced to eat more stem or low-quality forage, which can reduce intake. This is in contrast to a continuously grazed pasture where they usually have a greater opportunity for selectivity unless the pasture is overstocked and has low forage availability. Warm-season perennial grasses (bermudagrass, bahiagrass, dallisgrass) with a higher proportion of stems may require the animal to harvest more but smaller bites to obtain the desired forage. Cattle eat little dead material if green leaf is available, and bite size may be restricted as the grazing animal seeks out green leaves. Increased grazing time is often not enough to compensate for the effects of reduced bite size on forage intake when cattle are grazing short pasture.

Minimizing Hay Storage and Feeding Losses

Hay supply is easily measured as hay is produced. Useful hay production and storage records should be noted for each cutting and include field ID, acreage harvested, date harvested, forage type, number of bales, storage location, average bale weight, and forage analysis results. When possible, plan hay storage to match forage test results. For instance, hay with higher TDN or energy and crude protein levels would be better for indoor storage than hay with lower nutrient levels, given that storage waste is higher with outside storage.

Conserve the hay crop that is available by minimizing hay storage and feeding losses. Barn storage is ideal for hay, but there are many other methods of hay storage (tarps, on wooden racks, on gravel, proper site selection and bale orientation, etc.) that will reduce storage losses compared to outside storage on the ground. Hay storage losses of 30 percent or more are common in the southeastern United States over several months of outside storage on the ground. Feeding losses from trampling, refusal, and leaf shatter can exceed 50 percent of hay dry matter in extreme cases. Do not allow cattle unlimited access to hay. Hay racks and rings will help reduce hay feeding waste. Also, feeding high-quality hay can result in less animal refusal.

Use of CRP Ground for Grazing During a Drought

The Conservation Reserve Program (CRP) is a voluntary program for agricultural landowners that encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filter strips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. The program is funded through the Commodity Credit Corporation. CRP is administered by the Farm Service Agency (FSA), with the Natural Resources Conservation Service providing technical land eligibility determinations, conservation planning, and practice implementation. For more information on CRP, contact your local FSA office or visit the FSA website. Local FSA offices can answer questions about CRP grazing restrictions and options in times of drought.

Forage and Pasture Concerns

Nitrate Poisoning Risks

Drought-stressed plants may accumulate toxic levels of nitrate, especially if nitrogen fertilizer has been applied. If nitrogen fertilizer has been applied to drought-affected pasture, then it makes sense to get a nitrate test conducted at the state chemical laboratory to make sure nitrate levels are below those considered toxic before grazing or making this forage into hay. Try to keep any nitrogen applications during a drought around 30 pounds of nitrogen per acre or less to help reduce the risk of nitrate toxicity and to give the plants a better chance of using the nitrogen if the weather remains dry.

Identify areas of the farm that have better water-holding capabilities and apply fertilizer inputs on these areas only.

Most producers have a mixture of soil types on their farms. It is often very easy to see these in a drought, as the ridges become brown and the valleys or bottoms stay green. If these different areas are present, then it is better to put nitrogen fertilizer on the ground with better water-holding capacity and avoid wasting it on the more drought-prone soils.

The Mississippi State Chemical Laboratory offers two nitrate tests. The qualitative test is $15 per sample and indicates whether nitrates are present in the forage sample. The quantitative test is $35 per sample and indicates a specific nitrate level present in the forage sample. Nitrate levels should be evaluated according to the guidelines in Table 16.

Table 16. Forage nitrate level guide for beef cattle.

Nitrate concentration[1]	Recommended management
0.0 to 0.5%; 0 to 5,000 ppm	Safe to feed
0.5 to 1.0%; 5,000 to 10,000 ppm	Risk to pregnant animals and to cattle that are not accustomed to high nitrate-containing forage
1.0 to 2.0%; 10,000 to 20,000 ppm	Not more than half of the diet
>2.0%; >20,000 ppm	Do not feed

[1] If nitrate-nitrogen values are needed, multiply the nitrate concentration values by 0.23. If potassium-nitrate values are needed, multiply the nitrate concentration values by 0.14.

Signs of nitrate poisoning in cattle include bluish discoloration of the skin, bluish-brown mucous membranes, labored or rapid breathing, muscle tremors, lack of muscle control, staggering, weakness, diarrhea, frequent urination, dark to chocolate-colored blood, rapid pulse, possible coma, and eventual suffocation. Necropsy results often reveal brown, badly coagulated blood. Pregnant females that survive nitrate poisoning may abort due to lack of oxygen to the fetus. Abortions generally occur 10 to 14 days after exposure to excess nitrates.

Nitrate Poisoning Concerns

- Nitrogen fertilization during drought increases risk.
- Nitrate tests are available for forage samples. **Test before feeding!**
- Sorghum-sudangrass, pearl millet, corn, and bermudagrass are susceptible.
- Haying or ensiling does not eliminate nitrate problems.
- Watch for signs of nitrate poisoning in cattle and treat immediately.

If forage has high nitrate levels, they will not fall once it is made into hay. Depending on the nitrate level, forage containing nitrates will need to be "diluted" with other feed sources to make the total nitrate levels less than 1 percent on a dry weight basis for feeding to beef cattle.

A quick field test of forage nitrate concentration can be a useful tool in deciding whether significant risk exists for harming livestock. A widely available field test kit uses 0.5 grams of diphenylamine in 20 milliliters of distilled water with concentrated sulfuric acid added to make a total volume of 100 milliliters. Nitrate test kits based on this solution are often distributed in amber dropper bottles to protect the solution from light.

To test for nitrate, drop some solution onto the suspect tissue. Split stems of corn and other coarse grasses and drop the solution on the inner portion near the base. Nitrate tends to accumulate there, so low levels in the lower stem generally indicate low levels throughout the shoot. Development of a blue color indicates the presence of nitrate. If a dark blue color develops within a few seconds, dangerous levels of nitrate may be present. Test multiple locations within a field to account for normal variability in plant composition. A positive response on this qualitative test should be followed up by collecting a sample for laboratory testing.

Poisonous Plants

Perilla mint (purple mint), nightshades, bracken fern, lantana, mountain laurel, and pigweed are examples of poisonous plants that can cause problems in cattle when consumed. Buckeye (horse chestnut), wild cherry (black cherry), and oak trees also can cause potential livestock disorders if their leaves or nuts are consumed. In most cases, grazing cattle with a good supply of forage and/or hay will not consume poisonous plants. However, with limited forage availability, pastures should be searched for poisonous plants common in Mississippi, and cattle should be checked for problems on a regular basis.

Poisonous Plant Essentials

- Scout pastures and hay fields for poisonous plants.
- Cattle are more likely to consume poisonous plants when forage is limited.
- Quickly recognize and treat signs of poisoning in livestock.

Common Poisonous Plants

- Perilla mint (purple mint)
- Nightshades
- Wild cherry (black cherry)
- Oak buds and acorns
- Bracken fern
- Lantana
- Mountain laurel
- Pokeweed
- Pigweed
- Buckeye (horse chestnut)

Vitamin A Deficiency

Vitamin A deficiency can be a problem on drought-stressed forages. Actively growing forages normally provide acceptable levels of vitamin A to beef cattle. Supply cattle with a complete mineral supplement at all times. Include at least 200,000 units per pound of vitamin A in the diet. Vitamin ADE premixes are readily available for mixing in mineral or feed. Vitamin A is required for normal night vision, epithelial cells that line body surfaces and cavities, and bone growth.

Cattle Management Options

Early Weaning

Early weaning is often used to improve cow condition for rebreeding, particularly when forage is limited. The nutrient requirements of a dry (non-lactating) cow are approximately 50 percent lower than the nutrient requirements of a lactating cow nursing a calf. Research shows that when the stress of lactation is removed by early weaning, cows gain body weight and condition. A Florida study reported that early-weaning thin cows resulted in a significant reduction in the amount of total digestible nutrients (TDN, an indicator of dietary energy) needed to support cow body weight gain. Early weaning also effectively initiated postpartum estrus in these cows. Improved pregnancy rates in cows with early-weaned calves have been documented by numerous researchers. Early weaning may be most beneficial in years when pasture production is inadequate to support herd nutritional needs. Do not wait to early-wean until the cowherd has lost significant body condition and forage availability is very limited.

Advantages of Early Weaning

- Allows for more efficient feed utilization during drought.
- More cows can be carried on a limited feed supply.
- Excellent feed conversion of early-weaned calves can result in cheaper gains.
- Reduces herd energy requirements.
- Helps cows to cycle earlier and improves rebreeding rates.

Disadvantages of Early Weaning

- Calf management and nutrition must be excellent.
- Labor, facilities, and feed must be available for feeding small calves.
- Seedstock cattle must wean within defined age windows for breeds to accept data.

Calves can achieve dry matter feed conversion rates of 5 to 8 pounds of dry matter per 1 pound of gain. Because early-weaned calves can gain weight efficiently, it may be advantageous to retain calves and feed them for a period. This allows for more flexibility in calf marketing. By feeding early-weaned calves a concentrate-based diet (Table 17) from weaning time until the time they would be conventionally weaned, research consistently shows that their body

weights will be equal to or greater than the body weights of calves nursing their dams up to conventional weaning age. Operations developing heifers for replacements may want to consider less aggressive pre-weaning nutritional management strategies to prevent negative impacts on long-term productivity.

Choosing the most appropriate early weaning diet should take into account whether calf ownership will be retained through the feeding period and feed cost and availability. Steers weaned at approximately 5 months of age versus 7 months of age have been shown to have lower feedlot feed intake and better feed conversion. Research indicates that early-weaned calves tend to gain less in the feedlots, have lower carcass weights, and have similar yield grades compared to calves weaned at traditional ages.

Early Weaning Calf Feeding

- Start calves with a high-energy, high-protein diet designed for early weaning.
- Hand-feed diet for 10 to 14 days until feeding up to 4 to 5 pounds per head per day.
- Gradually increase to self-feeder as total intake increases.
- Manage scours and coccidiosis.
- Use a single diet for best performance through normal weaning age.

One of the challenges with early weaning is getting calves started eating and drinking. In situations where calves are weaned at a very young age (younger than 3 months), intensive management may be necessary. These extremely young, lightweight calves are highly stressed from weaning and may display a wide variation of eating and drinking behavior. It is critical to get these young calves trained to a feed bunk and water trough as quickly as possible to reduce the risk of illness.

To both lower the risk of health problems and promote calf growth, implement proper vaccination programs in consultation with a veterinarian and get calves accustomed to concentrated feeds before weaning. Furthermore, low-stress weaning techniques such as fenceline weaning or fitting calves with anti-nursing devices may be valuable in early weaning programs. A coccidiostat may be fed to early weaned calves if coccidosis is a problem.

Increased labor and feed costs are typically associated with early calf weaning and subsequent backgrounding along with the need for a separate feeding or pasture area. These increased costs may be easily justified during drought conditions or when herd females are thin and run the risk of low rebreeding rates. Early weaning just part of the herd could be a good option, as well. Start by early weaning young, pregnant cattle. With seedstock cattle, make sure to adhere to breed association weaning age windows for performance reporting purposes. Contact the respective breed association for weaning age requirements.

Table 17a. Early weaning calf diet example ingredients (total 2,000 lb/ton).

Ingredient	Diet 1 (lb/ton)	Diet 2 (lb/ton)
Corn	327	916
Oats	450	
Soybean hulls	438	
Soybean meal	298	350
Cottonseed hulls	450	600
Cane molasses		80
Limestone	26	38
Dicalcium phosphate	1	9
Trace mineral salt	9	6
Vitamin ADE premix	1	1

Table 17b. Early weaning calf diet example nutrients.

Nutrient	Diet 1 (% dry matter)	Diet 2 (% dry matter)
TDN	71.2	71.7
Crude protein	16.3	15.4
Crude fiber	23.3	16.6
Crude fat	2.8	2.6
Calcium	0.71	0.98
Phosphorus	0.32	0.40

Creep Feeding

Generally, creep feeding will not greatly reduce grazing pressure on pastures nor reduce the strain that nursing calves are putting on their dams. However, the weaning weight advantages of creep feeding have been documented in numerous research trials. Creep supplementation may be attractive in situations of low forage quality where calf nutritional needs to support acceptable growth are not being met. In fact, the most profitable time to creep feed is probably during a summer drought. Early weaning may be a better alternative to creep feeding when forage quantities are extremely limited.

Creep Feeding Considerations

- Will improve calf weaning weights.
- Will not greatly reduce pressure on pastures or lactating dams.
- Good option when calf nutritional needs are not being met (poor forage quality).
- Early weaning may be a better alternative when forage supply is limited.

The decision to supplement nursing calves impacts pre-weaning and post-weaning performance and should take into account cost and availability of feed and forage supplements, replacement heifer concerns, calf prices, and calf marketing plans. The value of improvements in calf gains and marketability should offset the cost of supplementation. Look at creep supplementation as a management decision that is evaluated with each calf crop instead of as a management practice conducted each year.

Profitability of creep feeding may depend largely on current market conditions. Typically, when calf prices are high, creep feeding becomes a more viable and profitable option than when calf markets are low. Seedstock producers should also consider how increased average daily gains and weaning weights due to creep supplementation affects, and in many cases improves, marketability of bulls.

Cattle Culling Decisions

During drought or other conditions where forage and feed resources are limited, culling deeper into the herd than normal is often appropriate. This does not mean that producers must liquidate their herds to survive a drought. Instead, animal nutrient demands should be closely matched with nutrient supplies based on the economics of providing the nutrients for various cattle numbers and associated nutritional needs. Culling can help alleviate grazing pressure on drought-stressed pastures and decrease overall operation demand for supplemental feed or forage. Stocker operators running short of forage may want to consider shipping cattle to feedlots early and still can take advantage of retained ownership opportunities as they pencil out. In cow-calf operations, prime candidates for culling are open (non-pregnant) cows, cows without calves, cows with physical defects (cancer eye, bad udder, feet and leg soundness problems), older cows (older than 10 years), poor producers, late-calving cows, cows outside of the desired calving season, and bad temperament cows.

Example Logical Culling Order

- Open old cows
- Open replacement heifers (still young enough to feed out and meet fed market targets)
- Old cows with unsound mouth, eyes, feet, and legs
- Open cows of any age
- Thin cows over 7 years old (body condition score less than 4)
- Very late bred 2-year-olds
- Healthy bred cows that are over 7 years old
- Healthy bred young cows 2 or 3 years old
- Healthy bred cows 4 to 7 years old

Cattle Culling Highlights

- Pregnancy-check early to find open cattle.
- Establish a preferred culling order.
- Decide on how deep to cull.
- Cull in a timely manner to conserve forage and feed supplies.
- Consider custom grazing and retained ownership options.

Consider cull cow price levels and seasonal trends when deciding when to sell cull cows. When cull cow prices are trending upward, it is often advantageous to wait to market cows if the increasing values can cover added production expenses from holding over cull cows. It also may be advantageous to retain cull cows until weight and body condition can be added. Unlike feeder cattle prices, cull cow prices generally increase on a per-pound basis with increasing cattle weights. If cull cow prices are trending downward, however, it may be advisable to market cull cows in a timely manner instead of investing more money in cow maintenance, particularly if this investment will not likely be recovered. In Mississippi, the traditional seasonal highs for cull cow prices usually occur in March, while the seasonal lows usually occur in November.

Alternatives to culling that reduce animal pressure on farm forage and feed resources include custom grazing and retained ownership programs. Break-even cattle feeding calculations can be performed with simple spreadsheets to help decide whether retained ownership is a good option at the current time. Contact your county Extension office for assistance with break-even calculations. Some cattle feeders will provide cash advances on cattle and partner with producers on percentages of their cattle. Make sure to visit with prospective feedyard managers in advance to learn about these services and feeding terms and conditions.

Cattle Management During Hot Weather

Water

Cattle need access to clean water and proper mineral supplements at all times. Ponds that are drying up may not provide adequate fresh, clean water for cattle. Alternate water sources may be necessary. Cattle should not have to travel long distances for water. Water requirements of cattle depend on a number of factors, including air temperature, water temperature, milk production level, pregnancy status, physical activity, growth rate, diet type, moisture level in the diet, salt intake, and dry matter intake. Temperature increases from 50 to 90°F can increase daily water requirements by 2.5 times.

As water levels recede in ponds and other livestock water sources, conditions become more favorable for water quality problems such as blue-green algae toxicosis. Blue-green algae (cyanobacteria) can be a problem for cattle, particularly during summer in warm, stagnant water with abundant nutrients. Blue-green algae can produce toxins that can cause sudden death in cattle when high concentrations are ingested. Muscle tremors or convulsions, extreme thirst, watery or bloody diarrhea, coma, and death within 4 to 24 hours following ingestion are possible clinical signs of blue-green algae toxicosis. Surviving cattle may become sensitive to light and have increased liver enzymes. Cattle should be immediately removed from suspect water supplies. Contact a veterinarian immediately to discuss treatment options. Copper sulfate (0.2 to 0.4 parts per million) can be added to the water to control cyanobacterial growth, but cattle must be removed from the affected water source for a minimum of 5 days following treatment to avoid exposure to high toxin levels.

Shade

Provide ample shade—at least 30 to 40 square feet per head for mature cows on pasture. If cattle crowd too closely together, limited shade can be worse than no shade at all. Shade options include natural (trees), permanent (barns and sheds), and portable shades. Strategically planting trees along the west side of a pasture will help provide afternoon shade. If a metal roof is used as a permanent shade, make sure that it is insulated and does not radiate heat like an oven. Portable shades are usually less expensive than permanent shades and can be moved to accommodate different grazing systems. Shade placement should be strategic since it will affect cattle distribution and forage use. Shades need to be high enough (at least 10 feet off the ground) to allow adequate airflow. Good ventilation and airflow are also recommended for confined cattle.

Cattle Working Strategies

Arrange to work cattle during cooler parts of the day instead of during the heat of the day. While working cattle in the late evening may seem like a good idea, cattle build up a heat load during the day and need at least 6 hours to dissipate heat and cool down from an extremely hot day. Researchers have observed cattle body temperatures reaching daily maximums at 10 p.m., well after outside temperatures peaked. If possible, try to work cattle early in the morning before the temperature rises to uncomfortable levels.

When working cattle, make an effort to limit the amount of time they must spend in a confined area with limited air movement. If cattle must remain in a confined area for an extended period, provide access to fresh, cool water. Very excitable cattle are particularly prone to heat stress. Practices that reduce cattle stress are beneficial during hot weather. Implementing a few precautionary measures to help the herd beat the heat can make the difference in avoiding production losses associated with heat stress.

Feed Intake During Weather Extremes

Extreme temperatures and weather can impact feed intake. As temperatures rise above the animal's thermoneutral zone upper critical temperature (the point at which heat stress begins), dry matter intake falls. Likewise, as temperatures drop below the animal's thermoneutral zone lower critical temperature (the point at which cold stress begins), dry matter intake increases. Temperature-based stress on cattle impacts their energetic efficiency. The effects of temperature on feed intake depend on the animal's thermal susceptibility, acclimation to the conditions, and diet. Temperature effects on feed intake are heightened by mud, precipitation, humidity, and wind. The duration of these adverse conditions also may be important. Adaptability of cattle to the environment can be important as it relates to feed intake and cattle productivity.

Hot Weather Management Tips

- Keep water sources clean and readily available.
- Provide adequate shade at all times.
- Work cattle early in the morning.
- Plan nutrition programs knowing that feed intake levels may be reduced.

Giving Cattle Advantages Through Good Herd Health

Common Conditions for Grazing Cattle

During the summer months, there are the usual disease problems seen in grazing cattle. However, in times of drought, an increase in the incidence and severity of these conditions is often observed. As forage gets shorter and the temperatures rise, cattle will spend more time under shade or in ponds trying to keep cool. With this behavior comes an increase in pathogen buildup that causes disease.

The organism that causes "footrot" is continually shed by the animals and resides between the toes. As cattle spend more time standing in water, the area between the toes becomes softer and more susceptible to trauma. This may lead to an increase in the disease. "Pinkeye" problems may also increase due to increased eye irritation from dust and flies. Also, disease spread is enhanced as cattle spend more time near each other under the shade source or around water. It is also common to see an increase in "anaplaz" in cows and "summer pneumonias" in calves for many of the same reasons. Decreased nutrition due to forage shortages, increased fly numbers, lowered milk production, and heat stress all work together to increase the potential for disease in the herd.

Discuss treatment and prevention programs for these conditions with a veterinarian. Normally, catching and confining the cattle represents the major portion of the cost of treatment. There are long-acting antibiotics on the market that can give 3 to 7 days of effective drug levels from a single injection. Oral medications can be put in the feed or mineral to control these conditions. Vaccines do exist for some of these diseases, but their economic benefit should be carefully scrutinized.

Parasite Control Programs

Internal and external parasites are an additional burden on the cow herd and stocker calves alike. Face, stable, and horn flies are the main external parasites to worry about. Horn flies feed on the blood of the animal, causing decreased animal performance and milk production. Face flies have a critical role in the transmission of "pinkeye," and stable flies can act as a severe cattle irritant. If allowed to flourish unchecked, these flies can add significantly to the amount of heat stress cattle suffer. This is due to the energy that the cattle expend trying to rid themselves of these parasites and the fact that high fly numbers may actually drive cattle out from under shade sources.

If there is any good news to drought conditions, it has to do with internal parasites. Normally the pasture contamination by parasite eggs and larvae in the Southeast is lowest during the hot part of the summer. Lack of moisture will ensure that parasite survival on these pastures is even lower. However, when there is a stressful situation for the cattle, such as nutritional stress during drought, even these parasite loads can be an extra concern. Once it begins to cool off in the fall, worm burdens will increase in all classes of cattle. This will be especially difficult on cattle that have been stressed by drought and are carrying lower than normal condition. A mid- to late-summer treatment for internal parasites will make the fall transition easier for the cattle by having them enter this time of year parasite-free. Summer is a good time to discuss this program with a veterinarian.

"Calf Comfort" for Weaned Calves

Many producers may be considering a different weaning program due to the drought conditions. Whether early-weaning a calf crop or planning to precondition them to try and capture some additional weight, there are some things to consider regarding the health program. Young calves do have the benefit of having a relatively high level of maternal antibodies (from colostrum) present when early weaned. Therefore, they should be fairly resistant to disease if presented with a low-stress weaning process. However, when forage is limited, calves may be weaned

having marginal levels of copper, zinc, and selenium in their systems. These micro-minerals are necessary for proper immune function. Therefore, if calves are handled incorrectly, increased levels of sickness and death loss may result.

There are some general considerations to address for any weaning program. If early weaning calves, do working facilities fit this smaller-sized calf? In other words, the best diet in the world will not matter if the calves cannot reach it in the feed bunk. This is even more critical for water sources. Lack of adequate feed and water will decrease immune function and minimize vaccination program benefits.

Dust control in the working facility and holding pens is required to minimize irritation to the calves' respiratory tracts. Dust irritation will lead to pneumonia in calves. Spray down pens with enough water to settle the dust on an as-needed basis. Walk through the handling facilities to look for protruding nails, gate latches, or sharp metal surfaces that can injure the calves. Weaning is stressful enough when everything goes well, so take the time to evaluate the entire process.

In normal circumstances, try to get two doses of vaccines in the calves before weaning. The second dose should be administered at least 3 weeks after the first and at least 3 weeks before weaning. However, pasture conditions may force producers away from this normal schedule. If only able to give one dose of the vaccine before weaning, try to give the calves at least 2 weeks to respond. The second dose can be given within 2 days of weaning.

There is some evidence to support waiting 24 to 48 hours after weaning to give the second dose. This gives the calf a short time to get over the initial stress of weaning. However, in most instances, giving the vaccine on the same day the calf is weaned is usually more convenient from a labor standpoint. If the calves cannot be removed from the cows and vaccinated before the hottest part of the day, delay vaccination until the following morning. Significant heat stress will decrease immune function in cattle. Again, it is critical to work with a local veterinary practitioner on setting up these programs.

Use the Beef Quality Assurance Guidelines

Beef Quality Assurance (BQA) involves more than just how injections are given in cattle. It has been described as producing a wholesome product in a humane manner. This publication covers many issues related to BQA—culling decisions that are driven by drought, vaccine handling guidelines for your animal health program, "calf comfort" considerations for early-weaned calves, cattle handling in hot weather, and using antibiotics correctly to treat sick animals. Following BQA guidelines increases the quality of the product produced. Educational material for the Mississippi BQA program is available online at MSU Extension's BQA page or from your county Extension office. This information is available to use without certification requirements, but the BQA program is well worth the effort to participate.

Herd Health Recommendations

- Hot, dry weather can increase the incidence and severity of common diseases.
- Parasite control programs must address both internal and external parasites.
- "Calf comfort" is a critical component for successful weaning.
- BQA guidelines are even more important for cattle stressed by drought.
- Nutritional stress will have a negative effect on immune function.
- Work with a veterinarian to make needed program adjustments.

Useful Websites

Weather Resources

MSU Department of Geosciences

https://www.geosciences.msstate.edu/state-climatologist/resources

Hay and Feed Source Information

Mississippi Market Bulletin

https://agnet.mdac.ms.gov/mdac_mmb_public

Alabama Hay Directory

https://agi.alabama.gov/alabama-hay-listings/

Arkansas Hay Producers Database

https://hayproducers.uada.edu/

Kentucky Department of Agriculture Hay Sales Directory

https://www.kyagr-apps.com/AGLicensing/Hay/PublicSearch/Search

Missouri By-Product Feed Price Listings

http://agebb.missouri.edu/dairy/byprod/listing.php

Missouri Hay Market Listings

http://agebb.missouri.edu/haylst/

AllHay.com National Exchange

https://allhay.com/

Tennessee Hay Directory

https://www.tn.gov/agriculture/topic/emergency-response---resources/drought-resources/hay-directory.html

Texas Department of Agriculture Hay and Grazing Hotline

https://texasagriculture.gov/Home/Production-Agriculture/Hay-Hotline

USDA Memphis Weekly Feed Report

https://www.ams.usda.gov/mnreports/lr_gr210.txt

USDA Weekly Hay Report

https://www.ams.usda.gov/market-news/hay-reports

Helpful Drought-Related Links

Mississippi Beef Cattle Drought Information Resources

https://www.drought.gov/states/mississippi

Alabama Drought Emergency Relief Effort

https://www.aces.edu/blog/topics/emergency-handbook-home-family/drought-preparation-and-water-conservation/

Dealing with Drought: A Resource for Cattle Producers (Angus Journal)

http://www.angusjournal.com/drought/

National Drought Mitigation Center

https://drought.unl.edu/

NOAA Drought Information Center

https://www.drought.gov/

U.S. Drought Monitor

https://droughtmonitor.unl.edu/

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