

Beef Management Practices for Coping With A Short Forage Supply

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When environmental conditions are less than ideal, forage production can fall. The most common cause of low forage yield is less than average rainfall in the late spring and summer. Harsh winter conditions or early spring freezes can also result in less than optimum forage supplies.

Unfortunately, there are no cheap, easy fixes for beef producers who have both short pastures and limited hay supplies. Good management means beef producers should develop and implement a strategy that specifies what to do with pastured animals and where winter feed supplies will come from long before the last blade of grass or bale of hay disappears. If not properly managed, a drought year can affect the bottom line for three years: in the first year, feed costs increase and calf weaning weights are decreased; in the second year calf vigor, colostrum quality, milk production, calf weaning weight, cow reproductive performance, and forage production all suffer; and in the third year the calf crop weaned and forage production are still impacted.

This publication reviews 16 management practices that can be used in various combinations to help reduce the negative consequences of low forage supplies. When forage supplies are low, producers should consider the following:

1. Monitor the body condition of cows as a barometer of nutritional status.
2. Avoid overgrazing and employ rotational grazing.
3. Creep feed calves to create near normal weaning weights.
4. Early wean calves to take pressure off both cows and pastures.
5. Identify and manage poisonous plants in pastures and hay fields.
6. Establish summer annuals to increase late season forage production.
7. Pregnancy check and market cull cows earlier than normal to reduce feed needs.
8. Inventory hay and other feed resources.
9. Analyze feeds for nutrient profiles to help determine supplemental feed needs.
10. Use alternative feeds to supplement and stretch forage supplies.
11. Limit hay access time to stretch forage supplies.
12. Limit feed a high-concentrate diet to stretch forage supplies.
13. Graze crop residues and stockpiled forages to reduce harvested feed needs.
14. Use drought-stressed corn for silage, green chop, or grazing.
15. Provide clean, cool water to reduce heat stress and maintain herd health.
16. Add moisture around electric fence ground rods.

1. Monitor Body Condition of Cows As a Barometer of Nutritional Status.

Use body condition scores (BCS) as a composite management tool to determine if the cow's environment is in balance. BCS is an easy, economical way to evaluate the body energy reserves of the cow herd, and it is a better indicator of nutritional status and reproductive performance than weight. Cows should be maintained near a body condition score of 5 (1-9 scale). A "how to" video is available at the Purdue beef website (www.thebeefcenter.com).

Condition scoring allows a producer to manage feed resources by sorting cows into groups and then feeding them according to their nutritional needs. In order of importance, beef cattle use nutrients for: body maintenance, fetal development, lactation, growth, and conception. As an animal satisfies each requirement, any excess nutrients are available to the next priority. When nutrients are limited, reproductive performance, growth and milk production (calf weaning weight), respectively, will be compromised.

2. Avoid Overgrazing and Employ Rotational Grazing.

Forage plants need a rest period between grazing cycles to replenish carbohydrate reserves in their storage organs. Without rest, plants will weaken and take longer to grow back. Pastures that are continuously over-grazed, typically lose many desirable high-yielding forage species. During a drought, this result will be magnified.

The old grazier's recommendation to "graze half and leave half" is still good advice. The problem during droughty periods is that regrowth is limited in pastures, even when they have been rested for 30 to 45 days between grazing cycles. Ideally, cattle should be removed from pastures when plants are grazed to about a 4-inch stubble height. This will allow enough leaf material for photosynthesis to occur, which will allow the plant to regrow more rapidly when environmental conditions improve.

If all pastures have been grazed to a 4-inch stubble height and no regrowth has occurred, then drylot cows or designate a sacrifice area within a pasture with temporary fence and provide alternative feeds. This will minimize long-term damage to the whole pasture. The area that isn't sacrificed will need less time to recover when environmental conditions improve.

3. Creep-Feed Calves to Create Near Normal Weaning Weights.

When nursing calves are provided supplemental feed, it takes some pressure off the cows and can boost calf weaning weights. Purdue data suggests that creep feeding calves can increase calf weights by 30 to 50 pounds (variation of 0-125 pounds) and cow weights by 30 to 50 pounds (variation of 0-200 pounds) at the time of normal calf weaning.

The response to creep feeding depends on forage quality, forage availability, and location of the creep feeder. In years when forage quality and/or quantity is limited, the response to creep feeding is higher than when forage quality and quantity are both high. The location of the creep feeder can affect calf use and feed intake. Locate creep feeders where cows congregate such as near water, mineral feeder, and shade.

Implanting calves has the potential to increase calf average daily gains by up to 10%. Therefore, if calves are gaining 2.5 pounds per day as a result of creep feeding, a 25 pound increase in weaning weight and a 10:1 return on investment could be expected. It is recommended that all

steers and non-replacement quality heifers be implanted. Implanting, however, can compromise future reproductive performance in heifers and bulls to be kept for breeding and is not recommended.

Table 1 provides sample creep rations that should support gains of approximately 2.5 pounds/day. Calves should be vaccinated for over-eating disease (clostridia type C&D antitoxin) preferably at least 2 weeks prior to creep-feed initiation. Once creep feeding starts, care should be taken to not let the creep feeder run empty. If feeders run empty, and when feed is reintroduced, calves are at risk of over-eating which can cause digestive upsets such as bloat or acidosis.

Table 1. Sample creep rations (% , as-fed basis)¹.

Ingredient	Ration 1	Ration 2	Ration 3	Ration 5
Corn, cracked	40.0	32.7	—	32.75
Oats, crimped	40.0	32.7	—	—
Soybean meal, 48%	18.0	—	—	—
Soybean hulls, pelleted	—	—	49.2	32.75
Dry corn gluten feed, pelleted	—	—	49.2	32.75
Dry distiller's grains + solubles	—	32.7	—	—
Limestone, feed grade	2.0	1.9	1.6	1.75

¹To be fed to nursing calves with free-choice forage and high-quality cow mineral, fortified with vitamins A and E, magnesium, copper, zinc and selenium.

4. Early Wean Calves to Take Pressure Off Both Cows and Pastures.

Early weaning of calves is a viable option for conserving short forage supplies. Early weaning not only lowers forage intake of cows by removing the lactation requirement, it also eliminates the forage intake and trampling losses associated with the calves. Based on Purdue data, early weaned, early-gestation cows consume approximately 25 percent less dry matter than cows nursing calves. When all factors are considered collectively, it is possible to conserve more than 30 percent of a pasture resource by early weaning calves.

When forage resources are limiting, non-lactating cows in the late first trimester to early second trimester of pregnancy (a period of low nutrient requirements) can maintain or gain body weight and condition much more easily than lactating cows. In a normal year, it is not uncommon for cows with early weaned calves to enter the winter with a 0.5 to 1.0 body condition (40 to 80 pounds) advantage over cows that have normal weaned calves. More body condition difference would be expected in a dry year. In addition, early weaned calves are much more efficient in converting feed to gain (~4:1) than feeding cows to support lactation and calf gain.

Based on Purdue research, it is recommended that individual calves need to be at least 70 days old when weaned. Calves weaned at younger ages tend to have stunted growth and look like pot-bellied, orphaned calves. Ideally, calves should be vaccinated for IBR, PI₃, BVD, BRSV, and clostridia prior to weaning, and then receive booster vaccinations before or at weaning, and again when calves are about 7 months of age to prevent sickness.

Table 2 provides sample early wean rations that should support gains of about 2.4 lb/day when fed to a 350 pound calf at 2% of its body weight per day (350 x .02 = 7 lb/day) and allowed free-choice access to good quality grass or grass-legume hay, a good commercial vitamin-mineral

mix, and water. Adding an ionophore (Rumensin[®] or Bovatec[®]) to the early wean ration will help stabilize intake, minimize coccidiosis, and improve feed efficiency.

If calves were not creep-fed before weaning, begin feeding the grain mix at 0.5 percent of body weight per day (for example, 300-lb calf x 0.005 = 1.5 lb/head daily). Increase grain mix gradually over the next 10 to 14 days to equal approximately 2.0 percent of body weight (for example, 300-lb calf x 0.0 = 6.0 lb/head daily). A rule of thumb for increasing the grain mix is to add approximately 0.5 lb/head every other day. If calves were creep-fed prior to weaning, begin feeding grain mix at 1 percent of body weight. Ideally, the early wean ration would be the same, or very close to the same, as the creep ration, which can then be gradually transitioned to a new ration. When hand feeding an early wean ration, a good rule of thumb after transitioning calves, is to not exceed 2.0% of body of supplemental feed mix per day (i.e. 300 pound calf = maximum of 6 pounds/day). As calves increase in weight, increase feed mix accordingly.

Table 2. Sample early wean rations (% , as-fed basis)¹.

Ingredient	Ration 1	Ration 2	Ration 3
Corn, cracked	37.0	—	32.8
Oats, crimped	37.0	—	—
Soybean meal, 48%	24.6	—	—
Dry corn gluten feed, pelleted	—	59.0	—
Soybean hulls, pelleted	—	39.3	32.8
Dry distiller's grains + solubles	—	—	32.8
Limestone, feed grade	1.4	1.7	1.6
Vitamin-Mineral mix ²	Free-choice	Free-choice	Free-choice
High quality grass or grass/legume hay	Free-choice	Free-choice	Free-choice

¹Adding an ionophore, such as Rumensin[®] or Bovatec[®], to the early wean ration will improve feed efficiency and reduce the chance of coccidiosis. These products are often packaged in a concentrate form. For example, Rumensin 80 refers to a feed additive concentration of 80 grams per pound. Adding 0.5 pounds of Rumensin 80 premix per ton of early wean ration will provide 20 mg of Rumensin per pound of ration (i.e. 6 pound of ration intake = 120 mg of Rumensin per day).

²High-quality mineral fortified with vitamins A and E, magnesium, copper, zinc and selenium.

5. Identify and Manage Poisonous Plants in Pastures and Hay Fields.

Animals typically avoid consuming poisonous plants when forage quantity and quality are adequate. However, poisonous plants can become a concern if they are included in harvested forage, or when pastures are overgrazed. Avoid overgrazing pastures that contain poisonous plants. For more information about managing poisonous forage plants, see *Guide to Toxic Plants in Forages* (Purdue Extension publication WS-37) and *Indiana Plants Poisonous to Livestock and Pets* (WS-9), available from the Purdue Extension Education Store, www.the-education-store.com.

6. Establish Summer Annuals to Increase Late Season Forage Production.

Annual warm-season grasses (such as sudangrass, sorghum-sudangrass, and pearl millet) are popular choices for picking up the summer slump and adding late season grazing, but these species require soil moisture to germinate and grow. Other warm-season grasses to consider include foxtail millet and teff grass.

If seeding annuals is part of a strategy to stretch available forage, seed should be purchased early since supplies can be quickly exhausted. If these forage grasses are not sown before late July, it is unlikely that the resulting value of the growth will exceed the costs of production. Another option would be to seed spring oat in mid-August. If the forage is to be grazed, adding forage turnip with the oat could be an alternative. Purdue Extension publication ID-317, *Forage Field Guide*, will provide suggested seeding date, seeding rate and best use practices.

Wheat acreage harvested for grain provides an opportunity for establishing these crops. Pearl millet typically yields somewhat less tonnage than sudangrass or sorghum-sudangrass. However, if there is an extreme drought or killing freeze, pearl millet does not carry the same risk of prussic acid poisoning that sudangrass or sorghum-sudangrass pose.

It is critical to review labels of herbicides recently used to make sure that the time interval between herbicide applications and seeding of the desired crop has been met; if it has not, the desired crop may die because of residual herbicide remaining in the soil.

7. Pregnancy Check and Market Cull Cows Earlier Than Normal to Reduce Feed Needs.

In most years, feeding non-productive and less productive cows will increase costs and decrease profitability. Most large-animal veterinarians, or the newer commercially available blood tests, can accurately determine pregnancy in cows that are 35 days pregnant. If the calving/breeding season was longer than desired, consider selling the late-calving cows (regardless of pregnancy status, with or without calf at side) and pregnancy checking only those cows that calved early. For example, if a 60- to 75-day calving season is desirable next year, one should pregnancy check 95 to 110 days after the breeding season started and cull all open cows and any cows conceiving late in the breeding season.

Consider culling cows that have bad attitudes, lost their calves, open cows, old cows, unsound cows (arthritic, stifled, blind in one or both eyes, etc.), cows with cancer eye, and tail-end performing cows that have a history of weaning lightweight calves. Historically, cull cow prices dip in October and November when the cow market is flooded by many herds following weaning of their late winter and spring-born calves. Identifying and selling cull cows earlier in a drought year (before the market is flooded) will typically net more money than waiting until there is a serious forage shortage.

8. Inventory Hay and Other Feed Resources.

For planning purposes, one can assume that a cow will consume about 2.5 percent of her body weight of average-quality hay per day on a dry matter (DM) basis. Hay stored outside will have about a 20 percent waste factor; hay stored inside will have about a 7 percent waste factor. For example, forage needs for a herd of 30 cows with an average cow weight of 1,250-pounds consuming average-quality hay stored outside for a 150 day feeding period would be calculated as follows:

$$(1250 \text{ lb cow} \times .02 \times \text{waste factor of } 1.2) = 37.5 \text{ lb of hay DM disappearance per day}$$

If the hay feeding period is from December 1 to May 1 (150 days), then each cow will need:

$$(37.5 \text{ lb of hay DM per day} \times 150 \text{ days}) = 5,625 \text{ lb of hay DM/cow for the feeding period}$$

Bales stored inside will typically contain 88 percent DM, while bales stored outside will typically contain about 80 percent DM. If bales stored outside weigh 1,200 pounds, then the bale DM weight in this example would be:

$(1,200 \text{ lb per bale} \times .80) = 960 \text{ lb of hay DM per bale}$

The cow in this example would need:

$(5,625 \text{ lb of hay DM} \div 960 \text{ lb of hay DM per bale}) = 5.9 \text{ bales for the feeding period}$

If there are 30 cows, then:

$(5.9 \text{ bales per cow} \times 30 \text{ cows}) = 177 \text{ bales would be the estimate of hay needed for the winter feeding period}$

9. Analyze Feeds for Nutrient Profiles to Help Determine Supplemental Feed Needs.

Obtain representative forage samples from each field and harvest date, and then have a certified forage testing laboratory analyze them for their nutrient profile (testing laboratories can be found on the National Forage Testing Association website (www.foragetesting.org)). A basic nutrient analysis should contain the amount of dry matter (DM), energy (TDN or NE), crude protein (adjusted for heat damage), neutral detergent fiber (NDF), calcium, phosphorus, potassium, and magnesium. In the case of drought stressed corn, sorghum or millet, a nitrate analysis would also be justified. From this nutrient profile, a diet can be formulated to meet the animal's requirements in a cost-effective manner to optimize performance.

10. Utilize Alternative Feeds to Supplement and Stretch Forage Supplies.

In severe situations, counties may receive a release of Conservation Reserve Program (CRP) acres for grazing and possibly hay harvest. Typically, the quality of forage coming off of these acres is very low, but it is a resource that can be considered.

When forage supplies are short, crop residues such as wheat straw and corn stover should also be considered. Crop residues are not a direct substitute for high-quality pasture or hay, but when properly supplemented, these resources can satisfy cow requirements.

There are two crop residue feeding strategies to be considered. The first feeding strategy is to use crop residues as a roughage resource that can be supplemented with byproducts. Since crop residues and other low-quality, mature forages are characteristically low in protein (typically 4 to 5 percent crude protein (CP)) and energy (45 to 50 percent total digestible nutrients (TDN)), corn byproducts (such as corn gluten feed and distiller's grains) become attractive sources of both energy and protein.

For comparison, the CP requirement of beef cows is about 8 percent during mid-gestation and 12 percent during early lactation; the TDN requirement is about 53 percent during mid-gestation and 63 percent during early lactation. On a dry matter basis, corn gluten feed contains about 22 percent CP and 80 percent TDN, while distiller's grains plus solubles contain about 30 percent CP and 90 percent TDN.

Corn byproducts need to be fed to cows with caution. Overfeeding these byproducts can result in excessive amounts of dietary fat (which can affect rumen fermentation), sulfur (which can bind with copper and reduce reproductive performance), and nitrogen (which has the potential to lower fertility and reduce embryo survival). Table 3 provides sample rations that are safe for a 1250 pound cow in mid-gestation working in an 85° F environment and gaining weight.

Table 3. Sample non-lactating, mid-gestation cow rations (lb/day as-fed basis)¹.

Ingredient	Ration 1	Ration 2	Ration 3	Ration 4
Wheat straw	Free-choice	Free-choice	—	—
Corn stover	—	—	Free-choice	Free-choice
Dry corn gluten feed, pelleted	6.0	—	5.0	—
Dry distiller's grains + solubles	—	5.0	—	4.0
Limestone, feed grade	0.20	0.20	0.10	.10
Vitamin-Mineral mix ²	Free-choice	Free-choice	Free-choice	Free-choice

¹Assumes a 1,250-pound non-lactating cow, 2-6 months pregnant in an 85° F environment and gaining about 0.4 lb/day.

²High-quality mineral fortified with vitamins A and E, magnesium, copper, zinc, manganese and selenium.

A second feeding strategy is to treat crop residues with anhydrous ammonia to increase their protein content, improve forage digestibility, increase forage intake, and improve cow performance. This strategy is less attractive than the first because of the cost of anhydrous ammonia and the risks associated with its application.

Purdue research has shown that adding anhydrous ammonia to large round bales of crop residues at the rate of 3 percent of the forage dry matter will increase the crude protein content (6 to 8 percentage points) and dry matter digestibility (more than 4 percentage points in corn stover and more than 10 percentage points in wheat straw). In essence, these crop residues become the quality of moderate quality hay when properly treated with anhydrous ammonia. In the Purdue studies, supplements were formulated to meet cow requirements for protein, vitamins, and minerals for 90-day feeding trials during late gestation. Cows that received the anhydrous ammonia-treated residues (plus a corn supplement) consumed 23 to 30 percent more dry matter and were more than 60 pounds heavier than cows fed non-treated residues (plus soybean meal supplement). The condition score changes followed the same pattern as weight change. A “how to” publication on treating low quality forages with anhydrous ammonia is located on the Purdue beef website (www.thebeefcenter.com).

11. Limit Hay Access Time to Stretch Forage Supplies.

Results from several Purdue studies with dry, gestating beef cows suggest that beef producers can stretch their supplies of moderate-quality orchardgrass-alfalfa hay by limiting cow access time to large round bales. In 90-day studies, late-gestation cows were allowed 4-, 8-, 12-, and 24-hour access per day to large round bales fed in a hay feeder. Feeder space was adequate to allow all cows in each treatment simultaneous access to hay. Cow weight change and body condition score change were not significantly affected by length of access time and all cows gained weight.

Limiting access time to large round bales significantly reduced the amount of hay disappearance. Total hay dry matter disappearance was reduced by 37.2 percent when cows had access to hay for only four hours per day compared to cows that had 24-hour per day access. Limiting cow access time to eight hours per day reduced hay disappearance by 17.6 percent, while limiting access time to 12 hours/day reduced hay disappearance by 4.4 percent. A significant amount of this reduction was due to sorting and wastage of hay outside the bale feeder.

In a second set of Purdue studies, access time was limited to 1, 2 and 4 hours per 24-hour period of low quality grass hay, a mixed grass-legume hay, and high quality grass hay. The amount of as-fed hay intake varied slightly (Figure 1), but averaged about 0.6%, 1.0% and 1.7% of the

cow's body weight on a dry matter basis, respectively. This resulted in hay savings of about 70%, 50% and 20%, respectively, compared to 24-hour access. Figures 2, 3 and 4 show the hay intake of low, mixed and high quality hay and the amount of soybean hulls needed for each access time to meet the energy and protein requirements of a 1250 pound cow in late gestation gaining .25 pound per day. An equation has been developed from these studies, using the neutral detergent fiber (NDF) value from a hay analysis, to estimate intake of an individual hay with various access times. When hay intake can be estimated with accuracy, a supplementation strategy can be developed.

Figure 1. Hay consumption of different hay qualities by access time.

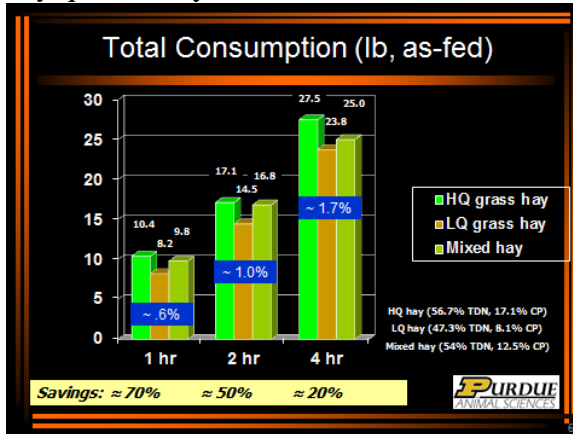


Figure 2. Low quality hay intake by access time and amount of soybean hull supplementation.

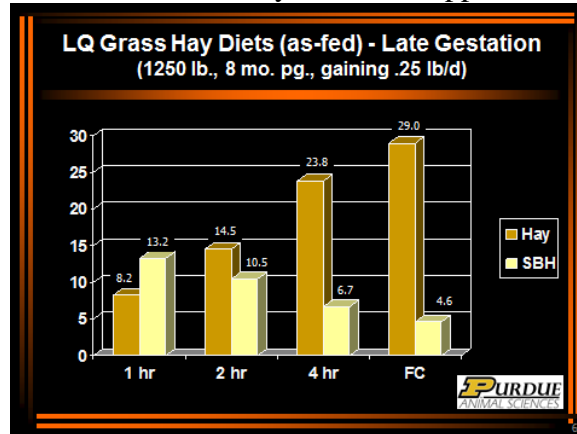


Figure 3. Mixed hay intake by access time and amount of soybean hull supplementation.

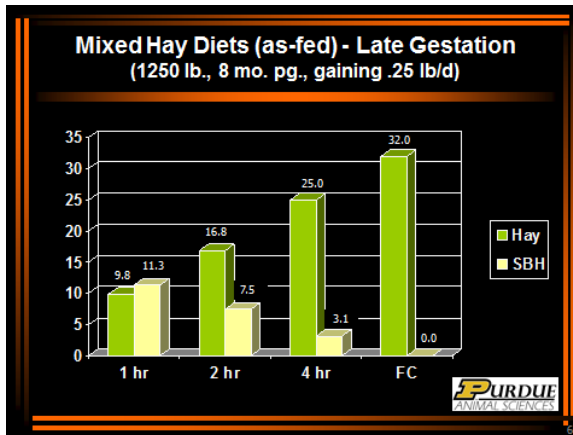
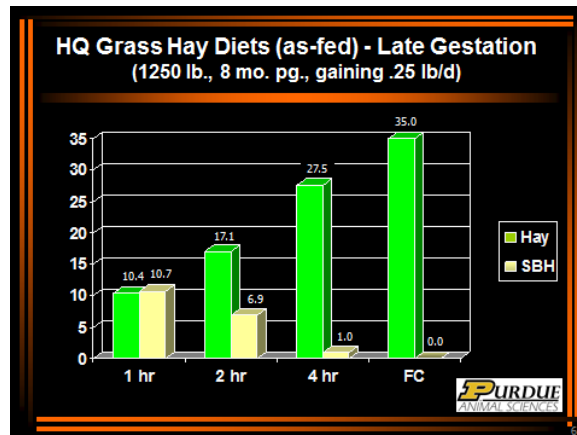


Figure 4. High quality hay intake and amount of soybean hull supplementation.



When cows are limit-fed, it is important to realize that free-choice consumption of a vitamin-mineral mix can exceed the desired level of 3 to 4 ounces (about one fourth pound) per day and it may be necessary to add additional salt as an intake limiter to achieve the desired level of mineral intake.

12. Limit Feeding a Supplementation to Stretch Forage Supplies.

Purdue research suggests that limiting daily hay intake (or access times to less than four hours per day) can also meet cow requirements when fed a properly formulated nutrient dense

supplement. This strategy requires careful management and 30 inches of bunk space per cow to provide all animals equal access to limited amounts of feed. Cows should be separated into at least two feeding groups: the first contains young, subordinate, and old cows; while the second contains mature cows. It is important to observe the dominant - subordinate relationships between cows when they are fed and it may be necessary to reassign some animals to another feeding group. Similar to starting feedlot cattle on feed, cows need to be started slowly on the supplement and the amount delivered per cow must be increased gradually over time. A good rule of thumb is to begin by feeding hay free-choice with supplemental feed at 4 pounds per cow. Increase the concentrate amount by 1 lb/head on an every other day basis. When cows reach the desired level of supplement feeding, begin to gradually reduce the amount of hay fed to the designated level. When limit-feeding is initiated cows will bawl and think they need to be fed more, but they will adapt to not having a full rumen in several days.

Sample rations for a 1,250-pound cow that is four months pregnant in an 85° F environment and maintaining weight are shown in tables 4 (non-lactating) and 5 (lactating). Note that free-choice trace mineralized salt will not meet the cows' mineral or vitamin requirements. Magnesium, copper, zinc, manganese and Vitamin A are deficient in all of these limit-fed diets, therefore a high-quality mineral mix that contains these minerals and Vitamin A needs to either be added to the concentrate mix, or provided free-choice. When corn-based byproducts are in the diet, it is important to supply a mineral mix that contains additional calcium (feed grade limestone or calcium carbonate) to balance the calcium:phosphorus ratio. In contrast, when corn-based byproducts are not included in the diet, more phosphorus (dicalcium phosphate) is often needed in the mineral mix.

Table 4. Sample limit-fed rations for a 1250 lb, dry, mid-gestation cow (lb/day, as-fed basis)¹.

Ingredient	Ration 1	Ration 2	Ration 3	Ration 4
Grass hay, moderate quality ²	7.5	7.5	7.5	7.5
Corn, cracked	3.5	—		
Soybean meal, 48%	1.5	—	—	—
Soybean hulls, pelleted	—	5.0	—	—
Dry corn gluten feed, pelleted	—	—	5.5	—
Dry distiller's grains + solubles	—	—	—	5.0
Limestone, feed grade	0.10	—	0.20	0.30
Vitamin-Mineral mix ³	Free-choice	Free-choice	Free-choice	Free-choice

¹Assumes: (A) a 1,250-pound non-lactating, cow that is 4 months pregnant in an 85° F environment and maintaining weight, and (B) cows are fed a moderate-quality grass hay stored inside with 88% dry matter.

²Cows can be limit fed this amount by limiting access time of large package bales to about 1 hour per day.

³High-quality mineral fortified with vitamins A and E, magnesium, copper, zinc, manganese and selenium. Salt may need to be added to lower the vitamin-mineral mix consumption to 0.25 lb/day (note- total consumption with the added salt could be near 1 lb/day).

Table 5. Sample limit-fed ration for 1250 lb, lactating, mid-gestation cow (lb/day, as-fed basis)¹.

Ingredient	Ration 1	Ration 2	Ration 3
Grass hay, moderate quality	7.5	7.5	7.5
Soybean hulls, pelleted	10.0	5.25	—
Dry corn gluten feed, pelleted	—	5.25	—
Dry distiller's grains + solubles	—	—	9.5
Limestone, feed grade	—	0.20	0.50
Vitamin-Mineral mix ²	Free-choice	Free-choice	Free-choice

¹Assumes: (A) a 1,250-pound lactating cow that is 4 months pregnant in an 85° F environment and maintaining weight and (B) cows are fed a moderate-quality grass hay stored inside with 88% dry matter.

²High-quality mineral fortified with vitamins A and E, magnesium, copper, zinc, manganese and selenium. Salt may need to be added to lower the vitamin-mineral mix consumption to 0.25 lb/day (note- total consumption with the added salt could be near 1 lb/day).

13. Graze Crop Residues and Stockpiled Forages to Reduce Harvested Feed Needs.

As previously discussed, harvesting wheat straw and corn stover, when available, can be used to extend limited forage resources. There is no question, however, that grazing corn stover in the field is more economical than mechanically harvesting it. Review pesticide labels used to make sure that the residues can be fed to beef cattle and that the harvest restriction time has been exceeded before mechanical harvest or grazing occurs.

A strategy of how corn stover grazing might fit into a winter feeding program needs to be developed for each beef operation. Grazing corn stover should be done in areas that meet state law requirements for a perimeter fence and that has adequate water available. A single “hot” wire may be an adequate internal, or division fence if cows have been trained to respect an electric fence, but not a perimeter fence. Ideally, corn fields should be strip grazed using “hot” wire division fences to maximize the use of the stover, and to minimize trampling of the shucks and leaves.

Corn plant residues are highest in nutrient value immediately after grain harvest, and the earlier in the season the grain is harvested, the higher the nutrient profile of the residue. During the first 30 days of corn stover grazing that follows the combine, a mid-gestation, spring-calving beef cow can probably come close to meeting her nutrient requirements if provided free-choice access to a high-quality mineral mix and water. Thirty days after grain harvest, residue quality will decrease due to weathering and a protein supplement is usually needed. When grazing or feeding low-quality forages, cow body condition should be monitored closely. If cows start losing condition, supplemental energy and/or protein will be needed.

When harvesting grain, consider disengaging the chopper on smaller combines to allow shucks and cobs to fall directly behind the combine in two or three rows. Since shucks and leaves have more nutrient value than the stalks, this will help minimize their deterioration. If corn residues are to be mechanically harvested, consider baling only those two or three rows directly behind the combine where the shucks and leaves were dropped. This will provide a higher quality forage resource compared to harvesting all residue material in the field and will minimize soil erosion.

If rains return before late August in a drought year, fall regrowth of cool-season grasses can be increased by applying 50 pounds of nitrogen per acre before late August. In normal years, this practice works well for stockpiling a forage resource that can be used in late fall to extend the grazing season. If urea is the nitrogen fertilizer of choice, it should be applied when rain is predicted since urea volatilizes to the atmosphere in hot, dry weather.

14. Use Drought-stressed Corn for Silage, Green Chop, or Grazing.

If corn is covered as a grain crop by crop insurance, it is imperative that policy holders check with their insurance agent prior to harvesting plant material as a forage crop. There are a number of variations in how crop insurance coverage is defined and there needs to be complete understanding of the policy rules before harvest so that settlement is not jeopardized. In many cases there is a requirement to have an adjuster appraisal and/or leaving test strips to provide a yield estimate before a fair insurance settlement can be determined.

Drought-stressed corn, sudangrass, sorghum-sudangrass, millet, and weed (such as pigweed, common lambsquarters, and Johnsongrass) can contain high levels of nitrates. Nitrate levels in plants can go up and down rapidly, but nitrates tend to accumulate in the lower parts of the stalks, not in the seed. Cool-season grasses such as tall fescue, orchardgrass, and timothy typically do not accumulate significant amounts of nitrate, and legumes are seldom a problem.

The symptoms of acute nitrate poisoning are related to the lack of oxygen in tissues. Symptoms include muscular weakness, incoordination, accelerated heart rate, difficult or rapid breathing, cyanosis, coma, and death. Less severely affected animals may be listless and only show rapid respiration when exercised. In chronic cases, a drop in milk production, abortion due to lack of oxygen getting to the fetus, poor performance, and feed conversion has been reported.

The feeding value of drought stressed corn silage is 80 to 100% of normal corn silage. Work done at Purdue in 1988 compared steers fed drought stressed silage (6 bushels/acre, 6 tons/acre) with corn silage from the previous year (175 bushels/acre). Both diets were supplemented to meet protein, vitamin and mineral requirements. Steers fed the drought stressed corn silage ate more dry matter and gained slightly faster than steers fed normal silage, but had slightly poorer feed efficiency. We would expect drought stressed corn silage to have 1 to 2 percent more protein, slightly more fiber and slightly less energy than normal corn silage.

Ensiling whole plant corn suspected of containing elevated nitrate concentrations is the safest way to feed it because the fermentation process can reduce nitrate levels by 40 to 60 percent. In cases where fields have been declared a loss, and acres are not a limiting factor, the cutter bar should be raised 8 to 12 inches above the ground to eliminate harvesting the lower stalk material which has the highest potential for nitrate accumulation. Corn harvested for silage should be in the 30 to 45% dry matter (55 to 70% moisture) range to ensure good fermentation and a resulting reduction in nitrate concentration. A quick way to determine if the plant contains too much moisture is to hand-squeeze a representative sample collected from the forage chopper and if water drips from the sample, it is too wet for ideal fermentation.

During the ensiling process, toxic gasses — such as nitrogen dioxide (NO₂) and nitrogen tetroxide (N₂O₄) — are produced, which may form a brown gas on top of the silo. This gas, which is heavier than air, has killed livestock and people. It can float down a silo chute and into a barn or confined area. Extremely dry crops that are ensiled may lose only 20 percent of the nitrate they contain. Whenever toxic gasses are a possibility, care must be taken to protect both humans and animals. Make sure that enclosed areas around the feed storage area (feed rooms, silos, animal pens, etc.) are well ventilated and safe before entry. Doors and windows to enclosed areas should be opened, and silo blowers should be run before any attempt is made to enter a silo. If there is any doubt about toxic gasses being present, an oxygen mask should be used in

and around the feed storage area. Oxygen masks and respirators may be available through the local fire department.

Green chop and hay harvested from drought-stressed crops such as corn, sorghums and millets grown on highly fertilized soils pose the greatest risk of elevated nitrates. Nitrate accumulation in corn harvested as green chop or hay in a normal year is typically not a significant factor, but the risk increases when it is harvested following a droughty period. Drought-stressed crops, and especially when drought stressed crops are harvested shortly after a rain, can be very high in nitrate. It is recommended to wait seven to ten days following a rain before harvesting drought-stressed forages that are suspected of containing high nitrate concentrations. Of the crop plants, drought-stressed corn or sorghum harvested as green chop or hay are the most likely to cause nitrate toxicity. Sorghum-sudangrass harvested or grazed under the same conditions may also cause problems. Drought stressed oat harvested as hay from land that received a heavy nitrogen fertilizer application and rain just prior to harvest (which encourages nitrogen uptake) has caused some cases of nitrate poisoning. When elevated nitrates are a concern, introduce green chop corn slowly into the ration. This can be done by initially feeding small quantities and increasing the amount fed over the next 7 to 10 days to allow rumen adaptation. When feeding green chop, raising the cutter bar to 12 inches for the first few days is recommended to eliminate harvesting the bottom of the stalk where nitrates are in highest concentration.

Harvesting corn as a hay crop can be potentially dangerous and it should be done with extreme caution. Nitrates do not dissipate during the drying process. One large round bale harvested from an area in the field with high nitrate concentrations can kill multiple cows. The reason for this is that cows fed large round bales typically have little opportunity to dilute a high nitrate intake with other feeds and limiting intake in this scenario is difficult. The standing crop should be tested for nitrates before cutting. If the nitrate concentration is high, delay harvest and test again in several days. When sampling plants before cutting for hay, it is recommended that several samples be submitted for nitrate analysis to reflect poorest, better and best corn areas in the field. It may be necessary to avoid, or delay, cutting some areas of the field to avoid high nitrate containing feeds.

The nitrate concentration that causes toxicity in ruminants varies depending on rate of intake, diet, acclimation to nitrate and nutritional status. As a rule of thumb, forages containing less than 5,000 ppm NO₃ on a dry matter basis are considered safe for all beef animals. Forages containing 5,000 to 10,000 ppm NO₃ are considered potentially toxic when provided as the only feed. Forages containing over 10,000 ppm NO₃ are considered dangerous. The only way these higher nitrate containing feeds can be fed safely is to limit their intake by diluting them with low nitrate containing feeds.

Laboratories report nitrate content of feed and water in different forms. Consider the form for expressing nitrate levels to avoid errors in determining the potential for toxicity. Table 6 should aid in interpreting laboratory results.

Table 6: Equivalent levels of nitrate.

Nitrate		Nitrate-nitrogen (NO ₃ -N)		Potassium nitrate (KNO ₃)	
ppm ¹	%	ppm ¹	%	ppm ¹	%
200	.02	46	.0046	326	.0326
5,000	0.5	1,150	.115	8,150	.815

10,000	1.0	2,300	.23	16,300	1.63
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¹parts per million

If there is concern about nitrate levels in feeds, consider the following:

1. If drought-stressed hay or green-chopped corn or sorghum from high-fertility soils is to be fed, it should be tested for nitrates before harvest - especially if the crop experienced a short period of rapid growth, due to improved environmental conditions, just prior to harvest.
2. Remember that thin cattle in poor health, or cattle suffering from respiratory distress are more susceptible to nitrate poisoning.
3. Gradually introduce cattle to suspect forages over 7 to 10 days. The objective is to give the rumen microbes an opportunity to adapt to the higher nitrate intake. Never allow hungry, unadapted cattle access to suspect feeds. Take time (one to three days) to make sure cattle are full and consuming a significant quantity of a bulky low nitrate forage (such as good-quality grass hay), and then introduce suspect feed slowly into their diet over the next 7 to 10 days.
4. Dilute suspected high-nitrate feeds with low-nitrate feeds. Dilution is one method that can not only help rumen microbes adapt to high-nitrate feeds, but also maintain a safe level of nitrate intake for the animal. Suspect feeds can be blended with low-nitrate feeds such as grass hay, crop residues or grain supplementation. Grain feeding at 2 to 3 pounds per head daily has the additional benefit of providing extra energy to stimulate microbial conversion of nitrate to non-toxic nitrogen compounds in the rumen.
5. When using suspect forages as a green chop, harvest only the amount to be fed immediately. Storing green chopped forages on wagons for later use can result in feeds that are more dangerous because there will be conversion of nitrate to nitrite, which is significantly more toxic than the original nitrate. When first introducing green chop into a ration, raise the cutter bar to 12 inches when harvesting during the first few days to reduce high nitrate levels associated with the accumulation in the lower stalk material. Feeding green chop in small amounts several times during the day vs. one larger feeding will also help the rumen adapt and minimize the negative nitrate impact on the animal.
6. When grazing high-nitrate forages, provide a palatable, low-nitrate hay or grain supplement to dilute the nitrate. In addition, consider limiting the grazing time of suspect forages for the first six to eight days, increasing the grazing time a little each day. For example, allow cattle to fill their rumens with hay for several days and then initiate grazing high-nitrate forage for less than two hours on the first day. On day two, increase their grazing time to less than four hours. Each subsequent day, increase grazing time by approximately for the next five to six days. Once cattle reach a grazing bout of 12 to 14 hours per day, it can be assumed the rumens are adapted and they can remain on the high nitrate containing forage all day if a low nitrate, diluter feed (hay or grain) is also available. Remember, nitrate levels are highest during the first several days after a drought-ending rain and then come down over the course of the next 7 to 10 days as plant metabolism returns to something approaching normal.
7. When grazing suspect forages, stock lightly so animals can selectively graze the leaves, and husks that have lower nitrate concentrations. Avoid overgrazing of high nitrate potential corn plants to minimize animal intake of the lower stalk where nitrates tend to accumulate.

8. Provide large quantities of fresh drinking water. Water dilutes nitrate concentrations in the rumen and helps to reduce the potential of toxicity.

15. Provide Clean, Cool Water to Reduce Heat Stress and Maintain Herd Health.

During hot, dry weather, cattle will drink more water. Provisions need to be made to accommodate this increased water consumption and free-choice access to clean, fresh water is extremely important. Stagnated stock ponds and creeks under drought conditions are often murky and contaminated with high nutrient levels, microbes and algae. Producers in this case may need to resort to finding alternative water resources that will allow cattle to perform at their potential. In some cases, it may be necessary to obtain water from a well located onsite or offsite and hauled to the cattle. Providing cool, fresh water during hot weather can also serve to help lower the body temperature of heat-stressed cattle.

16. Add Moisture Around Electric Fence Ground Rods.

As pasture resources are depleted, cows will be looking for greener pastures and that is often across the fence. Electric fences require good, functional ground rods to be effective. In a hot, dry environment, it is often necessary to add moisture to the area surrounding electric ground rods for the fence to work properly. Neglect in this area increases the risk of cattle escapes and liability.

Summary

When faced with a limited forage supply, there are a number of feeding and management strategies to consider, both individually and in combination. Each operation should develop a strategy that helps control costs, maintains optimal animal performance, and preserves profitability into the future.

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