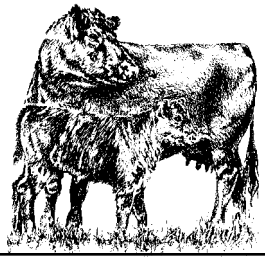
Western Beef Resource Committee

*Fourth Edition*



# Cattle Producer's Handbook

Drought and Other Natural Disasters Section 970

# Supplementation During Drought

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Breeding failure is the most important adverse consequence to the cowherd during drought. This is due to reduced forage quality and availability, resulting in nutritional stress. As forage quality decreases, lignin and other more slowly digestible components of forage increase. This lower quality forage remains longer in the rumen before exiting, which reduces forage intake. Thus, the cow may be unable to eat enough forage to maintain body weight (Fig. 1).

During early to mid-lactation, a beef cow will consume from 2.5 to 3.0 percent of her body weight in forage daily. During drought, stocking rates may be adjusted to increase forage for each animal unit, but forage quality may drop, thereby preventing adequate digestible nutrient intake. As forage digestibility drops, passage rate of undigested dry matter decreases and forage intake declines (Table 1).

In Montana, when forage digestibility was 61 percent, lactating cattle consumed 2.2 to 2.8 percent of body weight in forage. During a drought year, forage digestibility dropped to 43 percent and the same lactating cattle consumed 1.2 to 1.3 percent of body weight in forage (Havstad and Doornbos 1987). Forage intake at this level is inadequate to furnish the necessary nutrients for milk production and maintenance of cow body condition. To survive drought and maintain acceptable rebreeding percentages and economic viability, the cowherd should be managed for acceptable body condition (BCS of 4-5).

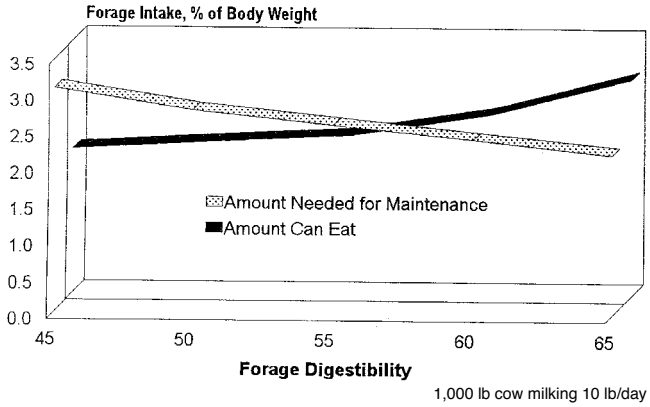


**Fig. 1. Forage intake of a lactating range cow.**

**Table 1. Forage intake of lactating cattle at different forage digestibilities.**

| Forage digestibility or TDN, % | Amount required to eat to meet maintenance requirements, % of body weight | Amount can eat at the forage digestibility listed, % of body weight[1] |
|---|---|---|
| 43 | 3.2 | 1.2 to 1.3 |
| 45 | 3.1 | 1.7 to 2.0 |
| 50 | 2.8 | 1.9 to 2.1 |
| 55 | 2.6 | 1.7 to 2.1 |
| 58 | 2.4 | 1.9 to 2.5 |
| 60 | 2.3 | 2.0 to 2.5 |
| 62 | 2.3 | 2.3 to 2.8 |
| 64 | 2.2 | 2.6 to 3.2 |
| Greater than 64 | | 2.6 to 3.2 |

[1]Research from various sources including Kronberg et al. 1986, Wagner et al. 1986, Havstad and Doornbos 1987, and Sprinkle 1992.

Forage should also be monitored for total production and quality to determine if the cow's nutritional requirements are being met. It may be a cost effective practice to analyze forage or fecal samples for total digestible nutrients (TDN) and crude protein during dormancy or drought and match supplementation strategies to the nutritional deficits in the forage. Your local Cooperative Extension office can provide addresses of laboratories that offer this service.

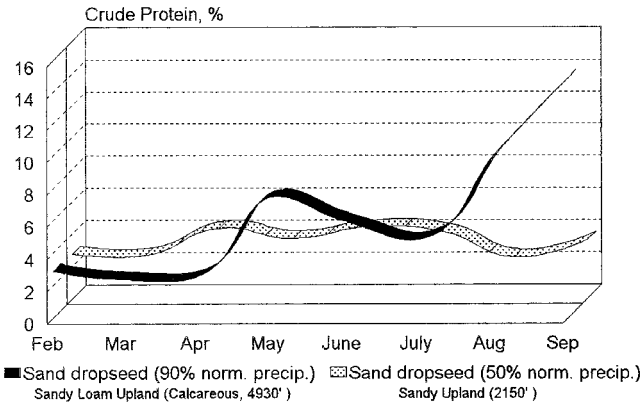


**Fig. 2. Crude protein in Arizona during drought** (Arizona Strip Range Forage Quality Analysis Study 1996).

## Protein Supplementation

Fig. 2 shows crude protein content of sand dropseed [*sporobolus cryptandrus* (Torr.) Gray; warm season grass] at two different range sites in Arizona during the 1996 drought. At one site, precipitation was 90 percent of normal and protein content increased to 14.92 percent by September after 2.32 inches of moisture from July through September. At the lower elevation site with 50 percent of normal moisture, crude protein of the forage never got above 4.4 percent.

At the same low elevation sandy upland range site, even winterfat had only crude protein above 6 percent for one month (April 96; 7.23 percent crude protein). Conversely, the crude protein of winterfat at the site with 90 percent moisture never fell below 6 percent and was above 11 percent during April and May.

Protein required for a 1,000-pound nonlactating cow is around 1.6 pounds/day or 7 percent crude protein in the diet. When the cow is lactating, 2.0 pounds or 9.6 percent dietary crude protein is required. Drought accentuates the need for protein supplementation.

Protein supplementation during drought can yield dividends. In a study at Fort Stanton, New Mexico, over several years of drought, weaning weights and conception rates for cattle of different ages were compared (Table 2). The supplemented cows in this study were fed 1 pound of cottonseed meal per day from just before calving until grass was green. The effects of the drought were most severe for younger cows, but supplementation increased weaning weights and conception rates in cows of all ages.

**Table 2. Production from cows during drought.**

| Cow age | No supplement | | 1 lb/day cottonseed meal | |
|---|---|---|---|---|
| | Weaning weight | Conception rate | Weaning weight | Conception rate |
| (Years) | (lb) | (%) | (lb) | (%) |
| 3 | 306 | 45 | 372 | 90 |
| 4 | 341 | 62 | 376 | 88 |
| 5 | 366 | 63 | 410 | 92 |
| 6 | 356 | 73 | 396 | 85 |

Source: Foster 1996

Other cattle at risk during drought are heavy milking cattle and/or large frame cattle. It is well to remember that during drought we are not only supplementing to meet deficits in this year's forage, we are also supplementing next year's calf crop.

When forage contains less than 6 percent protein, protein supplementation can be effective in enhancing forage intake (Canton et al. 1988). When additional protein is made available, this increases the number and activity of microorganisms in the rumen that are ultimately responsible for fiber digestion.

As the microbial population of fiber digesting bacteria increases, passage rate of forage increases, ultimately allowing for greater intake of low quality forage. In some cases, greater digestibility of forage has also been observed. Figs. 3 and 4 show how both forage intake and forage digestibility were increased by protein supplementation for cattle eating poor quality (2% crude protein) prairie hay.

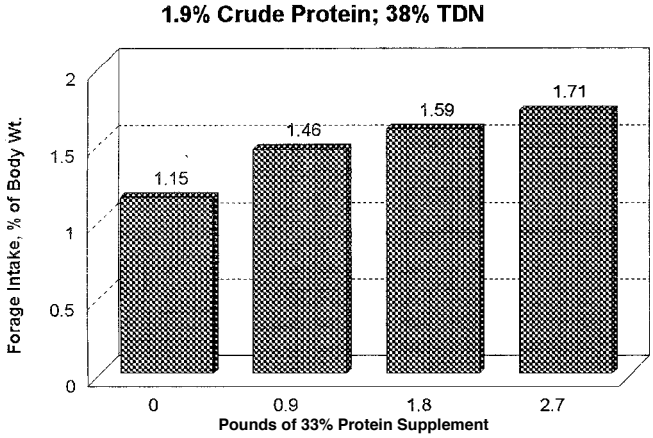


**Fig. 3. Forage intake on dormant tallgrass prairie hay** (Stafford et al., March 1996 Journal of Animal Science).

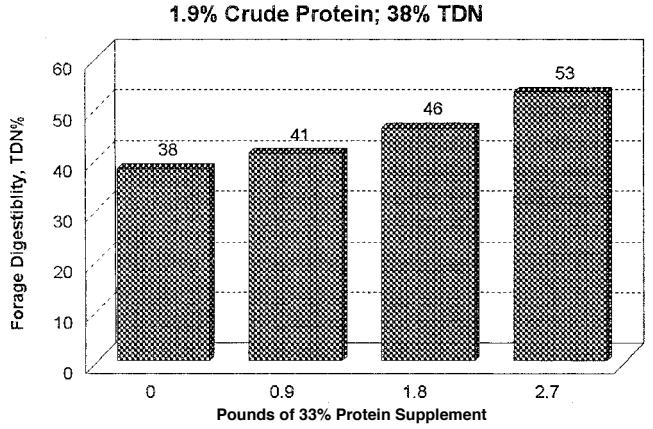


**Fig. 4. Forage digestibility on dormant tallgrass prairie hay** (Stafford et al., March 1996 Journal of Animal Science).

Steers fed the greatest amount of the 33 percent protein supplement increased forage intake 49 percent and had 39 percent greater digestibility of forage than control steers. The amount of TDN required to maintain body weight for nonlactating cattle is around 52 percent, so steers supplemented with the highest level of protein should not have experienced weight loss (although these data were not reported).

When a lower protein supplement (18%) was fed on an equal protein basis (1.7, 3.5, and 5.3 pounds of supplement per day), forage intake was 1.34, 1.48, and 1.33 percent of body weight for each increasing supplementation level. Total ration digestibility was 41, 43, and 50 percent, respectively. Cattle in this study appeared to be limited in protein intake with the low quality forage, and substitution of forage by supplement did not appear to occur with the higher protein supplement.

In this same study, some substitution of forage by supplement resulted when alfalfa hay was fed at the same rates as for the 18 percent protein supplement. However, no substitution occurred when alfalfa pellets were fed, presumably because of a positive effect on rate of passage.

An advantage with protein supplementation is that cattle can be supplemented as infrequently as once a week without detrimental effect (Huston et al. 1997). This is not the case for energy supplements (e.g., corn, milo), which need to be supplemented daily.

## Energy Supplementation

It is generally acknowledged that forage intake and digestibility of the forage will decrease with energy (grain) supplementation. However, sometimes the value of the grain to the animal offers a greater advantage than the disadvantage of lowering the forage value. Also, grain can be advantageous for stretching the forage supply.

If forage quantity is insufficient, it is probably more economical to supplement with a combination protein/energy ration (20 to 25% protein; 40 to 50% grain) than a high protein ration. **Cattle will be unable to capitalize on the benefits of a high protein supplement when the forage supply is insufficient.** As a general rule, if utilization of available forage is less than 50 percent, use a high protein ration, but if forage utilization is equal to or greater than 50 percent, use a protein/energy or energy supplement.

Fig. 5 shows the energy content (TDN) of the same grass from the same sites as shown in Fig. 2. The energy required for maintenance of lactating cattle is supplied by forage at around 56 percent TDN and for nonlactating around 52 percent TDN.

At no time during 1996 was TDN above 49 percent for the low elevation range site with 50 percent of normal precipitation. Assuming forage availability was adequate, protein supplementation at the low elevation range site could possibly have increased both forage digestibility and intake to more optimal levels.

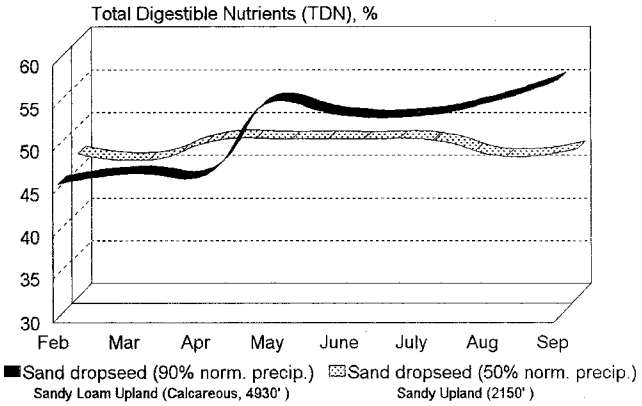


**Fig. 5. Energy content in Arizona during drought** (Arizona Strip Range Forage Quality Analysis Study 1996).

## Other Supplements

In stressful situations in which cattle are losing weight, some benefits have been demonstrated by feeding supplements with approximately 40 to 60 percent of the protein being ruminally undegradable or bypass protein. Feedstuffs high in bypass protein include feather meal, blood meal, corn gluten meal, and fish meal. Because of palatability problems, rendered animal products are usually limited to 25 to 30 percent of the total supplement and are combined with grain products to increase palatability.

> As a note of caution, many rendered animals products, particularly blood and bone meal, are not allowed to be fed to food animals due to the risk of *Transmissible Spongiform Encephalopathy's* (known as Mad Cow Disease in cattle).

Petersen et al. (1996) reported that weight loss has been reduced and conception rates increased in several experiments by feeding bypass protein. However, they reported that bypass protein supplementation only seems to be effective when animals are losing weight. The additional cost per ton for adding bypass protein is around $50 to $80.

Another form of supplementation during drought to increase harvested forage is the hauling of water to seldom used areas of pastures. Granted, this is labor intensive and requires acreage that is easily accessible. However, in large pastures with few water developments, this can help in grazing distribution.

In areas that are not excessively rugged, it is estimated that cattle will use 80 percent of the allowed harvestable forage up to 1 mile from a water source, but only 40 percent at 1.5 miles, and 20 percent at 2 miles from the water source. If there are areas in pastures exceeding 1 mile from water, then in effect you have a "forage bank" that can be used.

In order to avoid harming the range resource for subsequent years, maximum utilization of forage should not exceed 60 percent (Lacey 1995). Exceptions are crested wheatgrass (Lacey 1995) and annuals. Annuals should be grazed early and heavily during a drought year while they are still green and have greater nutritive values.

Pastures should be rotated frequently and include longer rest periods because of reduced growth during drought. In some instances, it may be advantageous to open up pastures into larger pastures to allow for more selectivity by cattle. This will also help prevent cattle from "bogging down" in earthen water tanks with dropping water levels.

## Urea Supplements

Urea supplementation is another alternative. However, when forage quality is low and the TDN or energy value of forage is low (less than 45%), it may be risky to feed protein supplements with urea. However, research in this area is rather limited (Dr. Bob Cochran, Kansas State University, personal communication). In some cases, urea toxicity may be more related to reduced forage availability than to forage quality. For more information regarding urea supplementation, refer to 322, "Urea in Range Cattle Supplements."

A rule that is widely quoted is that urea should constitute no more than one-third of the crude protein of a cow's diet. If this amount of urea in the diet is exceeded, there may be increased risk of urea toxicity and death. Symptoms of urea toxicity have been observed in cattle unaccustomed to urea in doses approximating 0.4 pound of urea (equivalent to approximately 1.15 pounds of crude protein supplied by urea) for a 1,000-pound cow (Radostits et al. 1994).

Even if there are no signs of urea toxicity, increased urea concentration in protein supplements fed to cows on poor quality forage may decrease animal performance. Cows grazing winter tall-grass prairie and supplemented with 4.8 pounds of protein supplement with 30 percent of the crude protein derived from urea lost more weight than cows fed the same amount of supplement with 15 or 0 percent of the crude protein derived from urea (Koster et al. 1996).

It is important to keep the crude protein:urea ratio at 3:1 in the diet. Liquid feeds may exceed the minimum urea suggested in this guideline. If intake of the liquid supplement is low, there may not be a problem. However, as supplement intake increases, cattle performance may decrease, and the risk for urea toxicity may increase.

The 3:1 cutoff value for an urea based supplement with forage of 5 percent protein and 45 percent TDN (15% increase in forage consumption factored in for protein supplementation) is 2 pounds per day of a 32 percent protein supplement with 83 percent crude protein from urea (equivalent crude protein provided by urea = 26.5%). If the crude protein in the supplement were dropped to 20 percent crude protein with 70 percent crude protein from urea (equivalent crude protein provided by urea = 14%), then the daily intake of the liquid supplement could be increased to 4.5 pounds per day.

One may be tempted to control the intake of liquid urea-based supplements by locking the wheels on the feeder. However, research suggests that after 3 days of urea deletion from the diet, adaptation to urea-based supplements is lost (Davis and Roberts 1959). It is a much better practice to either eliminate completely the feeding of urea during drought or else significantly reduce the amount of urea in the supplement.

Signs of urea toxicity include rapid, labored breathing, muscle tremors, severe abdominal pain, frothing at the mouth and nose, irritability to sound and movement to the point of being aggressive, slight incoordination followed by severe incoordination, and the inability to stand, weakness, bloat, and violent struggling and bellowing (Essig et al. 1988, Radostits et al. 1994). Treatment, which is often too late, is oral administration of 4 liters of a 5 percent vinegar solution for a 1,000-pound cow (Davis and Roberts 1959).

## Toxic Plants and Additional Cautions

An additional caution for supplementation during drought is to avoid feeding supplements containing ionophores (trade names of Rumensin® or Bovatec®). Doing so can increase the probability of nitrate poisoning (Radostits et al. 1994). Nitrates can accumulate in forage during drought, and especially in the "green-up" following drought.

Under normal growth conditions, plant roots absorb large amounts of nitrates from the environment. The stems and leaves are normally able to convert or reduce nitrate to protein. However, a plant's ability to convert nitrate to protein is diminished during drought conditions.

Plants that are particularly susceptible to nitrate accumulation include kochia, pigweed, nightshade, lambsquarters, oat hay, Russian thistle (tumbleweed), sorghum, and filaree, among others. These include oat hay, corn, small grains, sudangrass, and sorghum. Vegetable crops that are capable of accumulating nitrates include sugar beets, lettuce, cabbage, and potatoes (USDA-ARS 2006).

Nitrate poisoning is caused by the presence of nitrite in the blood at a level sufficient to cause anoxia or internal suffocation. Nitrate can be reduced to nitrite by microorganisms in the gastrointestinal tract at a rate that overwhelms the body. Under good conditions, ruminant livestock convert nitrate to nitrite then ammonia with protein resulting as the end product.

Nitrate poisoning symptoms are caused when nitrate is converted faster to nitrite instead of ammonia. Nitrite then accumulates in the rumen and is absorbed by the blood. This causes hemoglobin to be converted to methemoglobin. Methemoglobin is unable to transport oxygen to body tissues and the animal suffocates.

The chief symptom of nitrate poisoning is oxygen deprivation. Other symptoms of nitrate poisoning are similar to other kinds of poisoning and include rapid pulse rate, labored breathing, and possibly muscle tremors and convulsions. Symptoms that are somewhat unique to nitrate poisoning include darkened blue or chocolate-colored membranes in the mouth, nose, eyes, and vulva (females). Blood will be dark red to chocolate dark red to brown blood instead of bright red blood (Essig et al. 1988).

Clinical signs include diarrhea and vomiting, salivation, and abdominal pain. Other subacute indications of nitrate toxicity include abortions, reduced weight gain, reduced milk production, and hypothyroidism.

If nitrate toxicity is suspected, remove animals immediately from the suspect feed material. Feed low nitrate forages to animals to help dilute nitrate concentrations in the stomach. It may also be beneficial to check water sources for high nitrate levels.

Treatment is accomplished with intravenous injection of 100 ml of a 4 percent solution of methylene blue per 1,000 pounds body weight (Essig et al. 1988). According to Radostits et al. (1994), supplemental feeding of sodium tungstate (wolfram) under veterinary advisement can reduce the effects of nitrate poisoning in cattle grazing pastures with high levels of nitrate (greater than 1% nitrate nitrogen; Essig et al. 1988). Methylene blue is not approved by the FDA for food animals; therefore, you must work with a licensed veterinarian for this diagnosis and treatment.

According to Radostits et al. (1994), supplemental feeding of sodium tungstate (wolfram) under veterinary advisement can reduce the effects of nitrate poisoning in cattle grazing pastures with high levels of nitrate (greater than 1% nitrate nitrogen; Essig et al. 1988). Supplying adequate amounts of energy supplements can also enhance the body's ability to convert nitrate to protein.

Prevention of poisoning is the best practice. Poisoning incidences can be reduced by having feeds and forages analyzed. If plants are drought stressed, don't graze stock on potentially dangerous forages and observe livestock frequently if any potential risks exist.

During drought, one also needs to be alert to the possibilities of toxic plant poisoning. Oftentimes, the greenest plants may be toxic (e.g., bracken fern, whorled milkweed). If cattle don't have adequate forage, they are more likely to ingest poisonous plants such as lupine, larkspur, milk vetches, bracken fern, whorled milkweed, and others. Many of these plants can cause death, birth defects in the fetus (teratogenic), lowered health and production, among others.

Forage production should be monitored closely and cattle should not be subjected to excessive stocking rates on the depressed forage base. Be aware of poisonous plants that exist in your pastures, and carefully monitor the use of these plants by livestock.

## Conclusion

It is important to plan ahead when supplementing cattle during drought. The most effective time to supplement cattle is before calving. It is almost impossible to put weight back on a cow during the first 45 to 60 days after calving. Nutrient requirements at this time are about 50 percent greater than in the last trimester of pregnancy. Producers should analyze forage for deficits in protein and TDN and supplement accordingly to maintain cow weight before calving (Sprinkle 1996). Reproduction will drop sharply if cattle are thinner than a body condition score of 4 at breeding.

It is acknowledged that drastic effects can occur in a relatively short period of time during drought. In some cases, cattle may be in adequate body condition shortly before calving and lose weight rapidly as forage supplies and forage quality decline. Cattle should not be allowed to get below a body condition score of 3 in order to avoid increased susceptibility to diseases. Also, conception rates in cattle will possibly drop to 40 to 50 percent at body condition score 3 and to practically zero at body condition score 2.

**If at all possible, a cow should not be allowed to become protein deficient during drought.** For every 1 pound of protein deficiency, the loss of 6.7 pounds of body weight would be required to supply this level of protein. Conversely, if the diet were deficient in energy (TDN), this would only require 1 pound of body weight loss for each l pound of TDN. If a cow were deficient in TDN by 1.5 pounds per day and initial body condition score was 4, the cow could lose 1.5 pounds a day for 53 days and drop to a final body condition score of 3.

In the worst case scenario, some cattle should be sold to stretch forage supplies while also feeding supplement to remaining cows to maintain desirable body condition during breeding. Heavier milking and larger cattle would be good candidates for culling, because their maintenance requirements will be much higher. Since 2-year-old cows will require more supplementation and be more difficult to rebreed, producers may want to consider selling these cows as well.

Above all else, use pregnancy testing as a tool to reduce herd size and preserve a reasonable calf crop the following year. Income from sale of cattle during drought may be eligible for income deferment for 1 year if in an area that has been declared a drought disaster. If extreme de-stocking is expected, early weaning of calves should be considered. Nonlactating cattle will eat only 70 percent as much as lactating cattle, so this will spare the forage base somewhat during drought.

In conclusion, drought usually requires some type of supplementation to avoid extreme weight loss in cattle. If cattle are allowed to become too thin, conception rates may decrease markedly. By obtaining forage or fecal samples and analyzing for protein and TDN, supplements can be matched to drought conditions.

### General Recommendations

1. Evaluate range to determine forage supply.
2. Analyze forage to determine nutrient deficiencies.
3. Start supplementation regime at least 60 days before calving to prevent accelerated weight loss after calving.
4. If forage supply is adequate (less than 50% utilization of forage), supplement natural protein (22% crude protein or greater) to meet forage deficiencies (generally 1 to 2 pounds of supplement per day for nonlactating cattle). Protein supplements can be given as infrequently as once a week.
5. If forage supply is limited, use a protein/energy or energy supplement. Energy supplements need to be fed daily.
6. Use urea supplements with extreme caution.
7. Use water to help distribute livestock to underutilized areas of the grazing allotment.
8. Cull cows to match animal units to forage available. Cull in this order: open cows, old cows (9 years or older), 2-year-old producing cows, 3-year-old producing cows, and replacement heifers.
9. Monitor use of toxic plants by cattle, and move cattle if necessary to avoid over consumption of toxic plants.

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