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Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.
- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

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EXTENSION

Supplementing Beef Cows

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On average, nearly 40% of total operating costs in cow-calf enterprises are associated with nutrition because purchased and harvested hay and concentrate feeds make up the majority of that cost. Consequently, the nutritional program represents a major target to trim cost of production. However, it is widely recognized that nutritional status of the cow is closely related to reproductive performance. If too many corners are cut in the nutritional program, pregnancy and calving rate dramatically suffer.

A ranching operation can appropriately be considered a forage production and utilization enterprise. Ranchers are in the business of converting sunlight, water and carbon dioxide into a high-quality human food resource; namely beef. With good management, forage is an extremely valuable renewable resource. As such, it represents the least expensive feed resource to maintain animal health and production in cow-calf and many stocker operations. A combination of excellent forage production and grazing management practices, cattle genetics that match the forage resources and a well-timed calving season results in minimum reliance on purchased and harvested feeds. Nevertheless, specific nutrients must be supplemented at times. While special emphasis is placed on supplementing beef cows in this section, much of the discussion and data presented are relevant to all grazing cattle.

Occasionally, cow-calf producers need to feed a concentrate or harvested forage to further increase body condition of the cows or to replace pasture forage due to limited pasture forage availability (see chapter 20 for body condition scores and chapter 12 for hay production). This practice, known as feeding or substitution, is in contrast to supplementation because the alternative feed or forage actually replaces consumption of the original forage resource. In general, consumption of the original forage resource declines when cattle are fed concentrate feeds at the rate of 0.5% of body weight (6 pounds for 1,200-pound cows) or more. Substitute feeding is more frequently used for growing cattle than for mature beef cows.

Identifying a Supplemental Need

The first step in implementing and maintaining an efficient supplementation program for grazing or forage fed cattle is to identify specific supplementation needs. In other words, the producer must identify specific forage nutrients not provided in adequate quantity to meet the animal's nutrient requirements. For grazing cattle, this is a difficult task because forage quality is constantly changing and so are the animal's nutrient requirements. Knowledge of these two factors is the basis for effective and efficient supplementation. Even though the task may seem difficult, years of research and current technology provides guidance in developing an effective supplement development and evaluation plan. The following steps provide a logical approach in identifying a supplemental need and evaluating supplement alternatives.

1. Determine the nutrient requirements for the appropriate stage of production.
2. Estimate the amount of nutrients cows will receive from forage.
3. Subtract item No. 1 from item No. 2 to determine if a nutrient deficiency or excess exists.
4. Evaluate supplement alternatives.

Nutrient requirements for cattle of various stages of production, mature size, age and productivity are discussed and are provided in OSU Extension Circular E-974, *Nutrient Requirements of Beef Cattle*. It should be noted that all possible combinations of the above factors are not available in the tables, simply because there are infinite possibilities. Computer software, such as OSU Cowculator, can better pinpoint an animal's nutrient requirement at a specific time and in a specific situation. These and other useful tools can be found at beef.okstate.edu/calculators.

Average nutrient composition of various feeds and forages common to Oklahoma are provided in OSU Extension fact sheet AFS-3018, *Nutritive Value of Feeds for Beef Cattle*. Anticipating nutrients supplied by the forage base is the most difficult task in grazing cattle nutrition. The formula for nutrient intake is simple: forage intake multiplied by concentration of available nutrients in the forage.

However, many factors influence both components in this formula. Forage intake is dramatically influenced by forage quality as well as forage availability and both of these factors can vary dramatically from year to year and month to month. General estimates of forage intake are given in Table 1.

The next step is to estimate nutrient content of standing forage or hay. As mentioned earlier, these values also vary, depending on forage type, maturity and weathering. The most accurate method to determine supplemental needs for cows that will primarily receive a hay diet is to have the hay analyzed for nutrient concentration. This will cost from $15 to $70 per sample, but can save hundreds, even thousands of dollars in some cases. As a starting point, AFS-3018 includes

Table 16.1. Forage capacity of beef cows[a].

Forage type and maturity	*Stage of production*	*Forage dry matter intake capacity, % of body weight*
Low quality forage (< 52% total digestible nutrients)	Dry	1.8
Dry winter forage, mature legume and grass hay, straw	Lactating	2.2
Average quality forage (52% to 59% total digestible nutrients)		
Dry summer pasture, dry pasture during fall, late-bloom	Dry	2.2
legume hay, boot stage and early-bloom grass hay	Lactating	2.5
High quality forage (> 59% total digestible nutrients)		
Mid-bloom, early-bloom and prebloom legume hay,	Dry	2.5
preboot stage grass hay	Lactating	2.7
Lush, growing pasture	Dry	2.5
	Lactating	2.7
Silages	Dry	2.5
	Lactating	2.7

a Intake estimates assume protein requirements are met by the forage or through supplementation when forage protein is not adequate. When protein requirements are not met, forage intake will be lower than the values shown in the table.
Source: Hibbard and Thrift.

average nutrient values for a few common feeds and forages found in the Southern Plains.

Once nutrient requirements have been established and a reasonable estimate of the nutrient contribution of the forage has been made, determining supplemental needs is simply a comparison of the two. Again, this comparison is easily and perhaps more accurately made using computer software, such as OSU Cowculator. For this example, it is assumed cows will graze winter range with little to no hay supplementation.

Average cow weight will be 1,100 pounds and average calving date is March 15. Consequently, these cows would be grazing low-quality winter range throughout the last one-third of gestation. Table 1 shows that a 1,100-pound cow requires about 1.62 pounds of protein and 11.7 pounds of total digestible nutrients (TDN) per day. Late-winter native range forage would be expected to contain only around 4% protein and 49% total digestible nutrients (TDN). These cows would be expected to consume around 2% of their body weight, or 22 pounds of diet dry matter (1,100 pounds x 2%), assuming adequate supplemental protein is provided. Table 1 suggests these cows would be expected to consume around 2% of their body weight, or 22 pounds of diet dry matter (1,100 pounds x 2%), assuming adequate supplemental protein is provided.

By using this information, supplemental needs can be calculated as shown in Table 2. Without supplementation, this group of cows would be deficient in both protein and energy and would be expected to lose considerable body condition before calving. Here, beef cows are used in the example. However, the process to determine supplemental needs for growing cattle is the same.

Once the supplemental need is determined, various supplement alternatives are relatively easy to compare. In this example, all three supplement alternatives provide adequate protein when fed at the daily amount shown. Energy or TDN is provided in considerable excess (compared to the supplemental need) with the 20% supplement option. Therefore, this strategy might be desirable if increased weight gain or body condition were desired. However, if the cows were in good body condition, this strategy would simply be more expensive than one of the other strategies given in the example because

Table 2. Nutrient supply compared to requirements for an 1,100-pound beef cow grazing native range during last one third of pregnancy.

	Crude protein (lbs per day)	*TDN (lbs per day)*	
Required	1.62	11.7	
Supplied by forage[1]	0.88	10.78	
Supplemental need	0.74	0.92	
	Feed protein concentration		
	20%	25%	38%
Amount to feed, lb	3.70	3.00	1.95
Cost per ton	300.00	340.00	380.00
Cost per day	$0.55	$0.51	$0.37
Protein supplied, lb	0.74	0.75	0.74
TDN supplied, lb[1]	2.78	2.25	1.46

1 All supplements are assumed to contain 75% TDN.

Example: A producer wants to self-feed cottonseed meal at the rate of 2 pounds per head per day to a group of 1,100-pound cows. Table 9 indicates that the daily salt consumption of 1,100-pound cattle averages 1.1 pounds when salt is used to limit supplement intake. Therefore, the producer's feed blend should include 1.1 parts salt and 2 parts cottonseed meal. Total intake would be approximately 3.1 pounds per day and the blend would contain 35%salt. The producer will need to monitor intake and adjust these percentages slightly to achieve the desired feed intake.

Assume that in addition to 2 pounds protein supplement, it is desired that the cow also consumes 3 pounds of grain (corn, milo, etc.) for a total nonsalt consumption of 5 pounds. In this case, the blend would contain 1.1 parts salt, two parts cottonseed meal and three parts corn grain for a total of 6.1 pounds intake per day. This blend would contain 18% salt.

Conclusion

Reducing feed costs, while maintaining performance is a must for Oklahoma cow-calf producers. By using a systematic approach to evaluating beef cow nutritional requirements, forage nutrient contribution and alternative supplemental sources, an optimal winter nutrition program can be designed. The lowest cost alternative will not always be the best program, due to the relative value of convenience, labor availability and feeding system. The most effective way to evaluate alternatives is to first determine the cost of the total supplementation program, then compare differences in cost with other factors.

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that a limit-grazing program is used. After the small grains forage begins to grow rapidly during late February or early March, protein needs can be met for 1.5 cows to three cows per acre, again, assuming a limit-grazing program is used.

While not as abundant in protein as small grain forage, tall fescue in winter will meet the protein needs of a dry cow with less than full-time grazing. An efficient system for wintering cows on fescue is to accumulate fall growth in the pasture for grazing after Dec. 1. When pastures are adequately fertilized with nitrogen, the accumulated forage contains from 9% to 14% protein. Similarly, fertilized, stockpiled Bermudagrass pasture can contain 9% to 14% protein through the month of December.

Limiting Feed Intake with Salt

Occasionally, it is desirable to self-feed supplements to cows in winter. For example, rough and inaccessible pastures limit a producer's ability to deliver supplements on a timely basis. In these situations, salt can be used to control intake of the supplement. The ratio of salt-to-supplement can be varied to achieve any desired supplement intake.

Self-feeding of supplements tends to allow timid, slow-eating cows to get their share. Vitamin A, minerals and other feed additives can be provided through the supplements.

There are disadvantages to feeding salt-concentrate mixes. Salt is not a precise regulator of intake since certain individuals will tolerate more salt than others. Additionally, salt is destructive to metal storage bins, feeders and farm vehicles.

The daily salt requirement for mature cattle is less than 1 ounce per head per day; however, voluntary intake often exceeds minimum needs. Maximum daily voluntary intake of salt is approximately 0.1 pound salt per 100 pounds body weight for most classes of cattle.

Effects of High Salt Intake

Salt toxicity is seldom seen in cattle because of their high tolerance for salt. The one-time lethal dose for mature cattle is 4 pounds to 5 pounds of salt. Salt is rapidly absorbed from the intestinal tract into the bloodstream. It is then excreted by the kidneys through urine. However, the animal is able to eliminate excess salt only when adequate clean water is available. Therefore, an abundant, clean water supply is a must when this method is used.

Salt toxicities are most likely to occur:

1. Where cattle have been deprived of salt for extended periods of time and suddenly have readily available salt.
2. When cattle eat excessive salt with an inadequate water supply.
3. When cattle drink water containing a high concentration of salt.

As a rule of thumb, cattle on salt mixtures drink 50% to 75% more water than normal, or approximately 5 gallons of additional water for each pound of salt. If only salty water is available, cattle will often refuse the supplement or may be forced into a toxicity situation. Salt content of water is usually measured by total dissolved solids (TDS) which includes calcium, magnesium, sodium chlorides, sulfates and bicarbonates. In general, caution is necessary in using salt-limited supplements when water contains more than 5,000 parts per million TDS. This analysis can usually be obtained through the Soil, Water and Forage Analysis Laboratory (SWAFL) of OSU (check with your local county Extension educator).

Salt used in self-fed supplements should be coarse, plain white salt. Cost alone prohibits the use of trace-mineralized salt; however, this should be avoided since forced feeding high levels of trace-mineralized salt could result in toxicity or mineral imbalances due to excessive intake of certain trace elements. If cattle need trace-mineralized salt, the amount consumed daily should not exceed 0.02% of the animal's body weight.

Controlled experiments in several states have failed to show any harmful effects upon cattle production from proper use of salt-concentrate mixes. High salt intake with adequate water has had no effect on fertility, calf crop percentage, weaning weight or appearance of animals.

Adjusting Salt Levels

Several factors influence the concentration of salt required in a mix to achieve a certain feed intake. Where large amounts of salt are naturally present in drinking water or forage, the amount of salt in the mix must be reduced to get satisfactory feed intake. On the other hand, it usually is necessary to increase the salt content of the mix through a period of time, as cattle become accustomed to the high salt level. Cattle also tend to consume more of a salt-limited supplement when forage is scarce or unpalatable. Extra precautions should be taken with these and other emergency conditions to ensure water supplies are adequate.

Estimates of salt needed to limit feed intake are shown in Table 9. Actual salt intake occasionally varies from the indicated values. Forage intake, palatability of supplement ingredients, salt content of the water and animal adaptation influence salt intake.

When cattle are accustomed to eating supplements but unaccustomed to self-feeding, prevent overeating by starting with a high salt level (50-50 or even 60-40 ratio of salt to meal). Then, the salt level should be reduced to obtain the desired level of intake. If cattle have not eaten concentrates before, a training period of a week or more of daily hand feeding of meal without added salt may be necessary.

If grain is included in a self-fed supplement, it should be cracked or coarsely ground and mixed with salt of similar particle size. This prevents separation of the salt from the grain and aids in preventing overeating. Adequate grass or hay must be available so the cattle are not forced to eat a salt-limited supplement to survive.

Table 9. Estimated salt intake of cattle fed salt limited supplements[a].

	Salt consumption, lbs/day		
Body weight, lbs	*Low*	*Average*	*High*
300	0.3	0.5	0.6
500	0.5	0.6	0.7
700	0.6	0.7	0.9
900	0.7	0.9	1.1
1,100	0.8	1.1	1.3
1,300	0.9	1.3	1.5

a Assumes drinking water is low in total dissolved solids (TDS).

of the increased feeding rate. Feeding just under 2 pounds (1.95 pounds) of 38% supplement provides adequate protein and energy to maintain bodyweight and condition during this stage of production.

Producers can make these calculations using this approach or a computer software program, then evaluate the costs, necessary feeding rate, convenience and expected animal performance outcome for each possible alternative.

In cases where one supplemental nutrient is needed, a very effective method to evaluate cost of nutrient sources is on a cost-per-unit-of-nutrient basis. In the example, the primary nutrient needed is protein. Assuming the 20% supplement cost $300 per ton, the cost per pound of protein is $.75 ($300 per ton divided by 400 pounds of protein per ton). If the 38% supplement costs $380 per ton, the cost per pound of protein is $.50 ($380 per ton divided by 760 pounds of protein per ton).

In this example, the cows can maintain their current weight and body condition (assuming it is adequate) with a supplementation program that costs about $.37 per head per day. Had the producer chosen the 20% supplement program, not recognizing the higher feeding rate, therefore higher energy intake was not necessary, the producer would spend about $.55 per head per day or approximately $18.00 more per cow in a 100-day period.

Additional Considerations for Supplementing Low-quality Forage

Supplementation Priorities

If supplementation is the goal for cattle grazing low- quality forage, priority should first be placed on meeting the protein requirement to maximize forage intake and digestion. Many years of research have consistently shown protein supplementation is extremely effective for cattle grazing protein-deficient forage (Table 3). In fact, energy supplementation will not be effective if dietary protein is deficient.

Once the producer ensures the supplementation (or feeding) program will meet the protein requirement, energy intake should be evaluated, similar to the example given in Table 3. The decision must be made whether the cattle need to maintain body weight and condition, gain weight and condition or can be allowed to lose some weight and condition. This decision will dictate how much supplemental energy should be provided.

Table 3. Influence of winter protein supplementation on performance of beef cows grazing native range.

	Treatment	
Item	*2 lbs/day of 40% protein supplement*	*No supplement*
Cow weight change during late gestation	23	-153
Cow BCS[a] change during late gestation	-.33	-1.61
Calf birth weight	88.5	77.5
Calf weaning weight	484	448

a Body Condition Score
Source: Steele.

Lastly, vitamin and mineral requirements should be compared to expected intake, have potential deficiencies identified and have supplemental alternatives evaluated. This does not mean vitamins and minerals are not important. Priority is given to protein and energy nutrition first because these items are needed in much greater quantities and they have the potential to have much greater impact on animal performance and efficiency of forage utilization. Vitamin and mineral nutrition of grazing cattle is discussed in detail in OSU Extension Circular E-861, *Vitamin and Mineral Nutrition of Grazing Cattle*.

Protein Sources

Protein from plant origin (such as soybean meal, cottonseed meal, corn gluten feed, wheat middlings or alfalfa hay) generally results in better utilization of low- quality roughages compared to nonprotein nitrogen sources such as urea and biuret. This is particularly true when a small amount of supplement is fed (0.5% of body weight or less). Nonprotein nitrogen sources are more effective in stimulating diet utilization and animal performance under one or more of the following conditions:

- When greater than 0.5% of body weight concentrate is being fed.
- When larger, more mature animals are being supplemented (greater than 600 pounds).
- When the protein deficiency in the diet is marginal (1% to 3% more protein needed in diet compared to 4% to 8% needed).
- When a blend of plant protein and nonprotein nitrogen sources are used.
- When it is provided in a form for animals to access more than one time per day.

Generally, when three or more of these conditions exist, studies have shown that nonprotein nitrogen sources are from 75% to 95% as effective compared to an all-natural plant protein source.

Alfalfa hay and alfalfa pellets are excellent supplements for moderate- to low-quality roughage growing programs. Alfalfa has long been known to have very favorable effects on rumen fermentation and is so common in most regions of Oklahoma it is often overlooked as an ingredient or stand-alone supplement. Studies at Kansas State University show alfalfa is equal to mixtures of grain and soybean meal containing the same percentage of protein when used to supplement roughages.

Interval Feeding

Significant costs in wintering cows and stockers on dry grass are the labor and transportation required to feed supplements. Adequate research has shown cows do not need to receive protein supplements every day. In one experiment using cottonseed meal as the protein source, cows were fed the same weekly amount of supplement on two-, four- and six-day intervals (Table 4). Although cow weight loss was slightly less when cows were fed on four-day intervals, there was no difference in cow weight loss between two- and six-day intervals. Calf weaning weights were similar among all treatments. In a more recent study, cows were fed the same amount of cottonseed meal-based protein supplement weekly, although the feeding intervals were three times per week or six times per week (Table 5). In this study, there was no difference in cow weight loss, body condition score or pregnancy rate due to

Table 4. Performance of beef cows fed supplement at different time intervals.

	Interval between feeding, days		
	2	4	6
Supplement, lb/feeding (41% cottonseed meal)	5	10	15
Cow weight change, lb	-185	-148	-170
Calf weaning weight, lb	433	440	428

Source: Pope.

Table 5. Performance of beef cows fed supplement three or six times per week.

	Days supplement fed per week	
	3	6
Cow weight in Nov., lb	1,187	1,211
Cow weight loss, Nov. to Apr., lb	242	255
Body condition score, Nov.	5.4	5.4
Body condition score, Apr.	4.4	4.3
Pregnancy rate, %	98	94

Source: Wettemann and Lusby.

supplement feeding interval. Many ranchers follow the practice of feeding two times the daily allowance on alternate days or feeding three times per week to eliminate Sunday feeding. With interval feeding, timid cows are more likely to receive their share of supplement. Even if cows are not fed daily, they should be observed as often as necessary, especially during the calving season.

It should be noted these results were obtained using dry supplements formulated with oilseed meals. These supplements had a high concentration of plant-based protein, which has a slower rate of degradation compared to supplements containing significant amounts of nonprotein nitrogen. Cows would not be expected to perform as well if dry supplements containing significant amounts of nonprotein nitrogen were fed at extended intervals, similar to these experiments.

Interval feeding does not work as well for higher feeding rates of low to moderate protein feed (energy feeds). For example, if the producer determines that 7 pounds per day of a 20% protein supplement (moderate protein concentration) should be provided, then 49 pounds of feed would need to be delivered each week. With three feedings per week, 16 pounds of feed would have to be delivered at each feeding. With four feedings per week, slightly more than 12 pounds per feeding would need to be provided. These large quantities of feed provided on an interval basis can lead to digestive upset, founder and reduced forage intake and digestibility. Therefore, the maximum recommended amount to provide during any one feeding event is 1% of body weight (11 pounds for an 1,100-pound cow). Using this rule of thumb and the 1,100-pound cow example, the maximum feed a producer should provide on a daily equivalent would be 4.7 pounds using three feedings per week (11 x 3 = 33 pounds per week; 33 ÷ 7 days per week = 4.7 pounds per day equivalent). The maximum daily equivalent provided using a four-days-per-week schedule would be 6.3 pounds (11 x 4 = 44 pounds per week; 44 ÷ 7 days per week = 6.3 pounds per day equivalent).

Supplemental Programs for Common Situations in Oklahoma

When hay or pasture nutrient concentration can actually be measured (samples collected and analyzed) and monitored, the methodical approach presented previously will be the most cost-effective way to determine the type and amount of supplement to feed. However, many low-cost producers do not feed hay and prefer to use their cows to harvest standing forage. If forage type and conditions are relatively constant from year to year, producers can develop a consistent supplementation program and fine-tune it when necessary. For example, when cattle graze native tallgrass prairie pastures, forage quality consistently declines through the summer, fall and winter months. Protein supplementation needs are quite predictable and may vary more from changing genetics or time of calving than forage conditions. Table 6 shows supplementation schedules for this type of forage with different calving seasons and winter weather conditions. Notice the feeding rate of the high-protein supplement gradually increases to offset the declining forage protein.

More energy is necessary when wet, cold weather conditions persist for long periods of time. Therefore, feeding higher daily amounts of a moderate-protein supplement is advised when these conditions exist or anytime cows are observed to be losing weight and condition too rapidly.

Table 6. Common supplementation strategies for cows grazing native warm-season forage[a] during winter.

Month	*Spring-calving dows*		*Fall-calving cows*	
	Good cow condition and/or moderate weather	*Marginal cow condition and/or severe weather*	*Good to moderate cow condition and/or moderate weather*	*Thin cow condition and/or severe weather*
October	None	1 lb HP	2 lb HP	3 lb HP
November	1 lb HP[b]	2 lb HP	3 lb HP	4 lb HP
December	2 lb HP	3 lb HP	4 lb HP	6 lb MHP[d]
January	3 lb HP	4 lb MP	6 lb MHP[d]	7 lb MHP
February	3 lb HP	5 lb MP[c]	6 lb MHP[d]	7 lb MHP
March	3 lb HP	6 lb MP	5 lb MHP[d]	6 lb MHP
April	2 lb HP	4 lb MP	3 lb MHP[d]	3 lb MHP

a Forage protein declines to a low of around 3% to 4% during mid winter.
b HP = high protein supplement, containing 35% to 40% protein, as fed basis.
c MP = moderate protein supplement, containing 20% protein, as fed basis.
d MHP = moderate-high protein supplement, containing 25% protein, as fed basis.

The goal for a spring-calving herd is to strive for a BCS 5 in mature cows by the time they calve in order to achieve optimum rebreeding during the spring and early summer months. Fall-calving cows usually calve in very good body condition (BCS of 6 to BCS 8) and the producer can allow these cows to gradually lose some condition through the winter. The main objective for a fall-calving cow is to prevent her from losing too much condition before the end of the breeding season. Once she is pregnant, additional weight and condition loss and lower rates of supplementation, will not hinder the established pregnancy.

When gestating cows consume hay or pasture that remains above 8% protein, low to moderate protein (energy) supplements, such as corn grain, soybean hulls, wheat middlings or milo can be used at about the same feeding rates as shown in Table 6. However, after calving, a moderate protein supplement may be necessary to offset the protein requirement for lactation. The amount or concentration of protein in the supplement will depend on the protein concentration in the forage base.

Using High-quality Pastures to Supplement Low-quality Forage

In many parts of Oklahoma, small grains pastures can be used to supplement cow herds in winter. Because these are high-quality forages, full-time grazing by beef cows results in considerable waste of valuable nutrients. A dry cow grazing continuously on small grain pasture consumes up to 10 times her requirement in protein. A more efficient use of these forages is accomplished by limit-grazing, restricting access to green pasture to a few days or hours each week and providing low-quality harvested or standing forage during the remaining time.

Small grain forages such as wheat pasture are high in protein, containing 15% to 30% digestible protein on a dry matter basis. Recent work at the Samuel Roberts Noble Foundation indicated mature steers consumed an average of 2.7 pounds of wheat forage dry matter in a 45-minute period. Since the wheat forage contained 30% crude protein, the steers consumed 0.8 pound of crude protein during this short period of time. This would be approximately equivalent to 4 pounds of a 20% protein supplement. Other research suggested beef cows consume between 0.5% to 1% of their body weight in rye forage dry matter during one fill-up grazing bout (Table 7). The fill-up period was approximately four hours in this study. Data suggest small grains forage dry matter intake is at the lower end of this range during the first few days of limit-grazing. Eventually, small grains forage intake increases substantially during the fill-up grazing bout after the cows have adjusted to the limit-grazing program. After about three weeks, these cows were consuming enough forage to supply about 3 pounds of crude protein; the equivalent of 7.5 pounds of a 40% protein supplement or 15 pounds of a 20% protein supplement.

Table 7. Beef cow rye forage intake during one fill-up period (approximately 4 hours).

Days relative to initiation of limit-grazing	Forage dry matter intake, lbs	Crude protein intake, lbs
Day 1	5.0	1.25
Day 2	7.2	1.80
Day 23	11.9	2.98

Source: Altom and Schmedt.

Labor availability, location of the small grains pasture, the low-quality forage resource and weather conditions frequently limit the use of limit-grazing systems. For these reasons, producers frequently use an interval limit-grazing approach. Rather than giving cows access to small grains pasture for a few hours each day, cows are provided access to small grains pasture for one fill-up grazing bout (three to five hours) for every two days to six days grazing the low-quality forage or consuming the low-quality harvested forage. A three- to five-hour grazing bout limits the loss of valuable forage due to trampling, bedding down and manure deposits.

The limit-grazing schedule shown in Table 8 is provided as a guideline for limit-grazing intervals necessary to provide adequate supplemental protein and energy to beef cows at different stages of production. For example, in January spring calving, cows would graze native range or consume hay with low protein content for three days, followed by one day (three to five hours) grazing small grains pasture before being returned to the low-quality forage source.

Replacement heifers will require approximately one day shorter intervals between small grains grazing bouts to continue growing, maintain or improve body condition and have a reasonable chance of rebreeding for their second calf. Remember that the appropriate time spent grazing the small grains pasture is likely to vary considerably depending on the situation. Factors such as low -quality forage protein and content and digestibility (energy content), small grains forage standing crop, cow size, stage of production, genetic potential for milk production, body condition score and age will have a substantial impact on this decision.

With average weather conditions in central and western Oklahoma, enough small grains forage should be accumulated by early December to supply the protein needs of about 1 to 1.5 cows per acre through the middle of February, assuming

Table 8. Approximate interval between small grains grazing bouts necessary to meet supplemental protein and energy needs of beef cows[a,b].

	Number of days consuming low quality forage per fill-up grazing bout	
Month	Spring calving cows	Fall calving cows[c]
December	4	2
January	3	2
February	3	3
March	2	3
April	2	3
Total days grazing small grains pasture (12/1 – 4/15)	38	42

a These suggested intervals assume that abundant low quality forage is provided at all times when the cows are not grazing small grains forage.
b Reduce the suggested interval by one day for first-calf heifers.
c Calves should be provided free-choice access to the small grains forage using creep gates.