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Chapter 17

Winter Cow Feeding and Management

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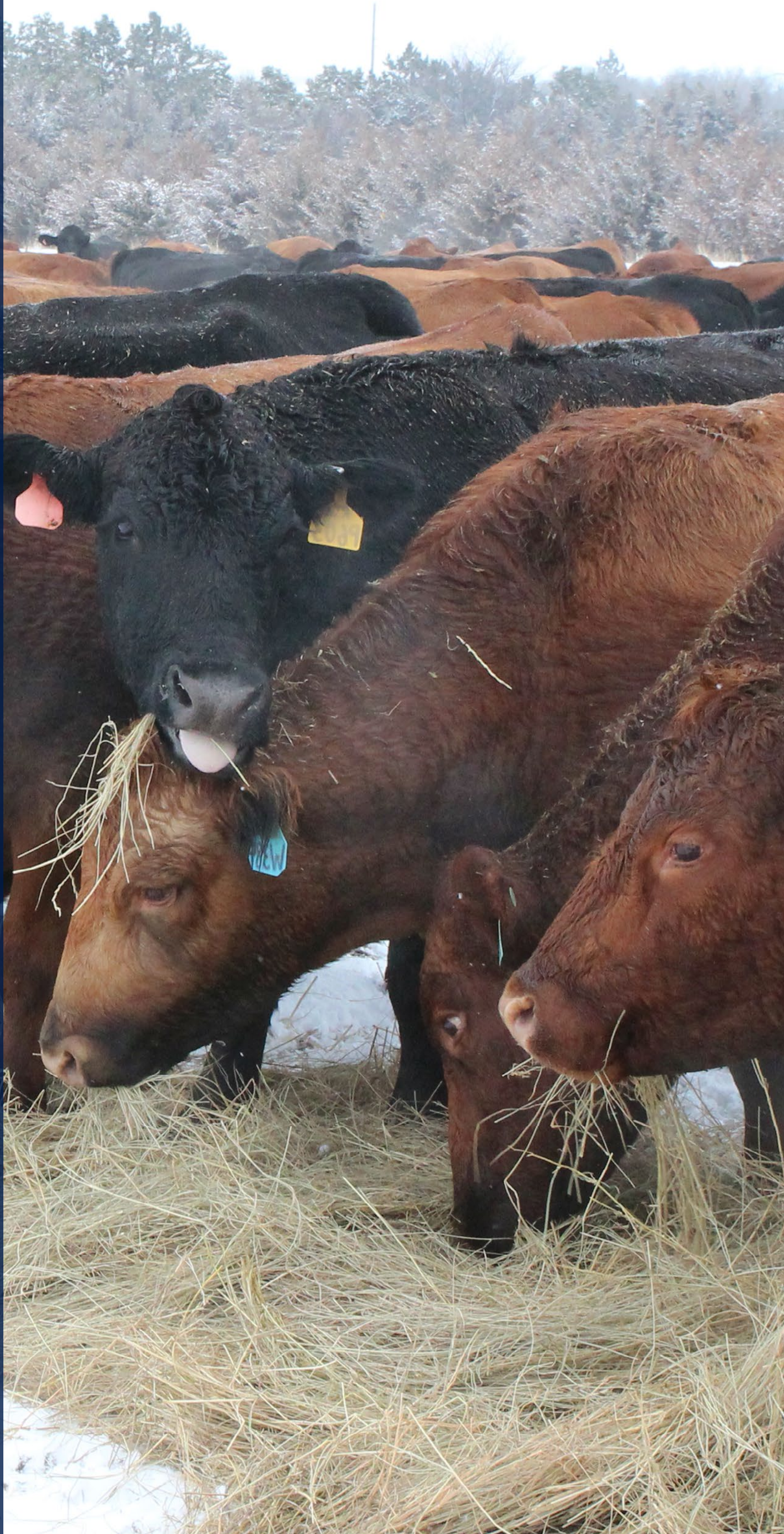

Chapter 17:

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Introduction

Standardized Performance Analysis records have shown that feed costs account for more than 60% of beef producers' annual cow cost, with over half of these costs attributed to winter feeding (Miller et al., 2001). These records also showed that feed costs accounted for over 50% of the variation in profit among herds. Therefore, winter nutritional management programs should be designed to provide feedstuffs that fulfill nutritional needs to meet performance targets in the most cost effective manner.

The focus in this chapter will be on winter feeding management of spring-calving cows because the vast majority of cow herds in South Dakota calve in the spring. Relationships between nutritional requirements and seasonal nutrient supplies, and possibly performance goals would be different for cows calving in different seasons, thus requiring appropriate adjustment in winter feeding programs. Although any of the feeding systems described in this chapter could be applied to cows calving in other seasons, they would need to be adjusted to fit the needs of cows in different stages of production in the winter. See Chapter 1, Systems Approach to Beef Cow Herd Management, for discussion about the influence of late winter, early spring, or late spring on winter input needs.

One of the most effective tools to ascertain that performance goals are being met is to body condition score (BCS) cows at strategic times during the winter feeding period as a measure of their nutritional status. (See Chapter 4, Influence of Body Condition on Reproductive Performance of Beef Cows.) Attaining targeted BCS at specific times indicates that nutritional goals have been met, whereas BCS that is lower or higher than the target will indicate under- or over-feeding, respectively. As indicated in Chapter 4, there are three key times to BCS spring-calving cows relative to winter-feeding programs. These are in the fall (at or after weaning), 100 days before calving, and at calving. Winter-feeding goals should be set with the end in mind, meaning that the feeding program

Key Points

- Winter feeding should be managed in conjunction with feeding programs for other seasons to manage cow body condition score to achieve performance goals at the least possible cost.
- Winter feeding programs can be based on grazed forages, harvested feedstuffs, or a combination of both to provide nutrients needed to achieve performance goals.
- Management practices to reduce winter feeding costs such as infrequent supplement delivery, windrow grazing, or bale grazing should be considered.

should be designed to achieve the desired nutritional status (BCS) goal at calving (typically at or near the end of the winter feeding period for spring calving cows). Substantial research (e.g. Houghton et al., 1990) indicates that the goal should be a BCS of 5 at calving to allow cows to return to estrus and be fertile by the beginning of the subsequent breeding season. Scoring body condition in the fall will allow for setting the nutritional plane of the winter feeding program to maintain or change BCS as needed to be at a BCS of 5 at calving. Scoring body condition at 100 days before calving allows a mid-winter monitor of nutritional status to make adjustments if necessary. It is also near the beginning of the final trimester of gestation, so it is a natural time to adjust for the increased nutrient requirements associated with late gestation. Once the average initial BCS of a group of cows has been measured in the fall, a ration-balancing program (see Chapter 15, Computerized Ration Balancing) can be a valuable tool to develop a ration based on available feedstuffs that will meet nutrient requirements to achieve BCS goals. Be aware that the output of a ration-balancing program provides a reasonable starting point for the winter-feeding program. Continued monitoring of BCS in the cow herd through the winter is important to adjusting the feeding program as needed to achieve the BCS goal at calving.

Priorities for available feed resources should be based on meeting the feed needs during the various cow production stages throughout the year. Underfeeding at critical times in the production cycle can place animals in a negative nutritional status that can be detrimental to their ability to meet performance goals. For example, under-nutrition of cows in late gestation or early lactation can result in reduced BCS that will likely delay return to estrus activity and reduce fertility, resulting in poor reproductive performance. However, there are certain times during the production cycle in which condition may be allowed to decrease slightly with few detrimental effects. For example, slight under-nutrition of mildly obese cows in mid-gestation (late fall and early winter for spring-calving cows) may have little negative effect on reproductive performance and could decrease annual feed costs. Thus, choosing which feed resources to provide during the winter feeding program will depend on nutrients needed to achieve performance goals, specifically moderate BCS at calving after the winter feeding program.

If facilities and feed resources are available, sorting cows into at least two groups (those at or above desired BCS and those below) is a good option to allow producers to strategically manage the nutrition program to meet goals while reducing unnecessary feed costs. For example, one group could be mature cows in peak performance (four to 10 years of age) in good BCS that are fed to maintain BCS, and the other group could be young, growing cows and old cows that struggle to maintain BCS and need to be fed to gain BCS. In general, the best time to determine BCS and sort cows is at weaning and approximately 100 days prior to calving. The most economical time of the year to increase condition is following weaning (mid-gestation) when lactation needs have ceased and fetal growth requirements are relatively low. If this window is missed, efficiency of BCS gain is much lower because the nutrient requirements for the fetus increase rapidly in late gestation. However, it is critical even during late gestation that the feeding program is managed to allow thin cows to calve in the desired body condition to avoid calving losses and future reproductive issues. See Chapter 4 for weight gains needed for pregnant cows in various BCS.

The winter-feeding strategy should be developed in conjunction with feeding strategies for the remainder of the year. Considerations for winter-feeding plans should include the expected BCS coming into winter with the goal to be in moderate BCS at calving for spring calving systems. It should also be planned in conjunction with other cow herd management that will influence nutritional status going into the winter and nutrient requirements during the winter, such as dates of calving (i.e. early- or late-spring) and weaning. For further discussion of coordinating times of calving and weaning with resource use, see Chapter 1, Systems Approach to Beef Cow Herd Management and Chapter 9, Weaning Methods to Improve Calf Performance.

Winter Feeding Systems

Forage-based livestock production systems may result in reduced availability of nutrients needed to meet requirements at critical physiological stages.

In spring-calving herds, rangeland forages are typically dormant and protein concentration is low during late gestation and early lactation. Conversely, protein and energy requirements of the cow in the third trimester increase by approximately 14% and 20%, respectively, as compared to the second trimester (Adams et al., 1996). Thus, alternative feeding strategies are often needed to meet increased nutrient requirements during the last several months of pregnancy.

It is important to consider that winter-feeding management may be complicated by the weather. For example, an extremely cold winter may require changes to the traditional feeding system in terms of additional feed quality and/or quantity (see Chapter 8, Cold Stress Impacts on Cattle). The lower critical temperature (LCT) of a cow is the temperature below which additional energy is required to cope with cold stress. The LCT varies depending on temperature, wind speed, and whether the hair coat is wet or dry. As a general rule of thumb, energy needs increase by 1% for each degree of wind chill below the LCT. For example, a cow with a dry winter coat has a LCT of 32° F. If the temperature is 32° F with a 20 mph wind, the wind chill, or effective temperature would be 17° F, and energy requirements would increase to 115% of normal. Cows can manage a few days of cold with few ill effects. However, cold stress should be managed during extended or severe cold periods by providing additional energy and ensuring that wind and weather protection are available. Dealing with winter cold stress is another reason why managing BCS during the winter-feeding period is important. Additional fat cover associated with higher BCS provides insulation that is valuable to coping with cold stress. Slight to moderate excess BCS also provides an energy reserve that a cow can draw on to meet the energy requirement of maintaining body temperature and still not fall below the target of having a BCS of 5 at calving.

A good understanding of winter feeding system options and how they may work within a given production system will allow producers to analyze feeding alternatives to best meet specific needs. Major strategies for winter-feeding systems in the northern Great Plains include:

1. Drylot feeding
2. Grazing winter range or pasture
3. Grazing crop residue
4. Windrow/Swath grazing
5. Bale grazing

Drylot feeding

This refers to any feeding program based entirely on harvested feedstuffs. While cattle are often placed in a drylot pen with little to no standing forage, in other situations they may be placed on pasture with delivery of a full feed of harvested feeds. A producer should realize that cattle on pasture will attempt to graze despite having abundant access to harvested feedstuffs that can put heavy grazing pressure on the pasture. This can damage pasture health. In addition, it will also reduce control that one has over the quality of the overall cow diet because the cows are consuming grazed forage that has not been accounted for.

The intensity of the drylot program will depend on the kind of feeding equipment that is available. It can vary from being as simple as baled hay being delivered on the ground to a total mixed ration (TMR) being delivered in a concrete feed bunk. Both of these extremes and a variety of intermediate options can be used to provide feedstuffs that meet the nutrient requirements to fulfill BCS and performance goals. Cost control of winter-feeding systems involves using low-cost feedstuffs that provide the required nutrients coupled with efficient and inexpensive feed delivery systems.

The first step in preparing for winter feeding based on harvested feeds is to have samples of all feedstuffs analyzed to determine their nutrient content so that a ration can be properly balanced (see Chapter 15, Computerized Ration Balancing). Once the ration is developed, whether it is mixed or fed as separate ingredients will depend on equipment availability. In the simplest situation, good-quality mixed grass and alfalfa hay will likely meet the nutrient requirements of a mid-gestation or early late-gestation cow with no additional feedstuffs. The best way to deliver the hay will need to be determined. Providing cows with free access to large round bales in a pasture is simple and convenient, but not the best way to minimize waste. One potential strategy is to provide a one- or two-day supply of hay using round bale feeders, making sure that spacing is adequate around and between the feeders. This gives every cow the opportunity to consume forage and also reduces hay waste. Landblom et al. (2007) found that feeding alfalfa-grass hay in a tapered-cone round bale feeder reduced hay waste compared to rolling round bales out on the ground or shredding round bales on the ground with a bale processor. The reduced hay waste decreased the amount of hay required per cow and winter feeding cost while maintaining cow BCS. Additionally, putting good quality hay through a tub grinder, bale processor, or loading it into a feed wagon increases cost (equipment and labor). It may also decrease the quality of forage consumed by causing leaf shatter and loss. Olson and Jaeger (1991) compared feeding large round bales of forage sorghum hay in bale feeders to the same hay shredded with a bale processor and delivered either in feed bunks or on the ground. They found that the waste associated with whole bales was primarily large stems that the cows refused to eat, while the waste associated with processed hay was primarily leaf material shattered into small pieces that they were unable to pick up and eat. Additionally, feeding whole bales in feeders maintained cow BCS better than feeding processed hay.

The next level of complexity is to feed two ingredients, such as one hay or silage along with one concentrate feed to overcome a nutrient deficiency in the base forage. In this case, hay can be delivered as one ingredient (again, perhaps as round bales in feeders) and the concentrate delivered separately in a feed bunk. Alternatively, mixing the two ingredients in a feeder wagon and delivering the mixture will ensure more even consumption of both feedstuffs across all individuals in the herd, ensuring more uniform performance among all cows. As the complexity of the ration increases with more ingredients, the value of investing in a feed wagon increases because the total ration can be mixed and delivered uniformly.

Good quality grass and legume hays or silages are expensive in current feedstuff markets. As a result, it has become more practical to consider alternative ingredients in beef cow diets. Mature beef cows have tremendous capacity to economically and effectively utilize low-quality feeds like crop residues. A mature beef cow can have a rumen capacity of 50 gallons or more. During mid-gestation when nutrient requirements are lowest, this capacity to digest huge volumes of slowly fermentable feedstuffs like cereal straws or corn stalks can translate into a cost-saving advantage. Low-quality roughages will require supplemental feedstuffs to overcome nutrient deficiencies (see Chapter 18, Supplementation of Beef Cows). Again, mixing the low-quality feed with the supplemental ingredient may be the best mode of delivery to obtain uniform consumption among individuals.

An additional alternative to consider when good-quality forages are limited in availability or expensive is to limit-feed concentrate-based diets. In this case, a concentrate or grain-based diet similar to a finishing diet for feedlot cattle is fed to cows, but intake is limited to meet requirements without allowing them to gain excess body condition. Careful management is critical to ensure uniform consumption among all individuals in a pen and to avoid nutritional disorders that are likely with high-concentrate diets, such as lactic acidosis. Good feed mixing and delivery equipment and experience with bunk management cannot be overemphasized in a limit-feeding scenario. An ionophore, such as Rumensin® or Bovatec®, is an important feed additive to use in this scenario to improve feed efficiency, but more importantly to help control nutritional disorders including bloat and acidosis. A key aspect of bunk management is allowing adequate bunk space, at least three feet per cow, so that every cow has an opportunity to be at the bunk when the limited amount of feed is delivered each day. Additionally, sorting young cows from mature cows will further ensure that the young cows don't need to compete with older, larger dominant cows at the bunk for their share of the feed.

Grazing winter range or pasture

Rangeland or pasture that is not grazed during the growing season can be "stockpiled" to provide winter grazing. Using cattle as the harvesters typically provides substantial cost savings relative to harvested feedstuffs. It also allows use of forage resources that cannot readily be mechanically harvested such as rangeland. The primary concern with stockpiled forage is that it will be low in quality because it has been allowed to grow to full maturity and go dormant in the fall. Thus, it will fit the definition of low-quality forage, meaning that it is deficient in crude protein (less than 7%), but high in digestible fiber if a protein supplement is provided to stimulate rumen microbial growth and fermentation capacity (see Chapter 18, Supplementation of Beef Cows.)

The major concern with grazing dormant, low-quality forage is controlling the cost of supplementation so that the cost savings of grazing vs. feeding harvested forages can be realized. Besides utilizing the least expensive source of the desired supplemental nutrient, alternatives to decrease the cost of delivering the supplement should be considered. Cost of delivery from a producer's commodity storage facilities to the cattle can be substantial when considering labor, mileage, and equipment depreciation. All of these costs increase dramatically as the distance to the cattle increases. Two options exist to reduce the cost of delivery: reducing the frequency of delivering the supplement or providing a self-fed product. A variety of research trials have been conducted on these topics, and results of these trials should be considered in evaluating feeding strategies for a specific operation. Some of the important findings from these trials are presented in the next section.

Frequency of Supplement Feeding. Response to infrequent supplementation depends on whether a protein or energy supplement is provided. Numerous research studies have evaluated the differences between daily, three times per week, two times per week, and once a week delivery of protein supplements. When evaluating cow performance, Schauer et al. (2005) indicated that supplementation frequency did not affect cow body weight or BCS when cows were supplemented with cottonseed meal daily or every sixth day while grazing low-quality forage. This data supported previous research by Huston et al. (1999) in a study that evaluated daily, every third day, or once a week supplementation. These studies indicated that supplementing as infrequently as once a week reduced losses in body weight and BCS compared to non-supplemented cows, and was as effective as daily supplementation. Bohnert et al. (2002) conducted a supplementation frequency study using Angus X Hereford cows grazing low-quality (5% crude protein) meadow forage. Cows were supplemented daily, every third day, or every sixth day with sources of supplemental protein that were either highly degradable (ruminally degradable protein [RDP] was 82%) or highly un-degradable (RDP was 40%) in the rumen. Their results indicated that all cow weight and BCS changes were positive for supplemented cows regardless of frequency or source of protein (average weight gain was 17 lb), but cows in the un-supplemented control group lost 86 lb. The reason that infrequent protein supplementation works is that ruminant animals conserve nitrogen from dietary crude protein in their bloodstream and saliva and recycle it back to the rumen so that ruminal microbes can use it to synthesize protein and more microbes. Thus, protein (nitrogen) consumed on days of supplementation is continually circulating and returning to the rumen on days that the supplement is not provided.

There is less research on how often energy supplements need to be fed. However, in general, high-grain energy supplements should be fed daily to decrease rapid fluctuations in the rumen environment. Kartchner and Adams (1982) reported that cows receiving corn grain on alternate days gained less body weight than cows that were supplemented daily. Those receiving daily supplement gained BCS while those receiving alternate-day supplementation only maintained BCS. Chase and Hibberd (1985a) found that alternate-day feeding of a high-grain energy supplement reduced intake of native grass hay compared to feeding on a daily basis. In another study, Chase and Hibberd (1985b) found that feeding corn at greater than 2 lbs per day decreased forage intake and digestibility of native grass hay. McCollum (1997) stated that feeding low-protein, energy dense supplements at rates of less than 0.3% of body weight had little impact on forage intake and may sometimes slightly increase it. This 0.3% of body weight is 3.6 lb (dry matter basis) per head for a 1200 lb cow. Once this level is exceeded, forage intake will decline due to substitution of grain for forage and performance will not increase as rapidly as expected. Energy supplementation should occur on a daily basis to decrease the opportunity for repeated shifts in fermentation patterns that reduce forage utilization (Kartchner and Adams, 1982), or worse, lead to lactic acidosis and digestive upset.

Another consideration directly related to frequency of supplementation is the amount of supplement that is provided at one feeding. If cattle are supplemented on a daily basis, there will be a small amount of supplemental feed allocated per head. Dominant cows will typically consume a larger portion of supplement than allotted, whereas, timid cows may not consume the desired amount, if any. For protein supplements, providing supplement on a less frequent basis means there is a larger quantity of feed available, which gives all cows a greater opportunity to consume supplement as the quantity is too large for the dominant cows to consume in a short period of time (Bowman and Sowell, 1997). For example, if 100 cows were fed a 30% crude protein range cake at 2 lb per head per day, 200 lb of the range cake would be distributed every day. In this situation, the timid cows may wait until feeding is finished and the dominant cows may have the feed nearly eaten by the time the others have made their way to the feed. If supplemented every third day, the amount of feed provided at each feeding would increase to 600 lb., which in most cases would give the timid cows more opportunity to consume their allotted amount of feed without competing with dominant cows (Bowman and Sowell, 1997). However, the type of supplement needs to be considered when determining frequency of supplementation, as less frequent supplementation of grain based energy supplements can have negative effects on consumption and digestibility (see Chapter 18, Supplementation of Beef Cows.)

To determine the feeding frequency that works best for a given operation, calculate costs to deliver the supplement. Take into consideration mileage to and from the cows, time and labor to feed, and equipment availability. For example, if cows are 15 miles from the feed and it takes 1 hour and 15 minutes to feed when fed daily, what is the cost to feed those cattle on a daily basis, every third day, or once a week, if the necessary equipment is available? If we use $0.50/mile for pickup mileage and depreciation, and $10.00/hour for labor, the cost to deliver the feed for daily feeding would be $192.50 per week. For every third day feeding, the cost of delivery would be $60.00 per week. This includes an additional 15 minutes of labor for the added time in loading and unloading the larger quantity of feed. For once a week feeding, delivery cost would be $32.50 per week with an additional 30 minutes of labor compared to daily feeding. To compare the daily versus weekly feeding on a strictly economic basis, you would save $160 per week by supplementing once a week. Many producers may want to see their cattle more frequently than this, so producers should balance cost savings with what works best for their management goals. Finally, add in equipment costs if it is necessary to purchase new equipment or upgrade current equipment to handle the larger quantity of supplement for infrequent delivery.

Self-fed supplements. Self-fed supplements are designed to limit average daily supplement intake to targeted levels so large, bulk quantities can be delivered infrequently. One mechanism to limit intake is the physical form of the supplement. For example, consumption of cooked molasses tubs is limited by the hardness of the product, and consumption of liquid supplements is limited by the rate at which the animals can lick the liquid from the tank. Another intake-limiting mechanism is to use an ingredient such as salt or flavor agents (sweet or bitter) that will affect the palatability of the supplement.

The major advantage of self-fed supplements is the reduced transportation and labor costs because of infrequent delivery. In addition, despite infrequent delivery, animals still have access for daily consumption. This can overcome the problems associated with infrequent delivery of hand-fed energy supplements described earlier. Thus, even though self-fed supplements often cost more per unit of nutrients (see price examples in Table 5 of Chapter 18, Supplementation of Beef Cows), they may still be more cost effective to use in rangeland situations because the reduced cost of delivery offsets the increased cost of the feedstuff. Partial budgeting is an economic tool that can help producers compare the costs of hand-fed vs. self-fed supplements to determine which provides the best economic value (Torell and Torell, 1996). In short, a partial budget is the summation of costs and benefits between two alternative management practices. In this case, it involves summing the cost of feed and delivery of each potential supplement and determining which is the least-cost alternative to provide supplemental nutrients to cattle. A new partial budget is necessary for each situation because of changes in supplemental nutrient needs, costs of potential feedstuffs, distances traveled, time and labor required to deliver each type of supplement, travel costs, and equipment costs. For example, consider that 0.5 lb. of crude protein per day is currently being supplied to 300 cows using a 30% crude protein hand-fed supplement, such as range cake/cubes. The supplement costs $375 per ton delivered to your ranch. To calculate the cost per ton of supplemental CP, the dry matter content of the supplement needs to be considered (see Chapter 18 for an explanation of calculating the cost of supplements on a unit of nutrient basis), which would be 85% for this example. The distance to the cows is 50 miles and it costs $0.50 per mile and $50 of labor to deliver it. If delivered daily, the cost of supplementation per week is about $1,475. The alternative is a 30% crude protein self-fed supplement such as a cooked molasses tub (95% dry matter) that costs $960 per ton but only needs to be delivered once per week. The weekly cost of supplementation in this case is about $1,865. Thus, the self-fed supplement costs about $390 more per week to provide. Differences in feedstuff costs, distance to the cow herd, fuel costs, labor costs, and frequency of delivery of the hand-fed supplement could all drastically change the outcome of this comparison. The daily delivery of the hand-fed supplement in this example is a major factor in the total cost of delivery; because it is a protein supplement, simply delivering it less frequently could substantially reduce the cost of hand-feeding. Additionally, other considerations may influence this decision, such as availability of time or hired labor to make daily deliveries. Often, producers cite convenience (i.e. less hassle and labor) of using self-fed supplements as being worth the extra cost.

There are a couple of additional concerns with self-fed supplements. One major disadvantage of self-fed supplements is increased variation of supplement intake among individual animals and increased percentage of non-consumers of the self-fed products (Bowman and Sowell, 1997). This appears to happen in spite of self-fed supplement delivery virtually eliminating issues of feed bunk space/competition issues. Bowman and Sowell (1997) reviewed 20 studies that compared various combinations of dry hand-fed, molasses-block, or liquid supplements. The average coefficient of variation (CV) across all experiments for supplement intake was 79, 60, and 41% for block, liquid, and hand-fed supplements, respectively (as implied, a higher CV means greater variation of intake among individuals.) Among the studies that directly compared hand-fed to self-fed (both block and liquid) supplements, the percentage of animals that were non-consumers was five and 19% for hand- and self-fed, respectively. A variety of factors contributed to variation in intake of supplements (Bowman and Sowell, 1997). For example, harder blocks led to reduced intake, but also increased variation in intake. Also, supplements with higher crude protein content led to reduced variation in intake. On the other hand, higher quality forage contributed to reduced intake and increased variation in supplement intake. Animals adjust consumption of feeds containing various nutrients in response to their need for those nutrients (Provenza, 1991), and likely adjust their intake of the supplemental block based on the nutrient level of the range forage and the supplement. The second concern with self-fed supplements is whether intake is adequate to meet the level of supplemental nutrient needed. From the last example, cows will need to consume 1.67 lb of the 30% self-fed supplement to receive 0.5 lb of crude protein. A producer will need to monitor supplement disappearance to ensure the required level of supplement is being consumed, and even then, there is no guarantee of adequate consumption due to the large variability in individual consumption.

In addition, the Bowman and Sowell (1997) review reported that cow age influenced self-fed supplement consumption, with younger cows consuming less supplement than older cows. This was apparently in response to social dominance of older, larger cows over younger, smaller ones. In a subsequent study using a liquid self-fed supplement, Sowell et al. (2003) provided further evidence to indicate that younger cows consumed less supplement than older cows. In contrast, Suverly et al. (2000) found that consumption of hand-fed protein supplements was greater by four- to six-year-old cows than older cows. This is a critical issue considering that nutrient requirements and therefore need for nutrients from the supplement are greater for younger cows that are still growing as opposed to mature cows.

Finally, supplements can play a role in cattle and range management beyond supplying additional nutrients. In particular, a great deal of attention has been directed toward use of cooked molasses tubs to improve grazing distribution. Bailey and Welling (1999) and Bailey et al. (2001) found that placement of cooked molasses blocks in underutilized range locations increased the amount of time that cows spent within 2000 feet of the tub location and increased utilization of forage near the tubs (with concomitant reduction in forage use at further distances from the tub). In both reports, Bailey's group concluded that grazing distribution could be improved by luring cattle to underutilized rangeland locations by strategic placement of cooked molasses tubs.

Grazing crop residue

Turning cattle into a crop field after grain harvest to graze crop residue is typically a low cost source of forage, especially in fall and early winter. Fall is an optimal time after calves are weaned and cows are in mid-gestation because this is the time of year that nutrient requirements are lowest (see Chapter 14, Nutrient Requirements of Beef Cows). The amount of residual grain left in the field will vary depending on factors such as crop variety or hybrid, harvest date, and harvest efficiency. If little or no fallen grain is available, then the crop residue may qualify as low-quality forage and supplementation with a protein feedstuff may be necessary (see Chapter 18, Supplementation of Beef Cows). Whether or not a protein supplement is needed depends on grazing management and BCS of the cows. Cattle are selective grazers that will consume higher nutritional value parts of the residue if the stocking rate (acres per cow per month) is low enough to allow them to be selective. With corn stalk grazing, selective grazing means cows will consume corn grain that remains in the field first, leaves and husks second, and stem last. Even within the stem, they will start at the top and eat down into the heavier part only if they are forced to do so. Leaves and husks are usually high enough in protein content that cows will not require a protein supplement if the stocking rate is light enough that they can consume mostly grain, leaves, and husks. Additionally, non-lactating mature cows that enter the fall in BCS greater than 5 have the energy reserves to withstand a small deficiency in protein while grazing crop residue, as described earlier in this chapter. If there is a large amount of fallen grain remaining in the field, grazing management may need to be relatively intensive to limit daily access to grain to avoid nutritional disorders from grain overconsumption such as acidosis. This can be accomplished utilizing strip grazing, wherein a temporary electric fence is moved daily or every few days to ration the available grain and forage to the herd. Recent crop breeding improvements have made significant advances in crop "standability" and reduced fallen grain from modern varieties and hybrids so this is less of a problem than it was in the past. Strip grazing will also ration a new portion of leaves and stalks providing a higher than usual dose of protein each time the cows are moved to a new strip. This may work literally like infrequent protein supplementation as descried above. If strip grazing is not used, cattle managers should expect that cows will receive adequate protein early in the grazing period, but should expect that protein supplementation will need to begin once the best parts of the residue have been eaten. Protein supplementation should be initiated once the grain and a significant part of the leaves have disappeared.

A concern with crop residue is potential nitrate toxicity. Nitrate levels are highest in the lower portion of stems, so light to moderate grazing as described above so cattle are allowed the opportunity to selectively avoid the lower stem will reduce potential for consumption of a toxic dose of nitrates. Sampling forage to test for nitrate concentration before grazing is highly recommended. For further discussion of management and testing for nitrate toxicity issues, see Chapter 21, Plant Toxicities, Defensive Chemical Compounds, and Other Feed

Concerns. Another toxicity concern with sorghum crops is prussic acid. If there is significant green regrowth after harvest, prussic acid levels in the green material could be at toxic levels. Again, see Chapter 21 for further discussion of prussic acid poisoning.

Although the forage is dead and concern about pasture health and condition is not as critical as with rangeland and perennial pastures, grazing management of crop residues is still important. Setting a stocking rate to achieve a moderate level of utilization is important to both cow nutrition (as described above) and soil health. Utilization should be light to moderate from an agronomic viewpoint to avoid excessive soil compaction because of trampling. Adequate residue should remain after grazing to protect the field from erosion and to provide organic matter to incorporate into the soil.

Windrow/Swath grazing

Windrow or swath grazing is another form of stockpiling forage for winter feeding. In this case, forage is cut and windrowed as typical for making hay. However, subsequent steps of haymaking, including baling and stacking for storage, are not completed. The swaths are left in the field and cattle are turned into the field to "graze" from them through the winter feeding period. Thus, the substantial cost and labor of baling, stacking, and feeding are eliminated. Using a temporary electric fence to ration the forage in daily to a few day increments is important to keep cattle from wasting the forage by using it as bedding or excessively trampling it. Determining placement of the electric fence to allocate adequate but not excessive forage should be an ongoing process during the grazing period. An allocation at initiation of grazing can be set, and then future allocations can be adjusted to ensure waste is minimized while cow behavior suggests they are eating their fill. Some effort will be required at the start of windrow grazing to determine the initial placement of the electric fence. One approach would be to gather the forage from a measured length of windrow and weigh it. As an example, the average for several 5-foot sections of windrow throughout the field is 15 lb., meaning there is about 3 lb. per foot of windrow. To compare this supply to forage demand by the cows, determine predicted dry matter intake (see Chapter 14, Nutrient Requirements of Beef Cows) based on cow weight, age, and stage of production, and then adjust to intake on an as-fed basis considering a reasonable estimate of dry matter content of the forage in the windrow. If the windrow is dry, 90% would be a reasonable estimate of dry matter content. If we determine the cows will consume about 30 lb of forage on an as-fed basis, we can multiply that by the number of cows and then adjust for hay waste. If there are 100 cows, then 3000 lb will be consumed and an additional 300 lb could be allowed if we expect 10% waste. At 3 lb per foot, 1100 feet of windrow should be allocated per day. Again, realize this is a rough estimate based on several assumptions, so it will likely need adjustment based on careful observation in the field.

Forage left in windrows retains substantial nutritional value relative to stockpiled standing forage that is allowed to go fully dormant for winter grazing. However, it loses some nutritional value compared to hay that is stored properly. Volesky et al. (2002) compared nutritional value of baled hay, stockpiled standing forage, and windrows on a wet meadow in the Sandhills of Nebraska. They found that baled and windrow-fed forage both contained 10.6% crude protein throughout the winter feeding period. However, the crude protein content of standing stockpiled forage declined to 5.7% as the winter feeding period progressed. Fiber content of the forage (reported as neutral detergent fiber and acid detergent fiber on laboratory forage test results) was similar between windrow-fed and standing stockpiled forage, but lower in baled forage, indicating somewhat higher expected digestibility and intake of the baled forage. Despite nutrient loss in windrows vs. baled hay, windrow forage typically still retains adequate nutritional value to be considered moderate quality forage that does not require supplementation. Under the conditions of their study, Volesky et al. (2002) reported substantial cost savings relative to the baled-hay storage and feeding strategy. One risk with windrow grazing is that heavy, drifted snow can bury the windrows and eliminate the ability for cows to access the forage. High, dense windrows no more than four feet wide are recommended in order to increase accessibility and keep the majority of the forage off the ground.

Bale grazing

Bale grazing is another approach similar to windrow grazing to reduce costs of winter-feeding programs. In this case forage is baled (typically large, round bales) after windrowing. One option is to leave the bales on the field and allow cattle into the field to "graze" from the bales. In this case, the costs of moving, stacking, and feeding the bales in the winter are eliminated. Again, temporary electric fencing will be needed to ration the bales to the cattle to eliminate excess waste. Based on estimated weight of the bales, allocation of bales to provide adequate forage and minimize waste can be done in an exercise similar to that described above for allocating windrows. In essence, it would be quite similar to determining the number of bales to deliver when feeding from stacked hay. A second option is to move the bales to a feeding area, but arrange them so that a few bales can be allocated using temporary electric fence moved every few days to ration hay to the cattle. In this case, the cost and labor of moving the bales to feed them to the cattle in the winter is eliminated. A major advantage to bale-grazing over windrow-grazing or stockpiled standing forage is that the bales will remain accessible by the cattle even in heavy snowfall situations.

Summary

There are many variations on the major themes described in this chapter for winter-feeding systems. Producers should evaluate the best combination of possibilities to fit their land and cattle resources. There are advantages and disadvantages associated with each type of program. Producers should consider feed and labor costs, time, facility and equipment requirements, management practices, and potential impacts on the operation (i.e., agronomic effects of windrow grazing) of each system before implementation. Changes in weather, feed quality, physiological state of the cow herd, and other factors should be evaluated throughout the feeding period and adjustments should be made as needed. The ultimate goal is to develop a winter-feeding system that provides adequate nutrition to meet cattle performance goals at the lowest possible cost. Because winter-feeding represents the largest portion of annual beef cow production costs, continued efforts to improve and refine winter feeding programs is encouraged.

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