Cowherd Feeding Options To Minimize Cost[1]

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Introduction

Feed costs make up over half the costs of producing a weaned calf. Financial information from Nebraska's IRM program indicates that there is a tremendous variation in feed costs from one operation to another. Average feed cost per calf weaned was $175 with a range of $112 to $230 for a difference of $118 per cow. When operating and ownership costs are added to feed costs, breakeven price needed per pound of calf weaned was low as $.65/lb. to as high as $1.07/lb. In a six year summary of Iowa records, those producers in the top on-third for profitability, sold 121 more pounds of calf per cow, had a 3.7% higher calf crop weaned; yet accomplished this at an annual feed cost that was $40 less per cow. In a dated summary of the IRM herds in Colorado it showed that the average cost of maintaining a cow was $324, but that range was from $239 to $386, or a difference of $147 per cow. Thus, it's fairly apparent that one of the keys is annual feed costs. Maybe the actually feed cost isn't that important in this information, but the range in costs should be of concern to producers.

Profitable cow/calf producers tend to have 3 important items in line with one another. Weaning weight in line with reproductive rate in line with cost of producing a weaned calf. Weaning weight and reproductive rate will likely not be maximum, but optimum given the feed, labor, and capital resources available. In addition, maximizing the use of winter and summer grazing opportunities and using harvested and commercial feeds at the "proper" time are important in making the cow/calf enterprise profitable.

Determining Nutrient Needs

Although there is not much difference in total pounds needed to meet the protein and energy requirements comparing cows and 1st-calf-heifers at similar stages of production, there is a tremendous difference in the percentage of the ration that needs to be protein and energy (TDN). Consult any nutrition book for requirements for beef cattle. The most recent is the 1996 Nutrient Requirements for Beef Cattle. For this reason alone, heifers should be managed separate from mature cows before and after calving, especially when harvested feeds are being fed. In addition, you'll be able to "target" those feeds that
are higher in protein and energy to better meet the young cow's protein and energy needs.

In almost all cases, a high energy feed (grain, silage, grain by-product, etc.) will need to be fed along with the forage source in limited amounts to first- calf-heifers, especially after calving to meet their energy requirement.

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Crop Residues

It has been estimated that there are 159.3 million tons of cereal residues available for feed use in the United States . Utilizing less than 50% of the crop residues would help support the fall and winter nutritional needs of the current U.S. cow population.

Crop residues such as corn stalks, milo stubble and stock-piled standing forage do offer economical feeding programs, especially for the mature cow. Economical in that cattle do the harvesting of the forage, that in turn, reduces total feed costs. Corn stalks alone can meet the protein and TDN requirement of the mature cow and heifer as long as there is corn, husk, and leaves available for cattle to consume. When the corn is gone, it will be difficult to meet the heifer's nutrient requirement, without supplementation of both protein and energy, and is the major reason that heifers need to be separated from the mature cows and fed differently after the corn is cleaned up.

The husk and leaves can be utilized by mature cows as long as they are fed additional protein. Toward the end of the stalk grazing period, if husk and leaves are still available for spring-calving cows weighing 1200 pounds, supplementing daily with 3 to 5 pounds of an 18% crude protein alfalfa hay or 1.5 to 2.5 pounds of a mostly all natural 36% crude protein commercial supplement should meet the protein requirement and will increase the digestibility of the husk and leaves. It would be more economical to feed protein every-other-day or every third day. If it was determined to feed 5 lb per head daily, that would be 10 lb per head every-other day or 15 lb per head every third day.

The major concern with using crop residues in winter feeding programs is over use. Many times, we try to get more out of the stalks than what is actually available. Once the grain, husk and leaves are cleaned up, be prepared to move to a new field or begin feeding the harvested forages.

We have data evaluating the impact of grazing corn and soybean residue on subsequent grain yield. Our data suggest that grain yield is not reduced due to winter grazing. I would not suggest to feed hay in a hay feeder in a residue field as cattle will congregate and compaction may occur in this area. Also, in the spring, if a lot of moisture occurs and the ground begins to thaw and there is a lot of mud, remove livestock from the residue field.

I've concentrated primarily on corn stalks, but milo stubble and stockpiled cool season grass also offer an opportunity in a feeding program. Milo stubble does an excellent job in meeting the cow's nutrient requirement in mid-gestation. The grain in a milo field is not well used by the cow, however, the leaves are well used. Milo stubble works nice into the winter feeding program because the leaves are on the stalk and not the ground and there is less loss due to snow or trampling.

Missouri researchers are experimenting with stock-piling cool season grasses (fescue) to be grazed in the winter. Summer or fall stockpiling of tall fescue does not appear to influence subsequent spring forage production, composition, or digestibility. Optimum fertilization rates and supplementation programs need researched.

The economic advantages of residue use should not be ignored by the cattle industry. Again referring to the Iowa State economic summary, the most profitable cowherd used 4.9 acres of residue/cow while the least profitable used 3.2 acres of residue.

Feeding to a Body Condition Score

Body condition scores (BCS) describe the relative fatness or body condition of a cow herd through the use of a nine-point scale. A body condition score five (BCS 5) cow is in average flesh and represents a logical target for most cow herds at calving, whereas a BCS 1 is extremely thin and a BCS 9 cow is extremely fat. Target first-calf-heifers to calve in a BCS of 6. Feeding to a higher body condition is not economical and feeding to a lower body condition could result in reduced cow herd reproductive performance.

Body condition of beef cows at calving has a dramatic impact on their subsequent rebreeding performance with cows in less than BCS 5 being significantly slower to rebreed. In addition, thin cows at calving (BCS 4 or thinner) produce less colostrum, give birth to less vigorous calves that are slower to stand and these calves have lower immunoglobulin levels, thus impairing their ability to overcome early calf-hood disease challenges.

The ideal BCS for mature cows (4 years and older) prior to spring calving is 5 and should be one condition score higher for first calf two-year-old heifers. The higher condition score is warranted for the younger cattle because after calving they are still growing while suckling a calf plus preparing for rebreeding.

It's much easier to get condition back on cows economically before calving because the nutrient requirements are lower compared to after calving. It is also more economical to get condition back on cows through grazing or grazing along with supplementation, when needed, as compared to hauling high energy feeds to cows to get them in the target body condition. The supply or amount of dormant season grazing will determine if this is an option.

If cows are not in the condition desired, then two feeding groups starting about 90 days before calving would be a good strategy; one group for mature cows in good condition (BCS 5) and a second group for thin cows (BCS 4). Often the thin cows are three-year-olds, pregnant with their second calf, and are thin because they lost body condition while nursing their first calf and didn't recoup their lactation weight loss in the fall after weaning. It may be possible to feed the thin cows with the first calf two-year-olds because the objective for both groups is weight gain while the objective in mature cows in good condition is simply to maintain condition. Also, the feedstuffs used for bred heifers are generally more energy dense (grain, grain byproducts, corn silage, alfalfa, etc.), as opposed to the common foodstuffs used to feed mature cows in good condition (winter range, hay, crop residue).

The most economical way to get females in the target condition before calving is through grazing opportunities as compared to hand-feeding high energy feeds. This is especially true for extended grazing systems that incorporate native range areas. The

key is to have females in adequate BCS going into the winter and then maintain condition during the winter with low input supplements. For females on range this may mean females be supplemented during the late summer while lactating, weaning calves from only thin females or weaning calves from all females in late summer or early fall before forages can not support putting condition back on. Females that have access to crop residues, typically can gain back body condition without supplementation, especially if there is some grain left in the field after harvest.

If mature cows are consistently in the thin group, a thorough re-evaluation of the breeding management program is in order. It could be the genetic production level of the cows simply doesn't fit the feed resource.

Developing Feeding Programs to Increase Body Condition

In order to increase body condition, the ration must meet the nutrient requirements for metabolizable protein, minerals, and vitamins; but exceed the requirement for energy for a given stage of production. Thus, to increase body condition, more energy must be fed, and in a dense enough form that the cow has the capacity to consume it on a daily basis.

Management practices that allow cows to gain body condition by grazing would always be more desirable than feeding harvested forages; however, striving for a BCS greater than 6 for mature cows by either route would likely not be economical.

When developing feeding programs, remember that as cows near calving, nutrient requirements increase as a percent of the ration and in total pounds. It is wise to feed lower quality forages in mid-gestation and save higher quality forage for late gestation and after calving. Lactating cows, for example, may not have the rumen capacity to consume enough low-quality forage to meet their needs.

Table 1 illustrates the amount of energy in megacalories (Mcal = one million calories) required to change body condition of cows. For example, if the goal was to increase the body condition of an 1100 pound cow from a BCS 4 to a BCS 5, the cow would need a total of 207 Mcal of energy beyond her daily maintenance needs (Table 1). This 207 Mcal of additional energy could be supplied by an energy dense feedstuff such as dried distillers grains that has 1.22 Mcal of NE_m per pound (Table 2). If 3 pounds of dried distillers grains were added to the existing ration, it would take 57 days (207 Mcal / (3 lb dried distillers grains x 1.22 Mcal NE_m per lb of dried distillers grains) = 56.6 days) to elevate the cow's body condition from a BCS 4 to a BCS 5. The cow would have to gain about 1.3 pounds per day, not including fetal weight gain, to achieve this change in body condition (75 pounds divided by 57 days = 1.32 pounds per day).

Table 1. Energy Reserves for Different Body Sizes and Condition Scores of Cows

	Mcal Net Energy for Various Cow Weights			
BCS	1100	1200	1300	1400
2	139	151	164	177
3	157	172	186	200
4	180	196	212	229
5	207	226	245	264
6	242	264	286	308
7	285	311	337	363
8	342	373	405	436
9	418	456	494	532

The numbers in the body of the table represent the energy required to move a cow from the next lower BCS to the present one. Nutrient Requirements of Beef Cattle, 7th Revised Edition, 1996. National Academy Press, Washington, DC.

Table 2. NE_m for Some Common Feedstuffs

Feedstuff	NE_m Mcal/lb
Corn, cracked	1.02
Corn Gluten Feed	.87
Dried Distillers Grains	1.22
Wheat, middlings	.92
Milo, rolled	.91
Corn silage/40% grain	.69
Alfalfa hay	.60
Prairie hay, early bloom	.58

Feedstuffs listed other than corn have less energy and would require larger amounts to be fed in order to affect a change of one body condition score. Alfalfa hay, for example, fed at 5 pounds per day beyond daily maintenance needs, would require 69 days of

feeding to change the cow mentioned above from a BCS 4 to a BCS 5. Thus, energy density is a critical factor in feeding cows to change body condition. To change cow body condition during late gestation will require some form of energy dense concentrate such as grain. If feeds with a lower energy density are used, then more days will usually be required to change cow body condition score. These rations will only be successful if the female is in her thermal-neutral zone. Energy demands increase during extremely cold environmental conditions.

Pay particular attention to young females as they are the group most likely to be thin, especially after they wean their first calf. After calving, a diet of high quality of hay or alfalfa will not meet their nutrient needs for energy. In these diets, energy will need to be added in the form of grain, silage, or a grain by-product (corn gluten feed, distillers grains, etc).

Harvested Forages

At some point in time during the winter, harvested forages will be used before and/or after calving. Although I say this, there are systems where cows are fed very little to no hay as calving, weaning, or a combination of time of year when calving and weaning occur. Forages available can differ tremendously in quality. "Average" quality alfalfa, is 16% crude protein and 55% TDN, corn silage averages 8% protein and 69% TDN. Because dry, pregnant, mature cows require 7 to 8% protein and 49 to 54% TDN before calving, alfalfa is used as a protein supplement and feeds such as prairie hay and corn silage are used as energy sources. Feeds like cane hay, sorghum silage, wheat hay, and wheat straw provide similar but slightly different "average" values. "Average" values provide only part of the story on forage quality. As expected, forage quality differed tremendously between the different forages but there are also wide variations within each type of forage (Table 3). The single most important factor influencing forage quality is maturity of the forage at harvest. Such large variation in forage quality can dramatically affect how that feed is used in a ration, and how the cattle will perform. Wouldn't it be nice to know the quality of the forage you have? Is the bale of grass hay you fed the cows this morning 3.4 percent crude protein or 10.0 percent crude protein?

Table 3. Range in Quality of Feeds Tested Using NIR Analysis (DM)

	Crude Protein (%)	TDN (%)
Alfalfa and Alfalfa Grass Hay	12-23	49-69
Grass Hay	3.4-10	41-56
Small Grain Hay	7.2-11	55-63
Corn Silage	8.2-10	65-72

Test forages for quality. Test for crude protein, energy (TDN), and moisture. Knowing forage quality allows for efficient and economical use. Forages of differing quality can

be “targeted” in a feeding program to reduce cost by knowing if?, when?, how much?, and what kind?, of additional feed is needed.

Supplementation Considerations

When determining supplementation programs for cattle when using low-quality forages, it is important to understand how different feeds might react with one-another when fed together. Some feeds when fed together compliment one-another and would have a “positive associative” effect when fed together. Some feeds, on the other hand, when fed together don’t compliment one-another and, therefore, would have a “negative associative” effect. Some feeds may not feed well together because some component or components of the ration is not balanced such that this feed can be well utilized by the animal.

A supplement that would have a positive effect on a low-quality forage would exhibit the following characteristics: 1. Would increase intake of the forage, 2. Would increase digestibility of the forage, and 3. Would reduce the amount of time that the low-quality forage stays in the rumen of the animal.

With the wide array of supplement that are marketed, the different methods of feeding, and the differences in price and ingredients, choosing a supplement can be difficult. A good understanding of the principles of nutrition and digestion by beef cattle, the quality of the forage to be supplemented, the supplement composition, and associative effects that the supplement has on the forage will aid in determining the supplement that will provide the most benefit.

This part of the paper is written with the assumption that the primary component of the diet is low-quality forage. The data presented will be discussed assuming that the goal is for optimum utilization of the forage to meet the nutrient requirements of the animal at a given production level. We will also focus on the aspects of interactions of nutrients that are available to the microorganisms in the rumen and the resulting associative effects of the supplements on forage utilization.

In formulating diets for beef cattle, many times, associative effects of feeds are ignored, and it is assumed that each feed will contribute the amount of nutrients without interfering with other feeds. For example, formulating a diet using 20 pounds of hay containing 90% dry matter, 45% TDN, and 5% protein and 4 pounds of corn containing 88% dry matter, 90% TDN, and 10% protein would result in feeding 22.3 pounds of dry matter, 12 pounds of TDN, and 1.3 pounds of TDN. The problem with this approach is that often we forget that much of this feed will be altered by the organisms in the rumen before it is absorbed by the animal. In actuality, with the above diet, may have more or less TDN and protein absorbed by the animal, depending on how the forage and corn interact with the microbes in the rumen. This interaction of two or more feeds are called associative effects. These effects can either be positive, negative, or no effect, resulting in improved, decreased, or no effect on utilization of the overall diet.

Associative Effects of Feeds

To understand associative effects, it is essential to understand the chemical makeup of the different portions of the diets and how these portions are acted on by the ruminal microorganisms. The primary energy source in diets of ruminant animals are carbohydrates. All feeds contain both structural carbohydrates and non-structural carbohydrates. Structural carbohydrates or neutral detergent fiber function in the plant to give support, while non-structural carbohydrates are used to in metabolism. It is very important to understand the difference between these two types of compounds, and how they are metabolized by the microorganisms in the rumen. Structural carbohydrates are primarily cellulose and hemicellulose and make up a large portion of the carbohydrates fraction of forages and other roughage. The digestion of structural carbohydrates is conducted in the rumen by the microorganisms, and depending on the complexity of the chemical bonding, usually the rate that they are digested is fairly slow. Few, if any, of these compounds would be available to the animal with the aid of the microorganisms. In contrast, non-structural carbohydrates are composed of starches, sugars, and other simple carbohydrates. These compounds can be digested by the microorganisms in the rumen or can be digested by the animal. The rate of digestion of these compounds is much faster than for structural carbohydrates, and the percentage that is digested is higher than with structural carbohydrates. Grains are high in non-structural carbohydrates.

Table 4. Effect of Cottonseed Meal Supplementation on Ruminal Retention Time and Intake of Low-Quality Prairie Hay

		Cottonseed Meal	
	None	**1.75 ld**	**Change**
Rumen Retention Time, Hr	74.9	56.5	-32%
Hay Intake, % of body wt.	1.69	2.15	0.27

Knowing forage maturity is important when considering associate effects of feeds. As forages mature, the percentage of structural carbohydrates increase with a corresponding decrease in the non-structural carbohydrates. The digestibility of the structural carbohydrates also decrease as forages mature. In studies conducted at the University of Wyoming using native meadow forages harvested at two different maturities, the digestibility of the structural carbohydrates was 45% in the late-cut or mature forage compared to 60% in the early-cut forage.

Examples of Associative Effects

Protein supplementation of low-quality, low protein forages results in a positive associative effect. Data (Tables 4 and 5) illustrates this concept. The prairie hay used in this study was less than 5% crude protein. When the ration was supplemented with 1.75 lbs of cottonseed meal, retention time of the forage was reduce 32% which resulted in an increase in feed intake of 27%. Because hay intake was increased, the animal has a better chance of meeting the protein and energy requirement without supplementing

other feeds. Because retention time was decreased, one could postulate the protein supplementation in this situation also increased digestibility of the hay.

Table 5. Effect of Alfalfa Hay or Cottonseed Meal on Performance of Weaned Heifers Grazing Dormant Blue Grama Rangeland

	No supplement	.8 lbs CP from alfalfa hay	.8 lbs CP from cottonseed meal
Supplement dry matter lbs.	0.0	4.0	1.9
Supplement TDN, lbs	0.0	2.3	1.5
Average daily gain, lbs	-.07	.51	.53

In contrast, when cattle are fed low-quality hay as the major part of the ration and supplemented with corn cows lost weight and condition. Data from a production trial conducted in Nebraska at the Gudmundsen Sandhills Laboratory are illustrate in Table 6. Cattle were fed either .63 pounds of protein from a 32% protein supplement that supplied 1.6 pounds of supplemental TDN, .63 pounds of protein and 2.6 pounds of TDN from a protein supplemental plus 3 pounds of ear corn, or .28 pounds of protein and 2.6 pounds of TDN from 3.5 pounds of ear corn. Cows grazed dormant native range (low-quality forage) during the 112-day period. Cows receiving the 32% protein supplement gained 15 pounds while cows receiving 3 pounds of ear corn lost 40 pounds. The cows receiving the 3.5 pounds of ear corn lost 121 pounds, however these cows received less supplemental protein than the cows on the other treatments. Metabolism studies indicate that corn at levels at .25% of body weight or lower should not decrease

Table 6. Effect of Ear Corn on Performance of Cows Grazing Dormant Native Sandhills Range

	.63 lb CP 0.0 lbs ear corn	.63 lbs CP 3.0 lbs ear corn	.28 lbs CP 3.5 lbs ear corn
Supplement dry matter, lbs	2.0	4.0	3.5
Supplement TDN, lbs	1.6	2.6	2.6
Initial weight, lbs	1158	1154	1164
Weight changes, lbs	15	-40	-121

forage utilization, however in this study the weight change of cows fed 3 pounds of ear corn (.26% of body weight) was 55 pounds below that of cows receiving only the protein supplement.

There is evidence the supplementation of small amounts of corn (grain) when cattle are fed low-quality forage results in a reduction in the digestibility of the hay in the rumen and; therefore, a reduction in forage intake.

Supplements

Data would suggest that to optimize forage utilization it is important that the animals DIP need be met. Meeting the DIP requirement appears to result in positive increase in intake and digestion of low-quality forages.

Protein Supplements and Low-Quality Forages

Protein supplements such as soybean meal, cottonseed meal, sunflower meal, and alfalfa hay appear to have a positive contribution when added to a ration that is a low-quality forage. Small additions of cottonseed meal to the ration increased digestibility of the low-quality forage and reduced retention time of the forage in the rumen. Protein sources mentioned above are readily digested in the rumen and do an excellent job of meeting the animal DIP requirement.

High-quality forages also have application as supplements for mature low-quality forages. Data from New Mexico State University indicate that heifers grazing dormant rangeland responded similar to supplementation of alfalfa hay when fed at an equal level of protein as they did to cottonseed meal (Table 5). Heifers receiving no supplementation did not gain any weight in this trial. Other studies have indicated that alfalfa hay supplementation of low-quality forage is equal to soybean meal.

Processed Grains as Supplements With Low-Quality Forages

Some by-products of the milling and processing industry offer feeds that are low in non-structural carbohydrates, and contain structural carbohydrates that have a high digestibility. Wheat mids and corn gluten feed appear to be feed sources that may be fed in small amounts when the majority of the ration is low-quality forages. These feeds are high in DIP and, therefore, one would expect a positive effect on forage intake and digestibility.

Cows receiving the supplement containing high levels of soybean hulls while grazing dormant native range consumed less forage, however, little difference was observed in the forage TDN content of the forage and these cows gained 39 more pounds than cows that received the supplement low in soybean hulls. Soybean hulls do not appear to have a negative associative effect on forage digestibility.

Researches at Oklahoma State (Table 7) evaluated wheat mids as a supplement for fall and spring calving cows grazing dormant native prairie. Cows received 1.2 pounds of protein and .8, 2.2, 4.9, or no wheat mids. The spring calving cows increased weight gain as level of wheat mids increased in the supplement. In contrast, the cows that had calves on them during the supplementation period all lost weight, with no difference in weight loss. The calves on these cows receiving the higher levels of wheat mids were 11 to 15 pounds heavier at the end of the supplementation period (difference was not significant). Any extra energy supplied by the supplement may have gone to increase

milk production instead on increasing cow weight.

Table 7. Effect of Wheat Mids-soybean Meal Based Supplements on and Performance of Spring and Fall Calving Beef Cows

	1.2 lbs CP 0 lbs wheat mids	1.2 lbs CP .8 lbs wheat mids	1.2 lbs CP 2.2 lbs wheat mids	1.2 lbs CP 4.9 lbs wheat mids
Supplement dry matter, lbs	3.0	3.75	5.0	7.5
Supplement TDN, lbs	2.4	2.8	3.6	5.1
Spring calving cows Weight change, lbs	50	68	89	125
Fall calving cows Weight gain, lbs	-114	-119	-126	-102

Energy Supplementation When Feeding Low-Quality Forage

Many times rations that are composed of primarily low-quality forage do not meet the animal's protein requirement but also fall short in meeting the energy requirement. As mentioned earlier, some of the feeds that are processed grain by-products contain high amounts of protein, especially protein that is readily broken-down in the rumen, but also contain high amounts of energy. It seems that processing these grain changes their composition such that the energy components of these feeds have less or no negative association when fed with low-quality forages. Therefore, if energy and protein are needed in a ration for cattle being fed low-quality forages, corn gluten feed, wheat mids, and soy hulls work well in the ration. Also, alfalfa hay should be considered.

The discussion in this paper does not imply that corn or other grains should never be fed with mature forages. In situations where forage is in short supply, it may be more economical to discount the TDN value of the forage and to use grain to provide the additional energy. It appears important that when grain, such as corn, is fed in small amounts along with low-quality forages that the ration be balanced for DIP. If DIP is balanced, then some of the negative effects of starch (corn) on forage intake and digestibility are less evident. In all situations, it should be realized because of associative effects of supplements on forage utilization, use of traditional methods to calculate energy intake that do not correct for adjusting for intake of the forage may result in error.

Limit Feeding Concentrate Diets To Beef Cows

In years when hay and forage production is low due to drought hay prices often escalate, and in severe cases forage of any kind may be hard to obtain. In situations like this, some producers need to consider limit feeding high concentrate rations to cows. Depending on the price of grain, nutrients to maintain and grow cattle may be cheaper to

purchase through concentrate feeds rather than roughage. This appears to be a year that this is true.

This nontraditional approach is often referred to as "limit feeding." The basic principle is to feed corn(or some other high energy source) and a supplement in just enough quantity to meet the animal's requirement for maintenance or a targeted level of weight gain. Generally, a very limited amount of roughage will be fed, or enough to keep the animal's digestive system healthy. These rations are much more nutrient dense compared to an alfalfa hay or dry grass, and the amount consumed is limited. Otherwise, there is not benefit in terms of feed cost savings and cows fed high grain ration become too fleshy.

Limit feeding is not for everyone. In fact, this technique may be limited to a small percentage of cattle producers. Adoption is limited by the additional labor requirement, management skills, feed storage capacity, and the availability of feed bunks, feed delivery equipment, and a sacrifice pasture or dry-lot. The cost effectiveness of limit feeding will depend on each producer's price of alternative forage, the price of grain, and the price of the supplement needed for the hay or the limit feeding program.

Feeding Management

Table 8 includes guidelines for rations based on corn grain, supplement, and a minimal amount of long stemmed hay. The amount of supplemental protein needed in the ration will depend on the quality of the hay used in the ration. If the hay is alfalfa, then there may be little or no need for the protein supplement. When designing limit-fed grain rations it can't be stressed enough that the forages need to be analyzed for nutrient value and ration be carefully balanced, weighed, and delivered. During drought years, some of the corn crop may be contaminated with aflatoxin, a toxic compound produced by molds.

Table 8. Guidelines for limit-fed rations based on corn grain.

	Amount to be fed		
Stage of Production	Corn	38 to 44% Protein supplement	Long stemmed grass hay
Gestating	.75% of body weight	2 lbs. per day	.5% of body weight
Lactating, avg. milk	1% of body weight	3 lbs. per day	.5% of body weight
Lactating, high milk	1.1% of body weight	3.5 lbs. per day	.5% of body weight

Additional Management Tips When Limit-Feeding

Feeding diets high in grain to breeding females will require greater skill and

discipline on the part of the herd manager. It is essential that you have a way to deliver the ration accurately. In most cases, some type of feeder wagon will be needed. Acidosis, bloat, and founder are always a risk when high-grain diets are fed to ruminants. These risks can be minimized by the following management practices:

1. When starting the concentrate feeding program, gradually increase the amount of grain fed and reduce the amount of hay over a 10 day to two week step-up period.
2. The grain must be weighed accurately and fed daily.
3. Provide plenty of feeding space to accommodate uniform consumption. A minimum of 24 to 30 inches of linear bunk space per cow should be used, more it the cows are horned.
4. Whole shelled corn is safer to feed compared to finely processed grain. If the grain must be processed, it should be coarsely cracked.
5. Long stemmed hay should be fed at a minimum DM level of .25% and up to .5% of body weight for cattle receiving whole shelled corn. If cracked or rolled corn is used, provide a minimum of .5% body weight hay DM, but do not exceed .75%. Feeding less hay reduces the cost, but increases the need for greater management intensity. If hay is chopped, make it as course as possible. Bloat may occur if finely chopped hay is fed in these rations. The purpose of the hay is to maintain a healthy rumen and decrease the possibility of bloat.
6. Feeding an ionophore will help prevent acidosis and bloat as well as reduce the amount of feed needed by 7 to 10%. Rumensin® is currently the only ionophore cleared for feeding to beef cows, and should be fed at the rate of 100 to 200 mg per head per day.
7. Feed cattle limit-grain rations at the same time every day. Altering the time of feeding, especially in limit feeding programs, greatly increases the risk of digestive upset.
8. The total pounds consumed per day will be less than what the cattle are accustomed to. The cattle will likely act hungry for the first few days. They will also have a gaunt appearance. Resist the temptation to feed more because they act or look hungry.
9. Cubing the ration will make grains less competitively economically compared to forages.
10. Consider separating off younger cows and feeding them separate form mature cows.
11. Monitor body condition of cows closely and adjust amount of concentrate to maintain a body condition score of 5 for mature cows and 6 for first-calf heifers.

Relative Values Of Protein Supplements

There are several ways to evaluate a protein supplement. Cost per ton is perhaps the most obvious but the intrinsic cost factors must also be evaluated as well. Management from one operation to the next can vary tremendously in terms of the amount of home-raised supplemental ingredients raised as well as labor and time constrains to the beef operation. Current trends indicate that the number of beef operators having a part-time

job on the side is increasing with many undoubtedly finding themselves in a time pinch. Unfortunately, supplemental protein is often purchased as a convenience item. Consequently, the manager may be unknowing over supplementing one nutrient to meet the requirements for another unless he/she custom designs the supplement to meet their cowherd's requirements. Thus, costs may be unreasonable.

Regardless of your situation, you should re-evaluate your supplementation program from a cost standpoint (costs due to supplemental ingredient as well as time, management, equipment, etc.) to determine if what you are presently doing can be justified.

A good place to start when evaluating protein sources is to evaluate them on a relative basis of their nutrient content. If feeds that are being compared are relatively similar in moisture content, then the following format can be used. If the moisture content of the feeds are different, then calculate the amount (pounds) of nutrient (protein) on a dry matter basis. Divide price of the feed by pounds of nutrient.

The following equation will help you compare protein supplements:

$$\text{Value of nutrient in supplement} = \frac{\text{\$/lb., cwt or ton of supplement}}{\text{\% of available nutrient}}$$

For example:
Soybean meal costs $176.50/ton ($.0883/lb.) and has 44 percent crude protein.

$$\frac{\$.0883}{.44} = \$.201/\text{lb. of protein from soybean meal}$$

Dehydrated alfalfa pellets cost $108.00/ton ($.0540 lb.) and has 17 percent crude protein.

$$\frac{\$.0540}{.17} = \$.318/\text{lb. of protein from 17 percent alfalfa pellet}$$

Alfalfa pellets cost $80.00/ton ($.040 lb.) and has 16 percent crude protein.

$$\frac{\$.040}{.16} = \$.25/\text{lb. of protein from 16 percent alfalfa}$$

The above calculations work well when the protein sources are assumed to be equally utilized and contain a similar amount of moisture. When NPN is included in the picture, then adjustments must be made to make the true values more realistic. As mentioned previously, urea is not utilized well on roughage rations (only 25 to 50 percent).

Energy Supplements

Energy supplements should be considered when ample quantities of higher protein forages, such as alfalfa hay, is available. As stated previously, energy levels of commercial supplements are difficult to evaluate because the levels are usually not

available from the manufacturer. The best indication of energy in a supplement is the fiber level in the supplement. As a general rule, the higher the fiber in a range supplement, the lower the energy. Grains such as corn, ear corn, wheat, etc., are usually a cheap source of energy. Ear corn can be fed on the ground the same as range cubes, however, the cost of processing the other grains and cubing or investments in feed bunks may offset the apparent low cost. Molasses in range liquid supplements is usually not as high in energy or as desirable in type of energy as supplements containing grain or grain by-products. The sugars in molasses are digested very rapidly and are not in the rumen for a very long period of time, plus the water content is much higher in liquid supplements compared to dry supplements. Consequently the level of energy on an as fed basis is usually lower than comparable all natural plant protein or grain supplements.

Processing Effects on Forage Quality

Some producers might think that processing or grinding low-quality forages changes the quality of the forage. Processing the forage does not change the quality of the forage. Processing does change the particle size, in fact it reduces particle size. Reducing particle size results in increased intake of the low-quality forage and, therefore, the animal has an opportunity to meet nutritional needs by eating more of the forage

Summary

Know cow nutrient requirements and feed and allocate feeds accordingly. Feed cows to a body condition. Putting on to much condition is not economical. Using corp residues keeps cow feeding programs economical. In years when harvested forages are limited, limit-fed grain rations are a feeding alternative for cow/calf producers, especially when grains are cheap. Limit feeding concentrate diets to beef cows is a management technique that will likely be used very infrequently. Grazing forages has always been and will continue to be the most economical and practical way to maintain beef cows.