Stored Feed Needs: How Much? What Quality?

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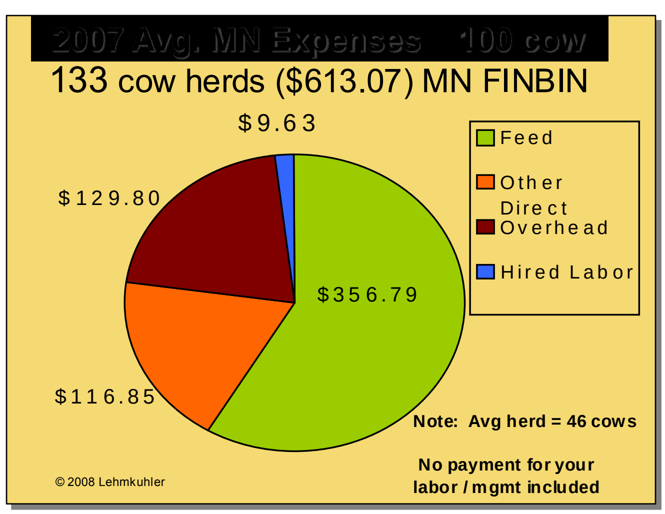
Introduction

Feed resources are the largest variable expense in beef production systems outside the initial investment in the livestock. When we look at Standardized Performance Analysis (SPA) information from Texas and Minnesota, states that are at the extreme from an environment stance, the projected costs for maintaining a beef cow are strikingly similar. It is important to note that these costs include all expenses and opportunity costs. Getting back to the SPA information, in 2007 the annual cost to maintain a cow in Texas was determined to be roughly $590 while the Minnesota value was near $610 or only about $20/cow higher. Looking at the costs associated with feed (grazed, purchased, and stored) it should not be surprising that this was approximately 60% of the total costs for the Minnesota herds. Breaking this down further, stored feeds (hay/silage) and purchased feeds (grain/mineral) accounted for roughly 80% of the feed expenses. We would certainly expect this value to be lower for Kentucky due to the fewer days of winter feeding, but it does reemphasize the fact that stored /purchased feed is an expense that impacts the net return of the cattle enterprise and should not simply be brushed aside. The remainder of this paper will focus on estimating the stored feed needs from a quantity and quality aspect for beef operations. These basic concepts apply to all the species and at the end an example hay inventory sheet is attached for meat goats from Dr. Andries.



Determining Need

Animal Inventory

When considering how much hay or stored feed is going to be needed, one has to decide if this is to be approached from what is needed or what is available. We'll approach this from what is needed which would often be the case when stored feed is plentiful. The other approach could be considered as a drought strategy to determine how many animals can be carried on a set amount of feed. The end result is the same and the total amount of hay is estimated for a group of animals over a predetermined length of time.

First, an animal inventory is needed. One should identify the number of animals in each class. Class is referring to mature cows, bulls, replacements (yearling bred heifers), and calves. This could be broken down even further if we had spring and fall calving cows to account for differences in cow intake and forage consumed by the nursing calf. For simplicity, we'll assume we are working with a spring-calving herd. The number of animals within each class should be recorded as this will be used later. An average weight should also be noted for each class of animal. This weight should refer to the average during the feeding period, not at the beginning or the end. For example, if the calf crop is to be backgrounded for a 75 day period prior to selling and the calves averaged 525 lb at weaning, one should use the average weight of the calves during this time. If the calves are on forage alone and they gain 0.75 lb per day, the average weight during this backgrounding period is close to 550 lbs. Mature cow weights should be adjusted to an average body condition score. If the cows are a bit thin at weaning and average weight of open cows sold was 1,100 lbs with a body condition score of 4.0, one would want to add 70-90 lbs to adjust to body condition score 5.0.

Next, determine the length of time that stored feed is needed or how long hay has to be fed. This obviously is weather dependent with respect to pasture growth, but experience provides a ballpark estimate as to when hay feeding starts and ends. If we assume hay has to be fed starting December 1st and ending April 1st, this is approximately 120 days. Drought years, cool-springs, marketings, and other factors may impact the length of time stored feeds are offered. Combining the animal inventory with the length of time, we have essentially all the information needed to determine how much hay or stored feed is needed.

The stored forage itself, hay in most cases, can play a role in determining how much is needed. Forage quality can impact intakes of the feed. In general, poor quality forages such as straw will have lower intakes than higher quality forages. Therefore, testing stored feed is a valuable management tool not just from predicting intake of hay, but also from determining if, what type, and how much supplement may be needed. In some references Neutral Detergent Fiber (NDF) percentage is used to estimate intake. The equation used is Dry Matter Intake (DMI) as a percent of Body Weight = 120/NDF %. For example a forage with a 60% NDF concentration is estimated to result in intakes of 120 / 60 = 2.0% of body weight DMI. This value is then multiplied by the average weight. A 1,000 lb heifer would have an estimated DMI of 20 lbs (1,000 lbs BW * 0.02 lbs DMI/lb BW). Higher NDF values result in lower expected intakes. This is not perfect as forages high in NDF can have a high NDF digestibility allowing for greater intake. Yet, it can be used to get in the ballpark.

The Nutrient Requirements of Beef Cattle publication by the National Research Council (NRC) is often utilized in models to estimate intakes. Several equations and methods have been investigated to predict intake and it is still difficult to accomplish. As research adds to our knowledge bank, new equations are developed or older equations are improved upon. But in most farm-level situations, these equations again get us in the horseshoe pit as the adage states “close only counts in horseshoes and hand grenades”. The NRC equation often used by the software models utilizes the Net Energy for Maintenance (NEm) value. Again, this value is reported on forage test reports making it easy to obtain and use for estimating intake.

The dry matter content of the forage can also impact how much feed will be needed. We often discuss intakes on a dry matter basis while we know that almost all of our feed has a certain amount of water contained within it. Hay may contain for instance 14-18% moisture in the bale. If a bull has a dry matter intake of 30 lbs on a dry matter basis, the actual amount of hay this bull would eat daily is 30 lbs DM / 0.85 lbs DM/lb hay = 35 lbs of hay as-fed. Compare this to pasture that may contain 80% moisture or only 20% dry matter and this same bull would consume 30 lbs DM / 0.20 lbs DM/lb pasture = 150 lbs of fresh pasture daily. We need to know the dry matter content of the forage to determine how many bales are needed as the bales moisture content may vary and this becomes extremely important in high moisture feeds such as haylage, baleage, corn silage and other wet feeds.

Storage Loss

From the time that hay is cut, raked, baled, and stored, significantly losses can occur with respect to the standing forage yield. With increased costs of hay production, these losses can have a large impact on the net economic return for livestock enterprises. Storage losses are often the most easily observed by producers on a daily basis during feeding. As soon as the bale spear hits the bale and lifts it off the ground after being stored outside since mid-June, the degree of hay loss can be noted from how much hay is left behind on the ground or sloughs off the bale as it is moved to the feeding area. University of Kentucky Extension publication AGR-171 is a good resource covering hay losses during storage. This publication lists hay losses for hay stored outside on the ground at 25-35%. Obviously the type of bale, twine or net wrap and storage method can all impact the degree of loss during storage. This loss cannot be overlooked when estimating the hay needed.

Feeding Loss

Once the hay is made and stored, losses do not stop here. How the hay is fed can impact feeding losses. Michigan researchers investigated hay feeders and how their design impacted hay waste. It was found that the type of feeder could impact hay loss by as much as 11%. Cone feeders which suspend the bale off the ground allow hay to fall inside the feeder rather than on the ground where it is likely to be trampled reduced waste compared to more conventional ring feeders. Unrolling hay is a popular method of feeding hay and believed to be a strategy that minimizes hay waste. Recently, Canadian researchers investigated hay losses when hay was unrolled, processed and fed on the ground or processed and fed in a bunk. Unrolling hay on the snow was found to result in 12% wastage and 19% when processed and fed on the snow. No losses were observed when fed processed and delivered to a bunk. Waste from unrolling will be impacted by the quality of hay as well as the ground conditions. Muddy conditions will increase losses as hay is trampled into the ground along with cold, damp conditions as cattle will lay on the hay more.

A key to reducing hay waste during feeding is to manage how you feed. Purdue demonstrated that increasing the hay supply which would last a single day to a four day supply, without a feeder, increased the percentage wasted nearly three-fold from 11% to 31%. Limiting feed has been shown to reduce feed waste by Purdue and others more recently. Researchers in Illinois reported hay intakes were similar for cows that had access to hay 24 hrs/day compared to cows that only had access for 6 hrs. Hay disappearance was higher for cows with longer access time, but since the hay intake was similar this extra hay was being wasted. Thus, limiting hay offered either through amount delivered daily or through limited access time can reduce hay waste.

Calculating Stored Feed Needs

I'll always remember the simple formula that a long-time Missouri beef producer I worked for taught me on hay needs for beef cows. Mr. Horn stated it in quite simple terms, 1 round bale per cow per month. Nothing is this simple and straight forward or is it? So, the real question that remains unanswered is how much hay is needed?

Recently, we've developed a spreadsheet tool to help you calculate how much hay is needed. A print-out from this tool is shown towards the end of this paper. It allows the user to enter the number of animals by class and average weight. Forage DM and NEm is entered to calculate intake. The user enters the storage and feeding losses. Weights of a few hay bales are entered to determine an average bale weight to convert the pounds of hay needed to number of bales. Again, this is an estimate and should not be considered as an absolute value.

Using the information discussed above, we can also estimate the intake by hand. If NDF is used to estimate intake, intake is determined as a percent of body weight. A 60% NDF forage as we determined earlier results in a 2% DMI as a percent of body weight. For a 1,200 lb cow, this would be a DMI of 24 lbs. Converting this to as-fed, we divide by DM and using an assumed 86% DM value, 24 lbs DM / 0.86 lbs DM/lb = 28 lbs / d of hay as-fed. On a monthly or 30 day basis this is calculated to be 28 lbs hay times 30 days = 840 lbs of hay consumed. If the amount of loss from feeding and storage is estimated to be 15%, then 840 lbs / 0.85 lbs of hay consumed/lb stored = 988 lbs. This is quite close to the weight of a 5' x 5' mixed grass/legume round hay bale. KISS. Keep It Simple Strategy appears to apply here. Mr. Horn's rule of thumb is a simple strategy that can get one into the ballpark. Animal size, bale density, bale size, storage/feeding loss and other factors certainly can skew this rule of thumb.

Quality

Belly full of straw and starving is another older adage that I was told years ago to reemphasize the importance of hay quality. Yet, I would argue that too few consider hay quality as an important component of hay production. How often do we hear, "I got 1,500 lbs of TDN/acre" compared to "It made 10 rolls/acre"? The balance between forage yield and quality can be difficult to balance especially during years with wet springs that prevent early cuttings. However, forage quality is important especially for certain classes of animals. We'll discuss briefly the quality needs in the remainder of the paper.

Class of animal

Nutrient requirements such as protein, energy and minerals are a function of the class of the animal. Lactating cows require more nutrients than a cow that has recently weaned a calf and is in mid-gestation. A 600 lb calf gaining 1.75 lb/d requires less protein than a calf of the same weight gaining 2.5 lbs/d. The NRC lists the recommended nutrient requirements for beef cattle based on the class of the animal and stage of production (i.e. early lactation vs. dry).

Requirement

The recommended nutrient requirements for various classes of animals are listed in the table below. These requirements are based on thermoneutral conditions (no heat or cold stress). Using information from a hay test report and the nutrient requirements, one can match the hay to the class of animal. This can help when lots or cuttings differ greatly in quality to best match the hay to the needs of the animals. For instance in spring-calving cows, it is often recommended that the poorer quality hay be fed to cows first as this usually corresponds to lower nutrient requirement needs during mid-gestation. The higher quality hay is then available in late-gestation and early lactation when nutrient needs are higher. The opposite is recommended for fall-calving cows as they often are at a higher point in the lactation curve early on during the winter making the lower quality hay available later in the lactation curve when the nutrient demand is lower. Higher quality hay should be offered to young calves and developing replacements that are still growing.

	Dry, Mid-Gestational Cow	Cow Peak Lactation 20 lbs Milk	1st Calf Heifer, Peak Lactation 14 lbs Milk	Late Gestation, Bred Heifer	600 lb Steer 2 lb/d gain
DMI, lb/d	24	28	22	20	15
TDN, %	39	59	57	54	64
CP, %	6.1*	10.4	9.9	8.7	11.3
Ca, g/d	17	39	29	17	23
P, g/d	13	26	19	10	9

Values generated using the 1996 Beef NRC computer Requirement software. Thermoneutral conditions.

* Maintain a minimum of 7% available crude protein to support rumen function

Factors Impacting Nutrient Requirements

Environmental conditions can increase the nutrient needs of livestock. Both cold and heat stress increase the maintenance energy needs for livestock. Greater energy is required to maintain core body temperature. Hair coat status impacts the maintenance energy requirement. Wet hair coat during winter months reduces the insulating properties of the hair increasing the maintenance energy needs. Intakes have been shown to increase as a result of cold stress partially compensating for the increased maintenance energy needs. Similarly, cows that do not shed their winter hair coat as a result of fescue toxicosis have greater maintenance energy needs during periods of heat stress. Providing windbreaks and shade provides livestock with strategies to reduce environmental stress.

Ionophores have been shown to reduce the maintenance energy requirements of beef cattle. The increased energy efficiency is accounted for by the NRC by reducing the NEm requirement by 12% while reducing intake by 4%. Research conducted at the University of Kentucky has demonstrated when monensin was fed to beef cows at recommended levels, the daily hay required to maintain body condition and weight gain was reduced by 15%.

Conclusion

Determining hay needs, both quantity and quality, can improve forage management decisions. This allows for planning of late season hay cuttings and increasing opportunities for using acres for stockpiling forage. Recent years of drought should also refresh the notion of carrying over 20% hay for the following year. This hay should be stored in a manner that reduces storage losses. Hay at risk to greater storage loss should be fed first to improve efficiency of stored feed use and lower production costs. Lastly, improving the quality of forage has the opportunity to reduce purchased feeds needed to balance nutrient requirements or support feeder calf gains.