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Hay as Part of a Cowherd Production System

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Hay is a necessary part of cow-calf production systems in Virginia. Hay is forage which is harvested and stored in a dry form when an excess of forage is available, and fed at times when forage is limited or unavailable. This frequently occurs during the winter months when forages are dormant, but can also occur during the summer or fall as a result of drought, or in early spring before sufficient forage growth has accumulated.

Hay should be harvested after forages have made sufficient growth to justify the expense and labor associated with harvesting. Forages decline in quality (described by Total Digestible Nutrients and Crude Protein) as they become more mature. Although a greater quantity is harvested with more mature forage, its nutritive value is much lower. The optimum time for harvesting both grasses and legumes is, therefore, somewhere in the middle range of maturity.

- Grasses - Boot to Early-Bloom stage
- Legumes - Late Bud to Early Bloom stage

Table 1 shows the effect of stage of maturity on hay nutrient content and animal performance. Hay that is cut at an earlier stage of maturity is lower in fiber. This increases digestibility and enables cattle to eat more of it. As a result of higher intake of more digestible forage, animal performance is much higher. Note in Table 1 that Average Daily Gain is almost a full one pound higher for early vs late-cut hay

Table 1. Effect of stage of maturity of fescue hay on feed quality and animal gain

Stage of Harvest	% Crude Protein	DM Intake Lbs/Day	Percent Digestibility	Lb of Hay per Lb Gained	Gain per Day, Lbs
Late Boot to Head, cut May 3	13.8	13.0	68	10.1	1.39
Early Bloom (10% shedding Pollen), cut May 14	10.2	11.7	66	13.5	.97
Early Milk (seed forming), cut May 25	7.6	8.6	56	22.5	.42

From VCE Pub 400-055, Quality Hay Production

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Hay should be harvested in such a way that the time between mowing and baling is minimized. Substantial dry matter losses occur every day the hay remains in the field. Hay crops should be handled carefully to maintain a high quantity of leaf content. Because the leaf is the most delicate part of the plant, it dries much faster than the stem. If hay is too dry when it is worked, such as with a tedder or rake, many of the leaves will fall off. Much more protein and energy are found in the leaf, so management to retain a high leaf content is important to the feeding value of the hay. This is much more of an issue with legumes than with grasses.

Dry matter (or moisture) percentage of hay is critical to its quality. Forages, particularly the legumes, should not be raked or tedded when they fall below 35 to 40 percent moisture. The final drying (from 35-40 percent moisture down to 18-20 percent) should occur in the windrow. Unless some type of preservative is used, moisture in the hay crop should be no higher than 18 to 20 percent when baled. Hay that is wetter than 18 to 20 percent will mold in the bale, thus reducing both nutrient content and animal acceptability. However, if hay is baled at much less than 12 to 15 percent moisture, there is significant leaf loss due to the handling of this very brittle crop.

Even with recent advances in hay equipment, significant losses are associated with the harvesting process. If we consider the crop standing in the field before it is cut and compare that amount to the proportion of that crop that goes into storage, harvest losses range from as low as 10 percent for grasses to as high as 35 percent for legumes. Losses can be much higher if substantial rain falls on the crop as it approaches dryness. However, if no more than an inch of rain falls on hay within a day of being cut, little damage or loss occurs.

Proper storage of hay between harvest and feeding is critical. In Virginia, which experiences around 40 inches of annual precipitation, storage losses of uncovered hay can be substantial. Small square bales, weighing from 40 to 70 pounds, are normally stored under roof. Although there is a lot of labor associated with handling small bales, barns are effective for minimizing losses. Dry matter losses in small square bales stored in barns amount to around 8 percent of the material in the original bale.

Large round bales must be handled mechanically. The size, shape, and weight of these bales limit storage options. Bales cannot be stacked with a spear mounted on the back of a truck or the 3-point hitch of a tractor. A spear or fork on a loader of a tractor allows bales to be stacked either 2 or 3 high, but no higher. As a result, barn storage of large round bales uses available space less efficiently than small square bales stored in the barn. Consequently, fewer tons of hay can be stored per square foot of floor space with large round bales.

Outside storage of round bales is a common practice. Depending on the size of the bale, anywhere from one-third to almost one-half of the hay is located in the outside 6 inches of the bale (Table 2). The outside portion of the bale is most susceptible to weather damage. To protect the hay from substantial loss, water infiltration from the top, sides, and bottom must be prevented.

Table 2. Percentage of the volume of a round bale at different depths of the bale

Depth from outside	Bale Diameter, Feet		
of the bale	4	5	6
2 inches	16	13	11
4 inches	31	25	21
6 inches	44	36	31

One key to reducing hay storage loss is to break bale contact with the ground. Using such methods as a gravel base or stacking bales on pallets, poles, or old tires effectively reduces the wicking of moisture into the bale from the ground. Plastic caps, or other means of protecting the top of round bales, reduce losses further (Table 3).

Table 3. Storage method and dry matter (DM) losses of large round bales of fescue hay

On Ground	Yes	Pallet	Pallet
Top Cover	No	No	Plastic Cap
Initial Wt, lb DM	771	770	748
Final Wt, lb DM	565	632	682
DM Retained, %	72.2	81.1	91.4

From M. H. Poore et al., 1991 North Carolina State University, Raleigh.

An additional advantage to reducing losses from weather damage is the increased acceptability of the hay by cattle. Weather-damaged hay is not readily consumed by cattle, and excessive feeding losses can occur as a result of their refusal to eat the damaged hay (Table 4).

Table 4. Effects of storage method on nutritive value of large round bales

Storage Method	Dry Matter Loss, %			Digestible D M, %	DM Intake % of Body Wt
	Storage	Feeding	Total		
Inside	5.5	9.9	14.8	54.3	2.10
Outside and Uncovered	16.9	19.1	32.8	52.2	1.93
Outside and Covered	10.5	9.7	19.2	55.8	2.08

Six trial summary, as reported by S.R. Rust, Michigan State University, East Lansing.

Covered round bale hay is just as readily consumed by cattle as is hay stored inside. Hay digestibility and dry matter losses (combined storage and feeding) are very similar for inside and outside-covered storage techniques. The nutrient requirements of cattle are more likely to be met with quality hay that is well stored. Consequently, less, if any, purchased supplemental feed is required to properly nourish the cattle.

Feeding systems for round baled hay differ in cost, labor required, and feed wasted, as shown in the following chart.

Method	Consideration
Self-fed with unlimited access to all bales	High feeding loss and waste
Self-fed with access to just a few bales	Low cost, still moderate loss and waste
Self-fed using a hay feeder or hay ring	Low feeding loss, space per head is an important factor
Unrolled for feeding	Possible high feeding loss, depends on amount fed per head
Chopped and fed daily in a trough or bunk	Low feed waste, high equipment cost

Feeding loss and waste result from giving cattle more than a daily supply of hay, and using a feeding method that allows cattle to trample and lie in the hay that is fed. This loss can amount to one-third to one-half of the hay that is offered. Uneaten hay kills the grass underneath it and creates unwanted muddy areas after a rain or snow.

Feeding only the amount of hay required by cattle on a daily basis drastically reduces waste. One way to do this is to match bale size to daily cow requirements. For example, a bale that weighs 750 pounds when it is fed contains enough hay for 30 cows if they require 25 pounds per head per day. If one 750-pound bale is unrolled daily, 30 cows

will consume the entire bale with very little waste. However, if a 750-pound bale is unrolled daily for 20 cows, there will be 250 pounds of uneaten hay that will be trampled, spoiled, and wasted. Thus, matching bale size to cow numbers is one strategy to use in reducing feed waste.

When feeders and hay rings are used, consideration must be given to the space available around the feeder for adequate animal access to the hay. A round hay ring only has enough space for 10 cows to eat at a time. The more aggressive, boss cows will eat first and consume the more desirable hay. The more timid cows will be forced to eat the lower quality material or to go hungry. In either case, they are undernourished.

Using the above example, one 750-pound round bale is needed for 20 to 30 cows per day. A hay ring only allows 10 cows to eat at one time. To feed a 30-cow herd we could use one hay ring that is filled daily. A better alternative would be to use three hay rings that are filled every three days. This gives every cow in the herd the opportunity to get all the hay she wants, and the supply delivered will last for three days. A similar type of calculation would be used with other types of hay feeders. The three factors to consider are:

- number of animals
- hay needed per animal each day
- amount of hay in each bale

Grazing is much more economical than feeding hay. Cattle harvest their own feed, so no labor is needed. Feed quality is higher. Amount to feed each day is not a consideration when grazing. The forages available to extend the grazing season into the winter include:

- crop residues, such as corn stalks
- stockpiled fescue, or other species that have been accumulated for fall/winter grazing
- small grain cover crops
- other fall crops planted for grazing, such as turnips

Such forages are best utilized by strip grazing to limit cattle to a portion of the area. This reduces trampling loss and enables cattle to more fully utilize the forage.

Grazing during the fall and winter can greatly reduce the amount of hay needed for wintering a cowherd, resulting in a reduction in winter feed cost. Collins et al., (1987) demonstrated this in a calculation of the cost savings for fall grazing. They used the following assumptions:

35 spring-calving cows
135 days of hay feeding
the use of stockpiled fescue reduced hay feeding by 45 days
hay was valued at $60 per ton

The cost of hay fed without grazing ranged from $915 to $2240 for the herd, depending on the type of storage system used, and the total storage and feeding loss associated with each system. When hay feeding was shortened by grazing stockpiled fescue, the cost of hay fed was $610 to $1490. This resulted in a savings of hay for the winter season of $300 to $750. The greater savings was realized from the less efficient storage systems, because of the much higher quantity of hay that had to be handled in order to get adequate hay intake by the cows. Calculated hay consumption by each cow was 1.98 tons without stockpiling, and 1.32 tons when stockpiled fescue was utilized.

Hay is a very expensive and labor-intensive form of forage to produce, harvest, store, and feed. In contrast, grazed forages are much lower in both cost and labor required. Grazed forages also generally contain higher levels of nutrition. Cattle producers should take full advantage of their grazing resources while minimizing hay feeding to reduce the cost of producing a pound of beef and to enhance their profitability.

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