

### Quality Hay and Baleage Quick Reference

General Info – This reference guide outlines factors that influence hay and silage losses during harvest and storage. Understanding these factors could lead to management that improves overall quality.

Loss Factors – 1) Growth stage at harvest; 2) Conditions and handling of forage; 3) Baling moisture; 4) Storage conditions

Growth Stage at Harvest – Quality = high protein and low fiber. Leaves = high protein; Stems = high fiber. Delaying harvest by 10 days will result in average decreases of 20% total digestible nutrients (TDN) and 40% protein. Maintain grass in vegetative stages will improve persistence of stand and quality of hay.

Harvest Stage: Grass = late vegetative/boot (Except Bermudagrass = 28 day schedule)

Legume = % bloom

- Alfalfa 10% bloom f/b approximately every 28 to 33 days; last cutting depends on age of stand, vigor/health, fertility, forage need; allow 8 week rest period before freeze (25° F); late fall cutting leave 6 inch stubble and if after freeze baleage will protect quality
- clover 25% and lespedeza 30%

Conditions and Handling When Making Hay – Although losses during curing process cannot be eliminated, an understanding of the three primary areas of dry matter loss can improve overall quality.

Forage moisture at cutting is 75% - 80% and at baling: small square = 22%; round = 18%; large square = 16%

Loss areas: 1) Respiration; 2) Mechanical; 3) Leaching

1. Respiration is moisture and gas exchange through stomata on the leaf surface. Stomata open in daylight and close at night or under moisture stress to regulate respiration.  
**Management:** Cut hay in the morning after dew dries maximizes light exposure. Use wide forage swaths that cover 70% of cut area to keep stomata exposed to sunlight which can speed drying time by 50%, reducing time in field and increasing TDN.
2. Mechanical losses increase as forage moisture falls below 60% during the conditioning, tedding, raking process. As moisture falls below 60%, stomata close and rate of moisture loss from leaf and stem surface begins to slow down. Mechanical conditioning breaks cuticle wax layer and vascular tissue of stems and leaves improving moisture loss rate. Tedding hay can also reduce drying time.  
**Management:** Use properly calibrated mechanical conditioner which can reduce drying time by 30%.
  - Roller conditioners adjust clearance and pressure for grass and legumes (90% of stems should be crimped or cracked). Impeller mower conditioner work best for grass, adjust speed and height.
  - Ted hay early in the morning ideally the day after cutting when moisture is approximately 65% reduces leaf loss (especially for legumes) and potentially reduces drying time an additional 20%.
  - Raking when moisture levels are approximately 35% is a compromise between maximizing drying time and reducing leaf loss (especially legumes). Raking almost dry hay in the morning with dew present will reduce potential leaf loss. Maximum dry matter loss and leaf loss from raking will occur when moisture approaches 20%.
3. Leaching losses occur through rainfall events either in the field or during storage. Rainfall can leach soluble carbohydrates, proteins, and minerals from hay. Rainfall also prolongs respiration which compounds the losses. Highest impact from a rainfall event is after partial drying of forage has occurred in the field. A single rainfall event can leach up 40% of nutrients at this critical stage in the curing process. Rainfall duration and intensity

also affect leaching, where less leaching occurs with short duration, high intensity rainfall compared to long duration, low intensity rainfall.

**Management:** Use practices mentioned in paragraphs 1 and 2 to reduce drying time. Consider chemical drying agents if rainfall is in the extended forecast. Consider baleage to harvest under higher (40%-60%) moisture content. Store baled hay out of the elements.

Baled silage or Baleage – Forage quality is at its highest at the growth stages mentioned earlier. Often, extended spring rains delay harvest well past the optimum time ultimately reducing daily gain (Table 1).

Table 1. Stage of harvest on fescue quality (Montgomery, University of Tennessee).

Stage of Harvest	DM Intake lb/day	% Digestibility	% Protein	Lb of hay fed per lb of gain	Lb of hay per acre 1 <sup>st</sup> cutting	ADG
Late boot to head	13.0	68	13.8	10.1	1334	1.39
Early bloom stage	11.7	66	10.2	13.5	1838	0.97
Early milk stage – seed forming	8.6	56	7.6	22.5	2823	0.42

Baleage preserves the quality of the forage by: 1) allowing more flexibility of harvest timing around ideal growth stages, 2) reduced respiration, mechanical, and leaching losses, and 3) if wrapped properly, reduces storage losses. Baleage does not enhance quality if forage is over-mature, poorly wrapped, and/or baled outside the ideal moisture range.

1. **Baling:** Ideal baling moisture = 50% - 60%; Mower-conditioner can improve ensiling process; Slow ground speed to increase bale density which reduces spoilage; Avoid treated sisal twine because it degrades plastic wrap.
2. **Wrapping:** Wrap within 5 hours of baling is ideal, 12 hours is maximum; Wrap with multiple layers w/ 50% overlap; 4 millimeter thickness minimal and 8 millimeter thickness is ideal for storage; Keep oxygen out therefore minimize handling after wrapping to avoid puncturing; Patch holes.
3. **Ensiling and Feeding:** Fermentation process can vary with forage maturity, temperature and bale moisture. Inoculants can help speed fermentation process if moisture is not ideal. Typically, ensiling takes 6 to 8 weeks. It is best to wait at least 8 weeks before feeding baleage.
4. **Storage:** Baled and wrapped at the ideal moisture range, baleage will maintain feed value for 12 months. If moisture falls outside the ideal range, feed value can decline within 3 to 6 months.

Ammoniation - Low quality grass hay can be baled and treated with ammonia. Ammonia breaks linkages in the fiber that prevent forage digestion and also degrades ergovaline in toxic fescue. The procedure for ammoniation can be found at the following link: <http://extension.missouri.edu/p/AGW1003> . Take note that this bulletin shows bales stacked as 2 on the bottom and 1 on top.

Measuring Forage Moisture – To take out much of the guess work when determining the ideal moisture range for hay or baleage, utilize a commercial forage moisture tester or the microwave oven moisture test. The microwave test is outlined in MU Guide 3151. Basically, collect at least 3.5 ounces of fresh forage and weigh. Dry the sample in the microwave at short intervals (DO NOT LEAVE SAMPLE UNATTENDED and place a cup of water in microwave to reduce potential damage to oven) until weight no longer changes. Percent moisture = (Wet wt. – Dry wt.)/Wet wt.

Markets– Hay market summary and hay listings can be found on the Ag electronic bulletin board at <http://agebb.missouri.edu/> under farm marketing and hay listings.