

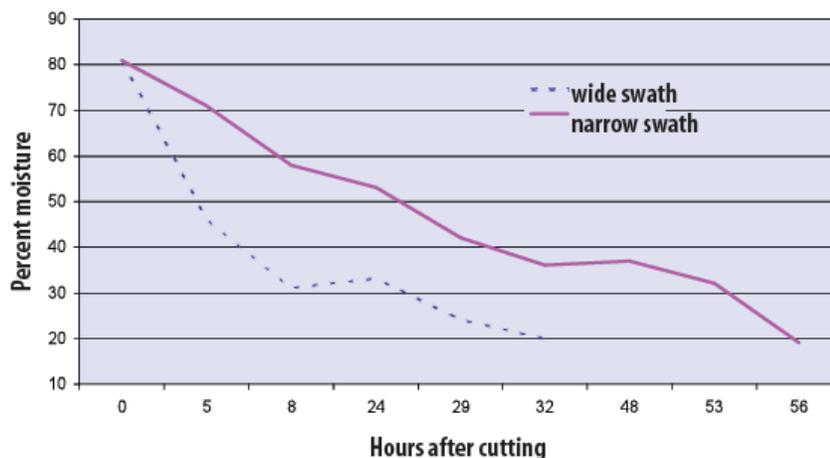
# KEYS TO SUCCESS WHEN HARVESTING ALFALFA AS BALEAGE

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Alfalfa is an excellent forage for high-producing cows and universally considered one of the highest-quality forages. Cows efficiently use the high levels of protein, calcium and high-quality fiber in alfalfa for producing milk and meat. The palatability of alfalfa is high, especially when the leaves are maintained during harvest. Typically, cows will eat more alfalfa than grass because the fiber content is usually lower in alfalfa. Harvesting alfalfa as baleage vs. hay greatly improves the chances maintaining high quality because there is less leaf loss and less loss of soluble carbohydrates. The most important factor is harvesting high quality alfalfa baleage is harvesting at the right maturity stage. A common goal for high-quality alfalfa baleage is to cut in the mid- to late-bud stage, which results in >20% CP, <30% ADF and <40% NDF.

A recent publication by Dr. Matthew Digman, Dr. Dan Undersander and colleagues “Field Practices to Hasten Drying of Hay and Silage” provides a good overview of new recommended field harvesting practices when making alfalfa baleage before baling and wrapping. One of the most important factors is cutting and laying in wide swaths to increase the drying rate as shown in Figure 1. Ideally, lay the crop in a wide swath that covers at least 60% of the cut area. This greatly enhances the initial 20% water loss to reduce plant respiration and preserve sugars. Conditioning is also effective when swath density is low and weather conditions are favorable. Therefore, think about a mower-conditioner’s maximum swath width capability when making a purchase.

**Figure 1. Representative drying curves for narrow and wide swath widths.**



For a copy of this complete publication see the UK Forage Website <[www.uky.edu/Ag/Forage](http://www.uky.edu/Ag/Forage)> under the “Publications” link and then under “Hay.”

The University of Kentucky publication, “Baleage: Frequently Asked Questions” has recently been updated by Brandon Sears and colleagues and provides an excellent overview of the steps for good baleage production and harvest. The following pages contain excerpts of this publication. The complete publication can be found at the UK Forage Website under “Publications” and then under “Silage/Baleage.”

### ***What happens during the baleage ensiling process?***

If high-moisture forage (40-60%) is baled like normal hay, it will soon be rendered useless by explosive microbial activity. However, if this forage is baled and wrapped in plastic, anaerobic microorganisms will ferment some of the carbohydrates in the forage to lactic acid, which will inhibit the growth of detrimental microorganisms. This is the same process that occurs when making corn silage or other types of silage in an upright or bunker silo. The advantage of making ensiling alfalfa as baleage over other methods is that farmers can often use existing machinery they have on the farm with the exception of the bale wrapper. Note: During the ensiling phase the lactic acid producing bacteria will consume some dry matter and digestible energy (mainly water soluble carbohydrates), but this loss is small compared to the dry matter losses that result from raking, baling, tedding, and storing round bales outside as hay.

### ***What should I use to mow?***

Mower-conditioners are the most popular and easiest-to-use mowing implement for the baleage system. This is mainly due to faster wilting and evenly formed swaths. Also, using a mower-conditioner exposes more of the forage’s surface area to the microbes involved in fermentation and can result in a faster pH drop and better fermentation earlier in the ensiling process. However, other types of mowers can also be used successfully.

### ***Can my round baler handle high-moisture hay?***

Most modern variable chamber balers (belt balers) are capable of baling wet forage into a dense package. However, special baleage models are recommended because they are specifically designed to bale wet forage—they have scrapers on the belts and rollers to prevent buildup of material, and they have heavy-duty bearings to help handle the increase in bale weight. Several baler manufacturers offer “silage kits” which can be added to older balers that will enable them to handle baleage. Fixed chamber and variable chamber balers will both work well; however, variable chamber balers are much more popular because they allow the control of bale size and maintain uniform density in the bales. Fixed chamber balers are also capable of making dense

bales but usually form only one bale size. In either case, it is important to drive slowly and maintain a high PTO speed.

### ***When should I bale?***

Baling at the proper moisture content is a key to success in producing baleage. Forage containing less than 40% or over 65% moisture should not be baled for baleage in order to avoid excessive molding or spoilage. Producing bales with too much moisture reduces forage quality, increases the chance of undesirable butyric acid fermentation, and reduces the amount of dry matter stored per storage unit—each of which greatly increases storage costs. Baling with inadequate moisture reduces fermentation and increases mold production, which greatly increase storage losses. Considering all factors, the optimum moisture for alfalfa baleage is in the 45-60% range.

### ***How should I make the bales?***

A slow ground speed during baling helps make tight, dense bales that are less likely to spoil. Plastic twine is recommended, but net-wrap or untreated sisal twine can be used successfully. Treated sisal twine should be avoided since the oils applied during the manufacture process often degrade the plastic film and can result in large storage losses. The most popular bale size is 4 feet wide and 4 to 5 feet in diameter. These bales will weigh 900-1300 lbs. (depending on forage type, bale density, and moisture level) and are best for handling and feeding.

### ***How soon should I wrap the bales?***

Delay between baling and wrapping lowers the quality of the bale because undesirable microbial activity and excessive heating occur while the bale is exposed to oxygen. In addition, waiting too long to wrap allows time for the bale to sag, and a sagging bale is difficult to wrap, uses more plastic film, and wastes time. Ideally, forage should be wrapped immediately after baling; however, research has shown that forage quality is maintained as long as it is wrapped within 12 hours of baling.

### ***How much plastic needs to be applied?***

Stretch-wrap plastic is usually one mil (0.001 in) thick and comes in rolls of 5,000 or 6,000 ft. The plastic is typically pre-stretched 50 to 70% on the wrapper's film dispensing unit to get the correct tension on the bale surface. Always ensure that the tension of the wrap (tacky side toward bale) is such that film is stretched uniformly on the bales. At least four layers should be applied to each bale, but 6 layers provides even better insurance against spoilage. For an individual bale wrapper, the preferred method is the 2+2 system whereby two layers of wrap are applied during one rotation of the bale

by a 50% overlapping of successive layers. Keep in mind that some types of wrappers dispense plastic differently than others. In-line wrappers can be purchased to dispense 4 rolls at a time rather than the standard 2 roll types. The 4-roll system increases wrapping speed. Some in-line wrappers also allow extra plastic to be applied at the joints between bales. If this option is available, apply 2-4 extra layers at these joints. Use the high end of this range if bales lack uniformity or do not match up well at the joints. Do not apply too little plastic or oxygen will penetrate the bale and cause spoilage, mold growth, and feed losses. The plastic used in baleage does not create an airtight seal. Low-density polyethylene plastic such as that used in silage films is four times more permeable to carbon dioxide gas than it is to oxygen gas, allowing the bales to vent excess carbon dioxide gas as fermentation begins.

### ***Should I be concerned with Botulism?***

*Clostridium botulinum* is a bacterium that produces one of the most potent classes of toxins known to man. The spores of these bacteria are widespread in the environment (soils in particular) but are dormant. Under anaerobic conditions and with the right nutrients, the spores can germinate and grow, releasing toxins. To minimize the risk of botulinum toxicosis from baleage, wrap bales at the correct moisture content (45-60%) and store them in areas that will reduce damage to the plastic from the environment or from critters. Type C botulism toxicity is usually associated with decomposing carcasses. This can be a problem if a dead animal is accidentally baled in the baleage or dry haymaking process.

### ***Is baleage higher in quality?***

The feed value of the baled silage will be no better than the quality of the forage at the beginning, and can be worse if the bale was too wet and/or spoilage has occurred. As with conventionally harvested dry hay, quality is a function of forage maturity at harvest, handling during harvest, and storage. Relative to hay, however, the forage going in is higher in quality due to decreased harvest losses (eg – mainly leaf shatter), and the resulting baleage will not exhibit the same degree of losses during storage. Therefore, baleage will be higher in quality than comparable hay.

### ***How soon after wrapping can I feed baleage?***

As mentioned earlier, baleage should be wrapped as soon as possible after baling to exclude oxygen and begin the fermentation process. Forage that is baled in the correct moisture range and wrapped with the correct amount of plastic will undergo the full fermentation process within 6 to 8 weeks (often in less than 4 weeks). Fermentation conditions can vary due to forage maturity, temperature and bale moisture differences. Cool temperatures, mature forage, and insufficient forage moisture levels will reduce fermentation rate. It is advisable to wait at least 8 weeks after wrapping to

begin feeding baleage bales. This will ensure that the baleage is stable and that it does not begin to deteriorate or heat when it is fed. This is especially important when attempting to feed in-line bales because feeding out these bales exposes the next bales to oxygen and spoilage risks.

### ***How long can baleage be stored before feeding?***

The length of storage depends on forage moisture and maturity. Over-mature forage may develop some mold after 3 months. Forage that is baled too wet (>60% moisture) may produce butyric acid during fermentation and cause feed value to be reduced after 3 months. If forages are baled at more than 60% moisture, feed these before they are 3 months old. At 30% to 40% moisture levels, feed value declines after 6 months. In general, forages baled at 40% to 60% moisture will maintain feed value for about 12 months as long as the integrity of the plastic is maintained. However, even where the forage was baled at the appropriate moisture level and the plastic has minimal holes, it is good practice to feed baleage bales within 9 months of when they were made.

### ***How do I determine the proper moisture content of my forage?***

- 1) “Dish rag” test. Take a handful of forage and wring it out like one would wring out a dishrag. If moisture can be expressed from the forage, it is generally above the 65% moisture range.
- 2) Commercially available testers are an option for measuring forage moisture levels. However, accuracy may be a problem. At least three moisture readings should be obtained to create an average value. Commercial testing equipment can be costly (\$200-\$400 range).
- 3) Koster moisture testers are heated, forced-air dryers that are used in silage production to dry down the forage. It takes longer than a microwave moisture test.
- 4) The best method to use is the microwave moisture test. Detailed instructions are found in the following text:

### **Measuring the Moisture Content of Forage Using a Microwave Oven**

1. Chop fresh forage into short lengths (< 1 inch) for ease of handling and uniform drying.
2. Weigh out at least 100 grams (3.5 ounces) of chopped forage.

3. Spread forage thinly on a microwave-safe dish and place into microwave. (A cup of water placed in the microwave beside the sample will help prevent the sample from igniting once dry.)
4. Heat for 1-2 minutes and reweigh.  
- If forage is not completely dry, shake and redistribute the sample, and repeat the heating cycle until the sample reaches a stable weight. (Microwaves vary considerably in drying capacity. It is better to dry for short intervals and reweigh until the last two weights are constant, than to overdry and run the risk of burning and damage to oven.) If charring occurs, use the previous weight.
5. Calculate moisture content using the following equation:

$$\frac{W1 - W2}{W1} \times 100 = \text{Content Moisture \%} \quad \square$$

Where: W1 = weight of forage before heating

W2 = weights of forage after heating

Dry matter (DM) is the percentage of forage that is not water. DM equals 100% minus the % Moisture Content.

Adapted from: Southern Forages 4th Edition, Page 303.