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Baleage: Frequently Asked Questions

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Introduction

Baled silage, or "baleage," is an excellent method for forage harvest, storage and feed efficiency. This publication focuses on common questions about baleage. Together with AGR-173: "Baling Forage Crops for Silage," this information will help producers better understand and use baleage.

Common Questions about Baleage

WHY SHOULD I CONSIDER MAKING BALEAGE?

Baled silage allows forage to be harvested at higher whole plant moisture levels than required for dry hay. Baleage is ideal for spring cuttings of annual and perennial forages when seasonally frequent rainfall events provide little opportunity for properly curing dry hay. Many producers who want to harvest high quality small grain crops have found baleage to be a good fit for their operation.

WHAT HAPPENS DURING THE BALEAGE ENSILING PROCESS?

Forages at 50 percent to 60 percent plant moisture that are baled and wrapped in plastic allow anaerobic microorganisms to ferment some of the carbohydrates in the forage to lactic acid. The accumulation of lactic acid lowers bale pH and inhibits the growth of detrimental microorganisms. Although this process consumes some dry matter and digestible energy (mainly water soluble carbohydrates), these losses are small compared to dry matter losses that result from raking, tedding, baling, and storing round bales outside as hay. Conversely, if high-moisture forage is baled like normal hay, excessive microbial activity will render the forage useless.

WHAT EQUIPMENT WILL I NEED?

A baleage system requires much the same equipment as a conventional hay system, with the addition of a wrapper and plastic. The minimum requirements are a mower, possibly a rake, a baler capable of baling wet forage, a tractor of sufficient horsepower to carry these bales safely, a bale spear, and a wrapper. Some balers have a chopping mechanism that aids in increasing bale density as well as reducing particle size for ease in mixing rations, but this is not necessary in situations where no mixing is needed. Bale spears are inexpensive ways of moving the bales prior to wrapping and just before feeding. Wrappers range in cost from $6,000 to $25,000 or more and differ considerably in labor and equipment requirements. An alternative to purchasing a bale wrapper is to work with a custom operator or rent one from locally.

WHAT SHOULD I USE TO MOW?

Mower-conditioners are the most popular and easiest-to-use mowing implement for the baleage system. Mower-conditioners crush stems, which dry faster and provide a more conducive environment for microbial growth.

Although mower-conditioners are ideal, other types of mowers also can be used successfully.

WHEN DO I CUT?

Cut the forage crop at the maturity stage that combines yields and quality sufficient for your feeding requirements. In general, cut legumes at 10 percent bloom and grasses at the boot stage or just as the head emerges. Ideally, rye and triticale should be cut before the boot stage. In general, early-maturity forage has higher soluble carbohydrate content, essential for proper ensiling. Conversely, over-mature forages will not ferment well because they are coarse, stemmy and have a reduced soluble carbohydrate content.

CAN MY ROUND BALER HANDLE HIGH-MOISTURE HAY?

Some modern variable chamber balers are capable of baling wet forage into a dense package. However, special silage models are recommended because they are specifically designed to bale wet forage. Silage balers have modifications such as 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.

WHEN SHOULD I BALE?

Considering all factors, the optimum whole plant moisture for baled silage is 50 percent to 60 percent. Baling at the proper moisture content is a key to success in producing baleage. Forage containing less than 40 percent or more than 65 percent moisture should not be baled for silage in order to avoid excessive molding or spoilage. Producing bales with too much moisture reduces forage quality and increases the chance of undesirable butyric acid fermentation. Baling with low moisture reduces fermentation and increases mold production, which greatly increases storage losses.

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. Avoid treated sisal twine 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 lb., depending on forage type, bale density, and moisture level. They are best for handling and feeding. Larger bales more than 2,000 pounds require less film per ton but can be very hard to handle.

SHOULD I APPLY ADDITIVES?

Excellent baleage can be made without the use of additives. Additives are not necessary even when ensiling legume crops which have more difficulty reaching stable, low pH. In some situations, Inoculating with *Lactobacillus buchneri* strains can accelerate the rate of fermentation and improve the stability of the silage during feed out.

HOW SOON SHOULD I WRAP THE BALES?

Ideally, wrap forage immediately or within 12 hours of baling. Delay between baling and wrapping lowers feed quality by allowing undesirable microbial activity and excessive heating.

WHERE SHOULD I WRAP?

Wrapping at the storage site minimizes handling of wrapped bales and reduces the potential for damaging plastic.Store bales on a well-drained sod and away from trees or weeds that might harbor rodents and insects that attract birds and lead to plastic damage. Avoid locations with excessively coarse stubble that may cause small punctures. Patch small holes in the bale's plastic using a repair tape treated to resist degradation from UV light (not duct tape).

WHAT KIND OF WRAP SHOULD BE USED?

The plastic wrap used in making baleage is a polyethylene plastic film that is pre-stretched 50 percent to 70 percent by the wrapper as it is applied to the bale. The plastic must be able to withstand the local environmental conditions such as UV radiation and changes in ambient air temperature. Tear strength and tack (stickiness) may also vary among brands of wrap.

Plastic film may be white or black. White plastic is most common in this region since it reflects sunlight better and reduces radiational heating of the plastic.

WHAT TYPE OF WRAPPER IS BEST?

Three major types of wrappers are available and all can produce good baleage. The main types are:

1. platform
2. swinging arm
3. in-line

Platform wrappers simultaneously rotate and revolve the bale on a platform to feed plastic from a stationary roll. Swinging arm wrappers have rollers that open to enclose and pick up the bale before wrapping. The plastic roll swings around the bale on an arm. More recently, integral baler-wrapper designs have become available that wrap the bale just after it is formed. In-line wrappers place bales end-to-end in a row while dispensing plastic from rollers that travel around the bale.

The most common type of wrapper available today is the in-line wrapper due to quick wrapping rates, reduced plastic consumption, and ease of use. Many in-line wrappers have automatic wrapping features with remote control options that allow the producer to operate the machine from the tractor thereby reducing labor requirements.

HOW MUCH PLASTIC NEEDS TO BE APPLIED?

Apply at least four to six layers of UV stabilized plastic per bale. Always ensure that the tension of the wrap (tacky side toward bale) is such that film is stretched uniformly on the bales. 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 percent overlapping of successive layers. Some in-line wrappers also allow extra plastic to be applied at the joints between bales. If this option is available, apply two to four 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.

HOW MANY BALES CAN BE WRAPPED PER HOUR?

Using an individual bale wrapper, experienced workers can wrap 25 or more bales per hour. This number can be doubled with an in-line wrapper.

HOW MUCH DOES IT COST?

Since each plastic roll costs approximately $80 and will cover 25 to 30 bales (four layers), the average cost per bale is $3 to $4. Because the cost of the wrapper varies and the type of wrapper determines the amount of labor and plastic that will be required, the total cost of baleage per ton of dry matter (DM) is highly dependent on the type of wrapper used. In-line wrappers are usually less labor intensive and can use less plastic than the cheaper models.

WHAT IF I FEED A MOLDED BALE?

Even in good baleage, some bales develop a surface white mold. This usually occurs on the flat ends of the bale and around previously undetected pinholes in the plastic. This type of mold rarely penetrates more than an inch into the bale. The animal usually eats around or even discards this portion. Even if ingested, this type of mold should not significantly harm the animal.

SHOULD I BE CONCERNED WITH BOTULISM?

Botulism poisoning of cattle from baleage is not common and can be prevented. Botulism toxicity is caused by the excessive growth of *Clostridium botulinum* bacteria in haylage that has been baled too wet (> 60% MC) and has a pH above 4.5. Clostridium bacteria is common in Kentucky soil and in the carcasses of decaying animals. Forage can become contaminated during raking and baling and from dead animals that get trapped in the baled forage. The risk of botulism toxicity from baleage is minimized by baling at MC less than 60 percent, using at least four layers of plastic, and preventing puncture damage to plastic during storage. If botulism toxicity is suspected, analyze a sample of the forage for pH and moisture content at a certified forage laboratory.

IS BALEAGE HIGHER IN QUALITY?

The single most important factor affecting forage quality is stage of maturity at harvest. The quality of forage cut is the greatest determining factor on the baleage quality. When comparing properly ensiled baleage to properly cured dry hay, forage quality of the baleage is higher due to decreased losses from harvest and storage.

HOW SOON AFTER WRAPPING CAN I FEED BALEAGE?

Forage 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 and but can reach a stable pH in 4 weeks. Cool temperatures, mature forage, and insufficient forage moisture levels will reduce fermentation rate.

HOW LONG CAN BALEAGE BE STORED BEFORE FEEDING?

In general, forages baled at 40 percent to 60 percent 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.

WHAT KIND OF FEEDING SYSTEM DO I NEED TO MINIMIZE LOSSES?

Use a ring feeder, cone-type ring feeder or elevated bale wagon to minimize losses during feeding. Losses can reach 50 percent when feeding without using one of these devices. When feeding whole baleage packages to any species, it is best to feed a sufficient number of animals that will eat the entire bale within two to three days. Baleage also may be integrated into rations by grinding and mixing.

WHAT CAN I FEED BALEAGE TO?

Traditionally, baleage has been fed to beef and dairy cattle but can be fed to sheep, and goats. Baleage is generally not recommended for horses in Kentucky because of surface molding and especially their sensitivity to the Closteridium bacteria that causes botulism poisoning.

To ensure the most efficient use of the quality in a baleage bale, it is important to match the bale's quality to the animals' economic productivity. Baleage can and should be tested for nutrient levels in the same manner as dry hay.

WHAT SHOULD I DO WITH THE USED PLASTIC?

Because the plastic can be used for making baleage only once, plastic disposal is a potential environmental problem. Currently, there are no standard policies for collection and disposal of used baleage plastic beyond deposition in landfills. In the future, used plastic may be collected for recycling. Such efforts have been successful in those areas that have enough plastic to warrant the collection and recycling of other agricultural plastics. Check with your local government or division of solid waste on applicable statutes in your area for disposal or recycling.

CAN I WRAP DRY HAY AS AN ALTERNATIVE TO INSIDE STORAGE?

Some producers who have limited inside space for storing dry hay rolls have successfully wrapped dry hay for outside storage. Typically only enough plastic to cover the bale is needed, usually two layers with about a 20 percent overlap at the edges. For best results, allow hay to go through the sweat period (typically one to two weeks) before wrapping.

HOW DO I DETERMINE THE PROPER MOISTURE CONTENT OF MY FORAGE?

- "Dish rag" test. Take a handful of forage and wring it out as one would wring out a dishrag. If moisture can be expressed from the forage, it is generally above the 65 percent moisture range.
- Commercially available testers are an option for measuring forage moisture levels but are less accurate than forced air dryer or microwave methods. Obtain at least three moisture readings to create an average value. Commercial testing equipment can be costly. Moisture testers for hay are not calibrated for the MC of baleage.
- Koster moisture testers are heated, forced-air dryers that are used in silage production to dry down the forage. The Koster system has a scale to measure weights, but it takes longer than a microwave moisture test.
- Some silage balers can be equipped with sensors that provide a continuous readout of moisture content while the bale is formed.
- A microwave may also be used to accurately measure moisture content.

MEASURING THE MOISTURE CONTENT OF FORAGE USING A MICROWAVE OVEN

(Adapted from Southern Forages, 4th Edition, Page 303)

- Chop fresh forage into short lengths (< 1 inch) for ease of handling and uniform drying.
- Weigh out at least 100 grams (3.5 ounces) of chopped forage. You will need scales capable of measuring small quantities, such as postal scales (available at office supply stores).
- 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.)
- 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.
- Calculate moisture content using the following equation:

$$\text{Moisture Content} = \left(\frac{(\text{Initial Weight} - \text{Final Weight})}{\text{Final Weight}}\right) * 100$$

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

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