

Conserving Forage as Round Bale Silage

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Nearly all farmers face a surplus of forage in late spring and a shortage during the winter. The traditional method of balancing feed supply and demand has been making and feeding hay. However, producing good quality hay requires cutting at the right stage, drying it quickly with minimum leaf loss, baling at low moisture, and storing it under cover.

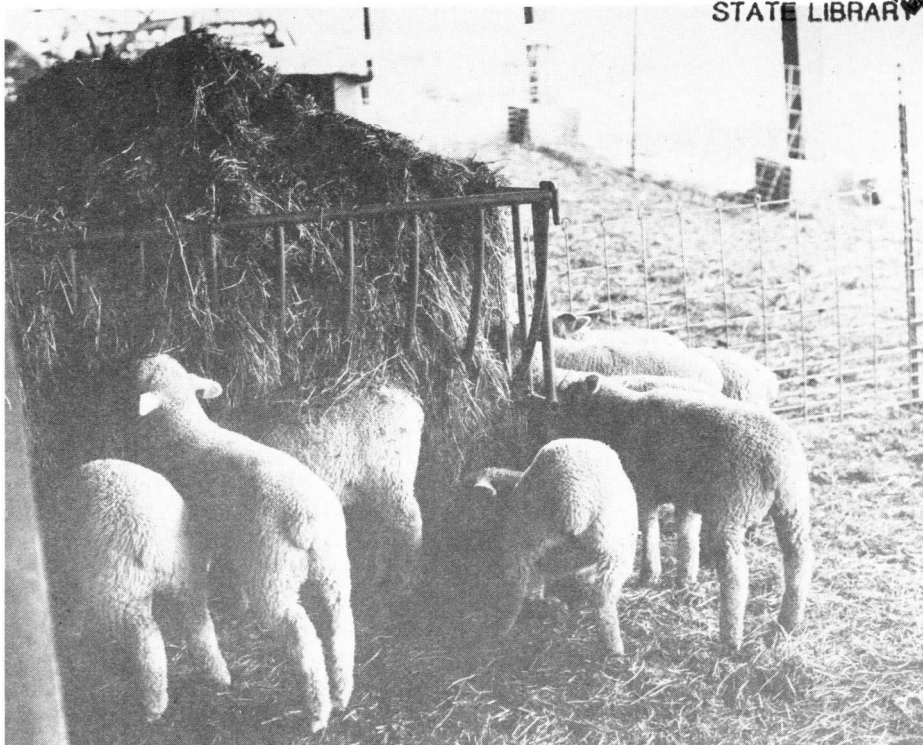
Weather plays a major role in determining the quality of hay produced, and that can be a problem for western Oregon farmers.

Good quality conserved forage requires harvesting at its peak nutrient content. Delaying harvest for good haying weather often results in forage of poorer quality because of increased plant maturity before you cut it. Total tonnage may increase, but nutrient content decreases, and lowered palatability means more animal waste.

Silage: Alternative to hay

Silage has been used for a long time as an alternative to hay because silage doesn't depend so much on harvest weather conditions. We make hay by drying forage, but we make silage by pickling it. In the absence of oxygen, the moist forage ferments, producing various organic acids. When acid buildup reaches a certain level, the fermentation bacteria die, and the silage remains in its preserved state as long as it's not exposed to oxygen.

Silage making usually involves specialized equipment for harvest, storage, and feeding. Round bale silage (balage)



Balage is a high-quality feed for all livestock, including growing lambs.

is a recent development that allows farmers to make silage with existing equipment.

What is "balage"?

Balage is silage made in a large round bale and stored in airtight plastic bags. It's baled at 50 to 70% moisture, compared to about 15% moisture for hay. Since most forage contains 80 to 85% moisture in late spring, it's clear that balage requires far less drying time.

Why should you consider balage?

Balage has several advantages over hay:

You can cut forage earlier and at higher quality because balage isn't so

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sensitive to weather conditions. The shorter drying period also means a lower risk of weather damage.

Your processing losses are lower because you lose fewer leaves during drying and baling. This contributes to higher quality forage going into the bag, particularly for legumes subject to high leaf loss.

Palatability of well-made silage is high. This keeps feed intake high and reduces waste during feeding.

Cutting forage early delays plant maturity and stimulates pasture plants to keep growing. Regrowth pasture has high quality for grazing, and you can extend the green feed period into the summer.

Early cutting removes many weeds before they can go to seed. Once made into silage, even thistles are readily consumed by livestock.

Balage bags are weatherproof, so they don't require covered storage as hay does.

Earlier harvest may increase the availability of custom equipment before the start of the haying season.

How do costs of balage compare to round bale hay?

Balage requires the use of plastic bags, which cost \$5 to \$7 each, depending on size and manufacturer. You can reuse most bags if you properly handle and store them. Initial cost per ton of dry matter conserved is higher, but you don't need to shelter it from weather. Damage to bags (from puncture or rodents) will cause rapid deterioration of balage.

Equipment requirements are similar. You can cut with a swather or mower. Because balage is baled at high moisture, there's usually no need for additional turning of windrows. Your baling costs will be a bit higher because the high moisture content will limit bale size for handling—you'll need slightly more bales per ton of dry matter.

You'll need modified equipment for handling.

Labor requirements at harvest can be higher—you'll need one or two people to apply bags.

You may not have a ready market for selling surplus balage.

Table 1.—Relationship of stage of alfalfa maturity at harvest to crude protein (CP), acid detergent fiber (ADF), and total digestible nutrients (TDN), all expressed on dry-matter basis^a

Maturity	% CP	% ADF	% TDN
Prebud	21.7	28	65
Bud	19.9	31	62
1/10 bloom	17.2	34	58
1/2 bloom	16.0	38	56
Full bloom	15.0	40	54
Mature	13.6	42	52

^aFrom *Nutrient Requirements of Dairy Cattle* (National Academy of Science, Publication No. 1349), 1978.

What's the comparable feed value and use of balage?

Because balage is harvested earlier than hay, it has less weather damage and leaf loss and is more palatable to stock. The net effect is more nutrients harvested and used in the balage system. The dramatic effect of maturity at harvest on nutrient value is illustrated in table 1, using alfalfa as an example (other forages follow the same pattern of nutrient decline with maturation).

Forage analysis results for western Oregon balage samples are shown in table 2. You can quickly see that both protein and fiber content of balage depend upon legume content and stage of maturity when you harvest the forage.

Oregon producers are using balage to meet a variety of feeding needs—as a weaning ration for calves, growing and fattening feed for lambs, supplement for cattle on corn silage, flushing feed for ewes, and wintering feed for beef cows.

Stock performance on balage varies and depends on the quality of balage you feed them. Well-made balage, processed at the right time, has given excellent results; balage made from rained-on mature forage has proven far less satisfactory.

How is balage made?

Cut forage as you would to make hay and allow it to wilt. Weather conditions, type of crop, and the density of the swath will determine the required wilting time. It's important that you don't let the forage get too dry—65% is about the ideal moisture level.

(At 65% moisture, a handful of forage tightly squeezed for 1 minute will unfold slowly, leaving no moisture in your hand.)

Roll the forage into bales to fit the bags you're using—rolling the bales as tightly and evenly as possible helps exclude air and improves fermentation. Remove the bales from the field and take them to the storage area, where you slip them into bags, stack, and tie them.

What equipment is needed for balage?

Most big round balers will work, but the "variable chamber" balers seem to do a better job than those with fixed chambers. Many beginners are tempted to make the bales too big—then the wet bales get stuck in the chamber.

Remember: These bales contain a lot of moisture, and they're *heavy*, so don't overload the strength of your baler, tractor, or loader.

Table 2.—Nutritional analysis of western Oregon balage: crude protein (CP), acid detergent fiber (ADF), and total digestible nutrients (TDN), expressed on dry-matter basis

Forage	% CP	% ADF	% TDN
Red clover, early cut	19.7	31	66
Alfalfa, early bloom	16.8	40	50
Ryegrass-subclover, early cut	13.0	31	66
Ryegrass-subclover, midseason	11.1	35	61
Ryegrass-subclover, late cut	8.5	38	58



Bales are readily transported with a front-end loader—but it must be done carefully!

It's best to move bales with a tractor that has both a front-end loader and a three-point hitch with two tines to slip under the bale. Carrying one bale on the loader and another on the hitch is efficient transportation to the storage site.

Some operators carry bales with a single-loader spike; others use one long (32-inch) spike with a short (12-inch) one below. The spike has to be sturdy enough to handle the load of a very heavy bale. Spikes can be made from a variety of materials, including truck axles.

Tractor strength (horsepower), weight, and center of gravity are important in bale *transport*, especially if you're making balage on rolling or hilly country. Carrying a heavy bale on the loader increases the danger of accidental tipping—*be careful!*

Bag your bales at the storage site. Slip the bags on before you set the bales on the ground and remove the loader tines. Bagging is most efficient when two people work from opposite sides of the bale.

Twist the bags closed at the mouth and double-tie them to ensure airtightness. Be careful when you bag—be sure that bags aren't punctured by coarse material in the bales or damaged by the loader tines.

It's not necessary to remove all *air*. In fact, efforts to remove air with a vacuum cleaner have resulted in bags punctured by forage stems in the bale.

How is balage stored?

Choose a location close to planned feeding sites. It's easier to handle the unbagged bales in dry weather than to move them later for feeding in bad weather. Rodents are a potential risk for damage to bags, so choose storage sites free of vegetation that's attractive to rats and mice.

Preparing a foundation base of pea gravel is a good investment if you expect to use the storage site repeatedly. Balage made from red clover or

immature grain may be more attractive to rodents. Keep an eye out for damage and start rodent control as necessary.

Heavy duty plastic silage bags are made with ultraviolet light inhibitors, so you can store them in direct sunlight. If you carefully remove bags at feeding time, you can reuse most of them. Reducing sunlight exposure (for example, covering with plastic sheeting) probably will increase your reuse rate.

Bags without ultraviolet light inhibitors may be adequate for use in Oregon, particularly in coastal areas.

Roll used bags on a bar or rod and keep them off of the ground to discourage mouse damage. Examine them carefully, especially for pin holes, before you reuse the bags. One suggested method is to stand in bright sunlight and hold the opened bag over your head. Holes are best repaired with suitable tape.

How is balage fed to livestock?

You can feed balage by most methods you'd use to feed round bales. It's most commonly fed with round bale feeders. Another method, used for sheep, is to set the bale on end and surround it with four 4-foot panels attached at the corners. Remove one board of each panel to allow animals access to the bale. Some producers successfully unroll balage for feeding.



Bales can be stacked for storage. A polyethylene sheet under the bales reduces likelihood of rodent damage.

Once you remove balage from the bag and expose it to oxygen, it begins to deteriorate. “Shelf life” is about 1 week, depending on the weather—the warmer the weather, the shorter the shelf life. If you know the approximate weight of your bales, you can quickly estimate the number of stock that a bale will feed (or the number of stock required to consume a bale before it spoils).

Necessary steps in making good balage

The rule to remember in any forage conservation program is that your final product can’t be any higher in quality than the material you used at the start. Mistakes along the way will only reduce quality further. Follow these steps to make good quality balage:

1. Harvest forage at the right stage of maturity:
 - *alfalfa*—late bud to 1/10 bloom stage,
 - *grasses*—early boot stage (before head emergence),
 - *clovers*—preflowering, and
 - *crop residues*—as soon as possible after crop harvest.
2. Bale at 50 to 70% moisture (65% is ideal) with a maximum wilt period of 24 hours. To estimate dry matter accurately, dry forage in a microwave or conventional oven to determine moisture loss.
3. Make the forage bale as dense as possible to exclude air.
4. Use good quality polyethylene bags. Those with an ultraviolet inhibitor are more expensive, but they’ll better withstand storage in direct sunlight.
5. Seal bags by twisting the necks as tightly as possible (tying with twine or fasteners), then double the twisted neck over and tie a second time. Respiration of available oxygen will normally cause the bags to puff up for 2 or 3 days after sealing and then shrink back to bale size. If you spot any bags that don’t expand, open them, check for leaks or holes, repair them, and retie them.
6. Remove and store bags carefully if you plan to reuse them.

Various silage additives are available to enhance fermentation. Results with additives have been variable. Balage properly harvested and processed under the right conditions gives an excellent product, so you *might* consider additives as “insurance.”

Some bales will have a bit of white mold at the neck, particularly if forage was on the dry side at baling. The mold doesn’t seem to reduce palatability for either cattle or sheep. No cases of listeriosis have been reported in sheep fed unspoiled balage.

Summary

Balage increases your forage conservation options, especially if you

have a surplus of spring forage. When made properly, balage is a quality forage with high palatability to livestock.

Don’t consider balage as a salvage or fallback option for rained-on hay, although it may produce a better product than the alternative. Balage can fit into many sheep and/or beef operations by making high quality homegrown forage available for feeding at critical times.

The early forage harvest associated with balage also extends the green feed period by stimulating plants to continue growing longer into the summer. Using balage in your feeding program can result in both higher stock carrying capacities and increased stock performance.

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