Alfalfa Silage

Although alfalfa is traditionally made into hay, weather conditions at the time of first cutting do not always cooperate with haying operations. Alternate methods of maintaining the feed quality of alfalfa include making silage or green chop. Alfalfa silage provides an opportunity to maintain the feed value without curing to 18 percent moisture for hay.

Feeding value

Alfalfa silage is higher in crude protein (CP), calcium (Ca), and phosphorus (P), but lower in total digestible nutrients (TDN) than some other silage materials (Table 1). Rations including alfalfa silage as a substitute for corn silage should be adjusted accordingly.

Table 1. Composition of Various Silages.

	Percent of the dry matter			
Type of silage	CP	TDN	CA	P
Alfalfa	17.1	57.0	1.64	0.26
Corn	8.9	68.5	0.33	0.21
Oats	10.5	55.0	0.26	0.24
Grain sorghum	8.5	65.2	0.28	0.23
Forage sorghum	9.2	57.9	0.30	0.24

Fermentation and pH

The principles of making alfalfa silage are the same as those for corn or other silage. Corn has a high concentration of readily fermentable carbohydrates, however, which makes the ensilage process possible without added carbohydrate. Alfalfa, a high protein feed, requires supplemental carbohydrate for proper fermentation.

When alfalfa is harvested (tops cut), the forage continues to respire actively for some time. In this process, plant enzymes and aerobic bacteria (those that require oxygen) use the readily available carbohydrates to produce heat and carbon dioxide (CO_2), which decreases the available supply. Supplemental carbohydrates are necessary to enable aerobic bacteria to produce lactic, acetic, and propionic acids, which preserve the forage as silage. These organic acids preserve the plant material by reducing the pH to 4.2 or below. This low pH inhibits further bacterial growth and enzyme action. This process takes about 2 to 3 weeks.

The most critical time in silage making is during the first few hours of storage. Long exposure of the forage to air may result in the disappearance of much of the readily available carbohydrate. This may prevent the production of an adequate amount of lactic acid and result in a high pH conducive to deterioration of the plant material. Undesirable bacteria, belonging to the genus

EC 1054

January 1981

OREGON STATE UNIVERSITY EXTENSION SERVICE

Extension Service, Oregon State University, Corvallis, Henry A. Wadsworth, director. Produced and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Extension work is a cooperative program of Oregon State University, the U. S. Department of Agriculture, and Oregon counties. Extension invites participation in its programs and offers them equally to all people.

Clostridium, grow under high pH and result in butyric acid, ammonia, and various amines associated with poor silage quality.

Water content

To reduce seepage from the silo and production of poor quality silage, permit alfalfa that is cut for silage to wilt in the swath or windrow until the moisture content reaches approximately 65 percent. The proper moisture content can be determined by a grab test. Squeeze or wring out the moisture in a handful of the forage and examine the ball. The forage ball should fall apart slowly, with no free juice apparent (see Table 2).

Low-moisture silage can be made from crops wilted to a moisture content between 40 and 60 percent. This type of silage is stored either in airtight or conventional tower silos. Assure air exclusion by filling the silo or bunker rapidly with fine-chopped forage and providing a good seal, as low-moisture silages have limited bacterial growth and fermentation. The most important consideration is the presence and maintenance of air-free conditions. Silages may be subject to spontaneous heating if they have less than 40 percent moisture or if oxygen is available. Spontaneous heating can produce fires or lower the quality of silage by caramelizing carbohydrates and reducing protein digestibility.

Table 2. Determining Forage Moisture Content by the Grab Test.

Condition of forage ball	Approximate moisture content
	Percent
Holds shape, considerable juice	Over 75
Holds shape, very little juice	70 to 75
Falls apart slowly, no free juice	60 to 70
Falls apart rapidly	Below 60

Additives

Feed additives or chemical preservatives are necessary when ensiling alfalfa containing more than 65 percent moisture. Use grains or feeds such as ground corn, barley, wheat, oats, or molasses to provide readily available carbohydrate for fermentation. Mineral acids such as formic, propionic, or lactic acid can be used as an alternative way to reduce the pH. The addition of sodium metabisulfite also has been used to prevent the growth of undesirable bacteria. This bacteriostat has been used less in recent years, however, because it reduces palatability of the silage. The quantity of feed additives and mineral acids needed to preserve alfalfa silage are listed in Table 3.

Table 3. Additives Useful in Making High-Moisture (>65%) Alfalfa Silage.

Additive	Quantity required
	Pounds per ton
Feed grains (ground corn, barley, wheat, oats)	100 to 200
Chopped hay, beet pulp, or ground corn cobs	200
Molasses	40 to 80
Formic, propionic, or lactic acid	20 to 40
Sodium metabisulfite	8

Process of making silage

The following steps are involved in making high quality alfalfa silage:

1. Swath, condition, and windrow (at late bud or early bloom stage of maturity).
2. Allow to dry to 60 to 70 percent moisture.
3. Chop forage from 2 to 5 inches in length.
4. Add readily available carbohydrate or preservative to high-moisture silage.
5. Fill silo or bunker rapidly and pack thoroughly.
6. Use a suitable seal to exclude air (black plastic on bunker or pit silo) .
7. Leave silo undisturbed until ready to use silage.

Following these steps will result in preserving a high quality feed at a time when waiting for haymaking weather conditions could cause a loss of this forage or severely reduced quality due to spoilage.

Prepared by David B. Hannaway, Extension agronomist—forages, Oregon State University. Adapted from C. H. Noller, "Grass-Legume Silage," and R. D. Goodrich and J. C. Meiske, "High Energy Silage," in M. E. Heath, D. S. Metcalfe, and R. E. Barnes, eds., *Forages,* 3rd edition, Iowa State University Press, Ames, Iowa, 1973.