ALFALFA BALEAGE PREPARATION AND QUALITY

Vincent Haby, Ron Randel, Allen Leonard, and Don Neuendorff

Background. Farmers and ranchers in East Texas need a high-nutritive value perennial legume that can be grown in the warm season for livestock feed. Alfalfa fits this description. Through basic and applied research and with recent demonstration activities involving ranchers, Texas Agricultural Experiment Station scientists have evaluated environmental and soil factors that inhibit alfalfa growth in East Texas. Results indicated that sustainable alfalfa production is possible under rain-fed conditions on Coastal Plain soils. Successful alfalfa production on limed acid soils is possible with proper site selection to include, in addition to well-drained soils, evaluation of subsoil acidity for pH above 5.5, liming the surface soil to raise pH to 7.0, and with proper fertilization to include phosphorus, potassium, magnesium, sulfur, and boron. Yields of 12%- moisture hay on five-plus acre sites on five East Texas ranches ranged from 3.6 to 4.5 tons per acre the first season, and from 4.6 to 5.3 tons per acre the second and succeeding seasons. With alfalfa hay valued at $135/ton and establishment costs prorated over five years, economic evaluation indicated net income could exceed $300/acre. One area that needed additional research to improve alfalfa production in Texas high-rainfall regions included determining alternative harvest methods for, and feeding of first harvest ensiled alfalfa.

Alfalfa was cut in the afternoon, monitored for moisture decline, and baled into high-moisture round bales the following morning using a Vermeer heavy-duty baler. Bales were delivered to the feeding location, weighed, sampled, and wrapped with four layers of 'Sunfilm' silage-wrap plastic on a Vermeer bale-wrapping machine. Bales were numbered, allowed to ensile for four weeks, and fed to fallow deer beginning with the lowest moisture hay and progressing to the highest from late spring through late fall. When unwrapped for feeding, each bale was reweighed to determine weight loss during storage. Each bale was also resampled for moisture content. All at-baling and at-feeding samples were analyzed for neutral detergent fiber (NDF), acid detergent fiber (ADF), and crude protein.

Research Findings. Thirty-six large round bales were produced from first-cutting alfalfa harvested from 11.25 acres (Table 1). Mean weight of bales was 1660 lb and ranged from 1260 to 2200 lb. At-baling moisture content ranged from 35 to 65%. Crude protein in these high moisture bales averaged 22.3% and ranged from 19 to 25% while NDF ranged from about 30 to 40% and ADF ranged from 23 to 30%. From wrapping to the time of feeding, bale weights declined an average of 2.78% while moisture increased an average of 0.65% (Table 1). Crude protein also declined during this time while NDF and ADF increased more than 3%. Pearson correlation coefficients indicated the at-baling percentage NDF and ADF were strongly related at

Table 1. Mean and range in nutritive value for high-moisture round bales and baleage at feeding.

Nutritive value factor	*Mean*	*Minimum*	*Maximum*
At baling:		------------------------% (except for weight)------------------------	
Bale weight (pounds)	1660	1260	2200
Moisture	49.2	35.3	64.6
Crude protein	22.3	19.0	24.9
Neutral detergent fiber	33.8	29.5	40.4
Acid detergent fiber	26.1	23.2	30.4
At feeding:			
Bale weight (pounds)	1607	1250	2070
Moisture	49.8	34.3	65.7
Crude protein	21.2	19.1	23.5
Neutral detergent fiber	37.6	31.3	47.3
Acid detergent fiber	29.4	24.3	39.3
Change:			
Bale weight (pounds)	-2.78	-10.73	0.40
Moisture	0.65	-6.50	11.60
Crude protein	-1.05	-3.74	2.34
Neutral detergent fiber	3.74	-3.35	11.98
Acid detergent fiber	3.22	-2.92	10.55

$r = 0.85$ ($p = 0.0001$) and crude protein percentage at baling was negatively related to NDF ($r = -0.51$, $p = 0.0017$) and ADF ($r = -0.44$, $p = 0.0067$) percentages. Similar negative correlations existed, but at a lower level of significance, between crude protein percentage at feeding and the at-baling NDF ($r = -0.33$, $p = 0.0469$) and ADF ($r = -0.33$, $p = 0.0499$) percentages. There were no differences in NDF or ADF based on moisture content at baling. At-baling crude protein was significantly greater in the high moisture-content baleage than in the low or medium moisture level baleage. The high-moisture baleage came from a different ranch and may have been less mature at cutting time. All of the baleage containing less than 44% moisture had areas of mildew estimated to cover one to several square feet on the exposed area of each bale when unwrapped. The five highest moisture bales (above 62%) spoiled during the holding period from wrapping to feeding. The safest moisture range for alfalfa baleage was between 45 and 60%. Regression analyses indicated that the change in NDF from baling to feeding was linearly related to moisture content at baling, and changes in ADF and crude protein from baling to feeding were quadratically related to moisture content at baling.

Application. Data indicated that the best keeping quality of plastic-wrapped alfalfa baleage occurred in the range of 45 to 60% moisture. Delaying baling until forage moisture content drops below 60% but remains above 45% is critical for preserving alfalfa baleage.