HARVESTING, STORING, AND FEEDING SILAGE TO DAIRY CATTLE

Barney Harris, Jr.

Introduction

Silage may be defined as a moist forage stored in the absence of air and preserved by fermentation. Fermentation is carried out by bacteria acting on plant sugars, starches, and cellulose (carbohydrates) in the chopped forage. The bacteria feed on the carbohydrates in the forage and rapidly produce lactic and acetic acids. When the production of these acids reach a certain level, they prevent further bacterial action, resulting in the preserved feed we call silage.

The production of excellent silage requires that forage be stored in the absence of air. If an airtight silo is not available, good packing is needed. For best results, the green forage should contain a Dry Matter (DM) content of 30-40%.

IDEAL	TOO DRY	TOO WET
63-70%	50-60%	80-85%
Moisture	Moisture	Moisture
DM loss 5-15%	DM loss 20-30%	DM loss 20-40%
	(excess mold and rot)	(strong odor)

Preserving forage crops of high moisture content may present problems. When such materials are exposed to the air, microbial activity involving yeasts, fungi, and bacteria takes place and causes high gaseous losses of dry matter. Over extended periods, the product becomes less palatable, frequently inedible, and may become toxic. Aerobic achievement and subsequent maintenance of these anaerobic conditions in storage. Even under anaerobic conditions, forages containing more than 74% moisture are subject to clostridia fermentation. These organisms break down sugars to butyrate and the protein fraction of the forage may be extensively degraded. As a result, the product becomes less palatable and of a poorer quality. Over 20% of the energy contained in the initial fermented carbohydrate can be lost during production of butyric acid.

*Professor and Extension Dairy Nutritionist, Dairy Science Department, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, Florida 32611

Table 1 shows the weight of settled silage per cubic foot in a full silo. Corn or grass silage, well packed in a trench or bunker silo, will weigh an average of 35 to 40 pounds per cubic foot.

Table 1. Weight of settled silage per cubic foot when the silo is full

Depth of Settled Silage (Feet)	Average Weight Per Cubic Foot (lbs.)
7	34.7
8	36.0
9	37.1
10	38.1
12	39.8
14	41.2
16	42.4
18	43.5
20	44.3
22	45.1
24	45.8
26	46.4
30	47.4
34	48.3
38	49.1
42	49.9
46	50.5
50	51.0

The Harvesting Process

The quality of forage harvested is frequently inferior to that which was potentially available for harvesting, due to rainy conditions, mechanical difficulties, labor problems, or perhaps harvesting earlier than desirable. Likewise, the quality of the silage fed may not reflect the quality of forages ensiled, due to conditions associated with improper fermentation such as poor packing.

Certain basic rules must be observed in order to harvest and store top quality silage. Studies at Michigan State, Kentucky, and Florida show that chopping at 1/4 to 3/4 inch (as compared to 5/g to 3/4 inch cut) increases the DM stored per cubic foot 6-17%. Fine chopping is encouraged to prevent storage losses, less separation, ease of packing, and increased digestibility. It is important that the chopper knives and the shearbar corners be kept sharp and properly adjusted. Dull knives tend to beat rather than cut, resulting in poor silage and increased fuel utilization.

Phases and Silage Fermentation

Silage fermentation is frequently divided into five phases. Figure l shows these phases and outlines factors involved in silage fermentation. While phases l, 2, and 3 are not clearly defined, phase l includes the final respiration of plant cells and the production of heat and carbon dioxide. Phase l is important since the stage is set for the production of acetic acid and a lowering of the pH of the fermenting forage. As the pH becomes lower, acetic-acid-producing bacteria decrease rapidly. Thus, phase 2 develops into phase 3 with the initiation of lactic acid formation. The first few days also include the settling of the forage in the silo with increases in rate of seepage, reaching its peak about the 4th or 5th day.

The dry matter content of forages changes rapidly in Florida during the harvesting process. If the harvesting period is extended over periods of more than 10 days to 2 weeks, the forage may become too dry, thereby reducing both the digestibility of the cellulose fraction of the forage and causing more difficulty in packing. If high DM silages (45% or more) are to be ensiled successfully, ensiling should be under gas tight conditions. Studies have shown that fermentation losses of high DM material in gas tight silos is about 6-10% as compared to 25-40% for bunker type silos. Stage of maturity is also important as shown in Table 2.

The Effect of pH - The success of the ensiling process is closely associated with the pH of the fermented forage. The formation of acetic and lactic acids as well as the presence of ammonia and amines have some bearing on pH. In general, legume forages such as alfalfa and soybeans that have high buffering capacities are more difficult to ensile than corn and sorghum type forages. Such crops frequently require additives such as acids or carbohydrates for good fermentation to occur. A pH of 3.5 to 4.5 is needed for storing good silage.

Carbohydrate Content of Forage - The carbohydrate content of forage-varies considerably as shown in Table 3. In general, forages having less than 8% soluble carbohydrates are fairly low and may require the inclusion of additives to improve fermentation.

Table 2. The influence of stage of maturity on corn yield (1)

	Silking	12 Days	25 Days	49 Days Mature
Silage Wt (lbs/acre)	16,000	25,000	34,000	40,000
Dry Matter (lbs/acre)	5,400	8,300	11,700	13,600
Stalks and Leaves	93%	72%	53%	37%
Ears and husks	7%	28%	47%	63%

1 Results obtained at University of Kentucky experiments in 1965.

Table 3. The water soluble carbohydrate (WSCHO) content of various forage crops

Crop	Stage of Maturity	WSCHO (Dry Matter)
Alfalfa	Early Bloom	4.26
Rye Grass	Bloom	10.21
Soybeans	Pods Formed	2.13
Corn	Milk Stage	20.25
Oats	Heading	9.93
Sudan Grass	Milk Stage	13.41
Cowpea	Early Bloom	6.55
Sorghum, Grain	Milk Stage	18.50

Forages low in water soluble carbohydrates and/or high in moisture may be enhanced by the addition of dry feed in the form of ground grain, milling by-products, or even chopped hay to increase the dry matter content.

Phase 4 usually begins 3 to 5 days after ensiling and requires 15 to 20 days for completion. The success of silage making is determined during this phase. There is a gradual increase in lactic acid content until the acidity becomes great (3.8 to 4.2 pH) enough to stop further bacterial action.

Phase 5 represents the keeping quality over an indefinite period. If sufficient amounts of acetic and lactic acids were produced in the first four phases, phase 5 is merely a period during which the silage remains constant. An insufficient amount of acid leads to increased decomposition, reduced palatability, and possible spoilage.

Factors Affecting Silage Quality

There are a number of factors influencing the production of quality silage under the four phases of fermentation. Such factors are fermentation temperature, dry matter of the forage, the effect of pH, available sugars and/or carbohydrates, and rate of filling and packing.

Temperature. The optimum temperature of fermenting forage varies from 90 to 105 F. Temperatures outside this range result in poorer quality silage even though palatability may remain quite good. Underheated silage gives a drab green color, strong aroma, slimy soft tissues, insipid taste, and a pH of about 5.0. Overheated silages, frequently referred to as "heat damaged", range in color from brown to dark brown and have a charred hay or tobacco aroma. In contrast, properly fermented silage is light green to yellow in color, has a pleasant vinegary aroma, firm tissues, and a sharp acid taste indicative of pH less than 4.5.

Heat damage resulting from high temperatures in fermenting forages has received considerable discussion in recent years. The digestibility of protein has been found to be reduced in the presence of oxygen and high temperatures.

The longer the heating the more the protein damage. Also, the rate of damage increases with temperature. Reductions in protein digestibility become quite serious above 120 F Heating appears to not only decrease the availability of protein to the animal but also reduce the availability of carbohydrates. While excessively heated silages remain very palatable and are readily consumed by animals, a considerable proportion of their food value is lost. Temperatures of fermenting forages varying from 800 to 1000 F ????should produce excellent silage.

Dry Matter (PM) Content - Forages high in dry matter present difficulties in packing. Unless good packing is accomplished, anaerobic conditions will be hard to maintain. The result is a higher temperature and pH in the forage. High moisture forage leads to greater seepage losses and possibly butyric acid formation. Seepage losses as great as 35% of the total nitrogen have been reported. Most data suggests an optimum dry matter of 28 to 35%. Table 4 contains information regarding harvesting of forages.

Table 4. Recommended stages for harvesting certain forages

Forage	Stage	Dry Matter
Forage Sorghum	Early Heading	28-35
Grain Sorghum	Late Dough	28-35
Small Grains	Early Heading	28-35
Corn	Medium to Late Dent	28-35

The water soluble carbohydrates in forages are a readily available source of energy to initiate and sustain silage fermentation. In the presence of adequate carbohydrates, the lactic acid bacteria multiply rapidly which results in the production of lactic acid, acetic acid, CO_2, and ethanol as fermenting end-products. Inadequate amounts of WSCHO in silage crops may result from the type of forage, delayed or poor sealing of the silo, stage of growth, harvesting methods, weather, and fertilization application.

Silage Additives and/or Preservatives

Additives can frequently be used to alter or improve fermentation. Forages such as corn and sorghums require no additives when properly harvested at the correct moisture content and properly ensiled. Once the acidity has reached a pH of about 4.0, the silage will keep for years providing it is protected from air and water. A few additives that have been used with varying degrees of success are as follows:

Grains - corn meal, citrus pulp, and similar type energy ingredients may be added to forage (150-300 lbs/ton) to increase dry matter or provide more readily available carbohydrates for bacterial fermentation.

Special Products - a number of products including urea, wet brewers' grains, and ground hay may be used to increase protein, dry matter, moisture, and other alterations as desired or needed.

Formic Acid and Formaldehyde - formic acid acidifies silage and results in improved lactic acid fermentation. Formaldehyde limits fermentation, particularly during the first few hours of ensiling, because of its bactericidal actions. These compounds usually result in improved digestibility of the forage crop to which they are applied. An additional benefit results from the maintenance of the integrity of the plant cell so that high-moisture silages will have less silo leakage. Formic acid and formaldehyde usually are added at about 0.4% of the green plant weight. Unfortunately, the cost has been nearly prohibitive in past years.

Weak acids - propionic acid is an excellent preservative for mold prevention. It has reduced temperature increases in high dry matter silages and helps conserve top silage in open silos. In experimental use, propionic acid has been the most effective preservative. In general, 0.5% to 1.0% of the green forage is applied depending on the moisture content. Benzoic acid and sodium benzoate are also effective against yeasts and molds in wetter materials. Acetic acid has preservative action but volatizes rapidly as heat increases. Because of the high cost of propionic acid, it is often recommended for application only in the last one or two loads of silage at the top of conventional silos to prevent top spoilage. It deserves consideration also in those portions of the silo that will be fed during hot weather since it will delay in-the-manger heating by 12 to 18 hours.

Anhydrous Ammonia - treating corn silage with anhydrous ammonia by the cold flow method prior to ensiling has been shown to be an effective way of adding MPH to corn silage. Most reports suggest the addition of 5 to 10 lbs. of anhydrous ammonia per ton with the preference of 10 lbs/ton. USDA studies at Beltsville using hard-dent corn forage treated with 7 lbs/ton of anhydrous ammonia added at the blower showed an increase in protein dry matter from 9.06 to 11.19%. The fermentation resulted in more lactic acid production on ammonia treated corn silage (4.3 vs. 3.21% in DM). Average daily gains for Holstein heifers in a 91-day growth trial were 1.9 lbs/day for untreated plus urea, vs. 2.3 lbs. for the ammonia treated silage.

Enzymes - products containing enzymes of Aspergillus Oryzae and similar type products have been used in recent years with varying degrees of success. A variety of such products are available in the field even though little or no research data is available on such products. Work at the University of Florida showed a 2.1 lbs. milk advantage when Aspergillus Oryzae product (GX) was used with sugarcane forage ensiled in a Silopress air-tight plastic bag and fed to Holstein cows. The sugarcane silage (as fed) and grain (18% protein) were fed evenly or at a 1:1 ratio to all cows.

Using Different Types of Silos

Structures varying from silopress bags to large bunker silos are found in Florida. The tower or upright silo is less popular on large dairies due to limited storage capacity it offers for feeding large numbers of cows.

Tower Silos - very little seepage occurs from forage ensiled with less than 70% moisture in upright silos. Losses reported in dry matter have normally varied from 8 to 20%. The losses reported from properly harvested forages stored in gas tight silos are usually less than 10%. Greater losses are easily encountered where packing and sealing are poor.

Bunker and Trench Silos - losses in horizontal silos have been observed as high as 30 to 50% in unsealed or poorly sealed silos. In recent years, the applying of plastic film has greatly reduced storage losses. Limited work indicates that low-moisture silage (65-75%) may be preserved at efficiencies approaching those found in conventional tower silos. Average losses from 70% moisture forage stored in well-packed bunker sealed silos is about 10-20% but somewhat higher in unsealed bunker silos.

Covering the Silos

In recent years a number of Florida dairymen have harvested large quantities of forage and stacked them on the ground. In many cases, little attempt may be made to cover or seal the forage to prevent exposure and spoilage losses. Air which gets into the silage mass because of insufficient packing causes spoilage due to heating and poor fermentation. Stacks entirely enclosed in plastic coverings have less spoilage than regular stacks.

Covering the bunker or horizontal silo is important due to the large exposed surface area. Covering with plastic held down with old tires has been a common practice. Silage removed from properly packed and covered horizontal silos is comparable to silage removed from upright silos.

USDA studies showed the use of plastic covers on bunkers and/or stacked forages to be an excellent investment. According to the studies, a 3 to 4 inch layer of spoiled forage covering the silo represents 10 to 12 inches of original silage. The studies showed about 10 lbs. of additional silage dry matter to be preserved for each square foot of sealed surface.

Removal Silage From Silos

It is important that care be used in removing silage from silos, especially bunker type silos, to keep secondary fermentation from occurring. Secondary fermentation involves aerobic deterioration of silage exposed to air and especially silage that has been loosened by mechanical processes. Noticeable signs are surface heating, slimy feel, formation of mold, and in water soluble carbohydrates, short-chain organic acids and starch and structural carbohydrates. On a hot day, the losses in nutrients of the loosened silage could exceed 40%. Feed consumption decreases with corresponding decreases in milk production.

Feeding Corn Silage to Dairy Cows

Corn silage is a succulent and palatable feed that may be fed in fairly large quantities to dairy cows. The amounts fed in most Florida herds vary from 35 to 40 lbs/cow in the very high herd, to 60 or 70 lbs/cow daily in the low producing herd. Two grain mixtures may be needed if the amounts of silage are varied too greatly since protein becomes limiting. The idea is to provide a balanced ration for all levels of milk production.

The two common approaches used in feeding silage include: 1) feeding it as a separate feed and 2) mixing the silage with the concentrate to form a complete feed. The latter system is most popular and has certain advantages. The greater advantages are reduced separation, assured intake of all ingredients in desired proportions, and improved intake of less palatable ingredients.

The composition of several silages used in Florida are listed in Table 5.

Information in Table 6 shows that an 18% commercial feed blended with the listed amounts of corn silage would meet the requirements of dairy cows.

Table 6. Feeding corn silage to dairy cows

	Groups			
	Low	Med.	Med. High	High
Milk Production (lb)	35	50	70	85
Feeding Program				
Corn Silage (30% DM)	55	50	45	40
Hay grass*	8	7	6	5
Grain mix (1 8% CP)	12	20	29	37

*Alfalfa hay is suggested for the high group. DM = dry matter; CP = crude protein.

Dairymen using mixer wagons and purchasing ingredients frequently blend a variety of ingredients together in a manner similar to the rations shown in Table 7. The amounts are multiplied according to the number of cows placed in the group.

Table 5. Average silage analysis 1967-82* (As fed)

Forage	Samples	Moisture (%)	CP (%)	Fiber (%)	TDN (%)	NEL (Meal)
Corn	300	71.0	2.4	7.0	20.1	17.5
Grass-Callie	7	65.0	2.7	10.6	18.0	15.0
Grass - Coastal Berm.	5	66.0	2.8	11.5	17.5	14.0
Grass-Pangola	25	71.3	2.2	10.0	15.1	12.0
Mixed Grasses	45	71.6	2.5	9.7	15.4	11.6
Millet	8	74.5	1.7	8.2	11.9	10.0
Small Grain - Oat	6	64.0	3.0	10.4	18.6	17.6
Small Grain - Rye	5	66.0	3.2	9.5	17.0	5.0
Sorghum - Grain	75	70.2	2.2	7.9	16.5	14.0
Sorghum - Sudan Hyb.	50	75.5	2.1	7.4	12.0	10.0

- Forage samples submitted to the State Department of Agriculture testing lab. CP = crude protein. TDN = total digestible nutrients, NEL = net energy for station as megacalories (Meal).

The mineral mix used in the rations shown in Table 7 demonstrate the importance of changing the mineral composition as ingredients are varied in the ration.

Table 7. Feeding corn silage to high producing cows

Ration 1 85# Milk

Ingredients	lbs	DM	CP	TDN	CA	PHOS
				lbs		
Corn Silage	40.00	12.00	1.00	8.00	0.03	0.02
Cane Molasses	2.00	1.40	0.12	1.30	0.02	.00
Corn Meal	11.00	9.90	0.95	8.80	.00	0.03
Whole Cottonseed	6.00	5.40	1.26	5.40	0.01	0.04
Alfalfa Hay	8.00	7.12	1.52	4.00	0.06	0.02
Soybean Hulls	5.00	4.45	0.60	3.25	0.02	0.01
Distillers grains	4.00	3.60	1.08	3.20	.00	0.01
Soybean Meal (48%)	3.60	3.24	1.73	2.74	0.01	0.02
Mineral	1.30	1.22	0.00	0.00	0.21	0.07
	80.90	48.33	8.25	36.69	0.36	0.22

Requirements (85# Milk)
(1400# BW) 8.20 36.40 0.32 0.20

Ration 2 70# Milk

	lbs	DM	CP	TDN	CA	PHOS
				lbs		
Corn Silage	45.00	13.50	1.13	9.00	0.04	0.02
Cane Molasses	2.00	1.40	0.12	1.30	0.02	.00
Corn Meal	6.00	5.40	0.52	4.80	.00	0.02
Whole Cottonseed	6.00	5.40	1.26	5.40	0.01	0.04
Bermuda Hay	5.00	4.45	0.40	2.00	0.01	0.01
Soybean Hulls	5.00	4.45	0.60	3.25	0.02	0.01
Distillers grains	4.00	3.60	1.08	3.20	.00	0.01
Soybean Meal (48%)	4.10	3.69	1.97	3.12	0.01	0.02
Mineral	1.20	1.13	0.00	0.00	0.19	0.06
	78.30	43.02	7.07	32.07	0.30	0.20

Requirements (70# Milk)
(1400# BW) 7.04 31.80 0.27 0.17

Ration 3 50# Milk

	lbs	DM	CP	TDN	CA	PHOS
			lbs			
Corn Silage	50.00	15.00	1.25	10.00	0.04	0.03
Cane Molasses	0.00	0.00	0.00	0.00	0.00	0.00
Corn Meal	4.00	3.60	0.34	3.20	.00	0.01
Whole Cottonseed	5.00	4.50	1.05	4.50	0.01	0.03
Bermuda Hay	5.00	4.45	0.40	2.00	0.01	0.01
Soybean Hulls	4.00	3.56	0.48	2.60	0.02	.00
Distillers grains	2.00	1.80	0.54	1.60	.00	0.01
Soybean Meal (48%)	3.10	2.79	1.49	2.36	0.01	0.02
Mineral	1.00	0.94	0.00	0.00	0.16	0.05
	74.10	36.64	5.55	26.26	0.24	0.16

Requirements (50# Milk)
(1400# BW) 5.50 25.80 0.22 0.14

Feeding Sorghum Silage to Dairy Cattle

Sorghum, sudangrass, millets, and various varieties of sorghum-sudangrass hybrids have all been grown with good success in Florida. They preserve well when harvested at the right stage of maturity and packed properly in silos.

Grain sorghums are popular forages for making silage. The combine-type grain sorghum makes a very palatable and quality silage and in trials at Mississippi State were found to be equal to corn silage. The corn was harvested in a dent stage and the sorghum (RS6 10) in a milk to soft dough stage.

Forage sorghum hybrids should be selected for their ability to produce forage (dry matter) rather than grain. Silage yields of forage sorghum are usually very similar to those of corn. Experimental trials at various stations have shown that forage-type grain sorghums do not support as high a level of milk production as corn silage.

Sorghum-sudan hybrids and millets are usually harvested between the time heads emerge from the boot and early bloom. If harvested more than once, they may be cut whenever the plants reach an average height of 30 inches or more. However, when cut at an early stage, it is important to wilt the crop to remove excessive moisture and to use a preservative. Sorghum-sudan hybrids and millets are better suited for pasture and green chop than for silage. An analysis of the various forages used for silage is shown in Table 5.

Sorghum silage is fed similar to corn silage in average amounts per cow. High producing cows are usually fed 35-45 lbs. daily with higher amounts to lower producing cows. Dairymen having both corn and sorghum silage are encouraged to use the corn silage for the higher producing cows.

Grasses for Silage

A variety of bermuda grasses including Coastal, Callie, Alicia, and Coastcross l as well as Pangolagrass are frequently harvested and preserved as silage in Florida. Most, however, are used in the production of hay and as permanent pastures. Work at the Coastal Plain Experiment Station in Georgia showed Coastal bermuda grass silage to be inferior to corn silage for lactating cows. In a subsequent study, the addition of 150 pounds of snapped corn per ton improved quality comparable to corn silage. Additional work is needed to determine the affect of ensiling on fiber digestibility.

Using Alfalfa as Silage

Alfalfa and mixtures of alfalfa and grass are frequently used for making silage. This is especially true under adverse weather conditions such as are prevalent in Florida during the summer. Harvesting the alfalfa as silage or green chop reduces leaf losses thereby preserving more nutrients.

While alfalfa forage presents some problems when using as a silage crop, those problems can be overcome with good management techniques and principles.

Alfalfa forage is lower in sugar content than corn or sorghum forage. Also, alfalfa contains more protein and is more alkaline. This alkalinity of alfalfa along with the higher protein content tends to neutralize the acids from sugar fermentation and causes some problems in arriving at the most desirable pH (3.5-4.0). To overcome this problem, wilting the forage to about 30 or 40% dry matter has been used with success (Table 8).

Table 8. Using alfalfa as silage (as fed basis)

	DM (lb)	CP (lb)	TDN (lb)	Ca (lb)	Phos (lb)	Fiber (lb)
Alfalfa, silage	40	7.7	26.6	0.60	.13	13.6
Alfalfa, silage	30	5.8	20.0	0.45	.10	10.2

Alfalfa silage may be used in dairy cattle rations similar to corn or sorghum silage with the exception that adjustments must be made in calculating the calcium and protein needs. Table 9 gives an example of the type of ration needed to use with alfalfa silage or haylage.

Table 9. Feeding program for cows producing 70# milk

	lbs (lb)	CP (lb)	TDN (lb)	Ca (lb)	Phos (lb)
Alfalfa silage	45	2.61	9.00	.208	.045
Hay Bermuda	5	0.35	2.00	.010	.005
Grain mix*	29	4.35	20.00	.145	.130
		7.31	31.00	.357	.180

- 15% crude protein, 70% TDN, 0.5% calcium, and .45% phos.

The level of calcium provided by the ration in Table 9 appears high but would present no problems so long as the level of phosphorus is adequate.

Economic Considerations in Feeding Silage

The economics for growing and feeding silage in Florida have become more favorable in recent years due to the high cost of by-product roughages. Information in Table 10 shows the value of corn silage used in combination with a grain supplement versus a complete feed. Figures shown are based on dairy cows consuming 50 lbs. of corn silage and adequate grain to meet the requirements for 50 lbs. of 3.5% milk versus the consumption of a complete feed with cottonseed hulls to meet the requirements for a similar amount of milk.

Table 10. The feeding value of corn silage per ton based on using a complete feed versus an 18-20% grain supplement to use with corn silage

18-20%	Cost of Complete Feed per Ton*					
Grain	$125	$130	$135	$140	$145	$150
$140	$37.30	$41.20	$45.10	$49.00	$52.90	$56.80
$145	$35.15	$39.05	$42.95	$46.85	$50.75	$54.65
$150	$33.00	$36.90	$40.80	$44.70	$48.60	$52.50
$155	$30.85	$34.75	$38.65	$42.55	$46.45	$50.35
$160	$28.70	$32.60	$36.50	$40.40	$44.30	$48.20
$165	$26.55	$30.45	$34.35	$38.25	$42.15	$46.05
$170	$24.40	$28.30	$32.20	$36.10	$40.00	$43.90
$175	$22.25	$26.15	$30.05	$33.95	$37.85	$41.75
$180	$20.10	$24.00	$27.90	$31.90	$35.70	$39.60
$185	$17.95	$21.85	$25.75	$29.65	$33.55	$37.45
$190	$15.80	$19.70	$23.60	$27.50	$31.40	$35.30
$200	$13.65	$17.55	$21.45	$25.35	$29.25	$33.15
$205	$11.50	$15.40	$19.30	$19.30	$23.20	$27.10
$210	$ 9.35	$13.25	$17.15	$21.05	$24.95	$28.85
$215	$ 7.20	$11.10	$15.00	$18.90	$22.80	$26.70
$220	$ 5.05	$ 8.95	$12.85	$16.75	$20.65	$24.55
$225	$ 2.90	$ 6.80	$10.70	$14.60	$18.50	$22.40
$230	$ 0.75	$ 4.65	$ 8.55	$12.45	$16.35	$20.25

18-20%	Cost of Complete Feed per Ton*				
Grain	$155	$160	$165	$170	$175
$140	$60.70	$64.80	$68.50	$72.40	$76.30
$145	$58.55	$62.45	$66.35	$70.25	$74.15
$150	$56.40	$60.30	$64.20	$68.10	$72.00
$155	$54.25	$58.15	$62.05	$65.95	$69.85
$160	$52.10	$56.00	$59.90	$63.80	$67.70
$165	$49.95	$53.85	$57.75	$61.65	$65.55
$170	$47.80	$51.70	$55.60	$59.50	$63.40
$175	$45.65	$49.55	$53.45	$57.35	$61.25
$180	$43.50	$47.40	$51.30	$55.20	$59.10
$185	$41.35	$45.25	$49.15	$53.05	$56.95
$190	$39.20	$43.10	$47.00	$50.90	$54.80
$200	$37.05	$40.95	$44.85	$48.75	$52.65
$205	$34.90	$38.80	$42.70	$46.60	$50.50
$210	$32.75	$36.65	$40.55	$44.45	$48.35
$215	$30.60	$34.50	$38.40	$42.30	$46.20
$220	$28.45	$32.35	$36.25	$40.15	$44.05
$225	$26.30	$30.20	$34.10	$38.00	$41.90
$230	$24.15	$28.05	$31.95	$35.85	$39.75

*Complete Feed contains 13% CP 64% TDN, 18% fiber, 0.7% Ca and 0.4% phos.

The information in Table 10 is quite simple and should be used only as a guide in estimating the value of good quality corn silage at the feed bunk rather than in the silo. As an example, if a complete feed cost $ l 50 per ton and a 20% grain supplement costs $ 170 per ton, the good quality corn silage would be worth approximately $43.90 per ton mixed and delivered to the feed bunk.

Contracting forages for Silage

In recent years, a number of dairymen have been contacted about purchasing forage for ensiling or the silage itself. Such an endeavor can be very beneficial to dairymen and should be explored when the opportunity presents itself. However, an equitable and competitive price must be reached by the two parties for the endeavor to be economically sound. An actual feeding value must be established.

The level of moisture in silage varies considerably. The variation is mainly due to the amount of moisture at the time of ensiling, the amount of surface area exposed to rainfall, and any seepage that may have occurred during storage. It stands to reason then that the amount of dry matter in silage must be taken into consideration prior to purchasing wet forage.

Table 11 contains a number of values per ton for silage containing different moisture levels. Please note that the price has been varied up and down from the 70% moisture base. As an example, if you agree to pay $18 per ton for corn silage containing 70% moisture and actually receive 75% moisture silage, you would then pay $25 per ton. Purchasing silage on the basis of dry matter is the most important and first agreement that must be settled between the two parties prior to signing a contract.

Summary

Group-feeding of a complete corn silage base ration represents a practical approach to feeding dairy cows where facilities and equipment are available to handle such a feeding system. In general, a mixer wagon with scales is needed and most of the feed is fed outside the milking barn. The grain mixture would be blended with the corn silage in the mixer wagon in such proportions to meet the needs of cows grouped according to production. Also, grain could possibly be added over the silage in a self-feeder wagon, and as the silage is unloaded, the grain is automatically mixed with the silage.

At the beginning of the silage feeding period, the grain mixture should be reevaluated and its protein content calculated: In general, more protein is needed in the grain mixture when corn or sorghum silage is fed. The specifications for protein content in a complete feed containing cottonseed hulls or bagasse pellets is about 13%.

The grain mixture fed in combination with corn or sorghum silage should contain from 16 to 20% crude protein depending on the level of corn or sorghum silage being fed. Less protein is needed in the grain to be blended with corn silage if a high protein supplement is fed in the parlor.

Table 11a. Dry matter equivalent table for determining value of silages with varying moisture content

Percent Moisture	Lbs. Dry Matter Per Ton	-----$ per ton based on DM content----			
80	400	16.00	17.34	18.66	20.00
79	420	16.80	18.21	19.59	21.00
78	440	17.60	19.07	20.53	22.00
77	460	18.40	19.94	21.46	23.00
76	480	19.20	20.81	22.39	24.00
75	500	20.00	21.68	23.33	25.00
74	520	20.80	22.54	24.26	26.00
73	540	21.60	23.41	25.19	27.00
72	560	22.40	24.28	26.12	28.00
71	580	23.20	25.14	27.06	29.00
70	600	24.00	26.00	28.00	30.00
69	620	24.80	26.88	28.92	31.00
68	640	25.60	27.74	29.86	32.00
67	660	26.40	28.61	30.79	33.00
66	680	27.20	29.48	31.72	34.00
65	700	28.00	30.35	32.66	35.00
64	720	28.80	31.21	33.59	36.00
63	740	29.60	32.08	34.52	37.00
62	760	30.40	32.95	35.45	38.00
61	780	31.20	33.81	36.39	39.00
60	800	32.00	34.68	37.32	40.00

Table 11b. Dry matter equivalent table for determining value of silages with varying moisture content

Percent Moisture	Lbs. Matter Per Ton	$ per ton based on DM Content		
80	400	21.33	22.67	24.00
79	420	22.40	23.80	25.20
78	440	23.47	24.93	26.40
77	460	24.53	26.07	27.60
76	480	25.60	27.20	28.80
75	500	26.67	28.33	30.00
74	520	27.73	29.47	31.10
73	540	28.80	30.60	32.40
72	560	29.87	31.73	33.60
71	580	30.93	32.87	34.80
70	600	32.00	34.00	36.00
69	620	33.07	35.13	37.20
68	640	34.13	36.27	38.40
67	660	35.20	37.40	39.60
66	680	36.27	38.53	40.80
65	700	37.33	39.67	42.00
64	720	38.40	40.80	43.20
63	740	39.47	41.93	44.40
62	760	40.53	43.07	45.60
61	780	41.60	44.20	46.80
60	800	42.67	45.33	48.00

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