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Manage Corn Silage for Maximum Value

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Roughages usually provide most of the protein, energy, vitamins and minerals in rations of ruminant animals. Feeding programs that incorporate quality roughages usually provide low cost nutrients for growth, body maintenance and production. The most economical production from your livestock depends on quality roughages blended with other feeds to minimize the need for costly supplements.

Corn silage is a major roughage crop in Idaho. This publication will help you take maximum advantage of corn silage as a field crop and cattle roughage.

Corn silage is unexcelled as a low cost roughage in livestock rations. Nutritionally, it is highly digestible and provides low cost energy. Harvesting and storage can be accomplished with ease at a low cost per ton. Relatively little labor is needed for feeding since corn silage is well adapted to preparation of complete rations.

Like all feeds, corn silage has shortcomings. These must be considered in planning a program designed for maximum economical production.

DRY MATTER

Corn silage can be divided into dry matter (D.M.) and moisture. If you divide 100 lb. of average corn silage, the proportions would be 30 lb. D.M. and 70 lb. water and other volatile fractions. These proportions of D.M. and moisture depend primarily on the stage of maturity. However, water added to corn at ensiling will also influence the proportion. The yield per acre, nutritional value and dollar value are directly related to the amount of D.M. in silage. Stage of maturity influences the total yield of D.M. per acre (Table 1). Maximum free-choice intake of D.M. usually occurs on well-matured corn silage that is about 33% D.M. When the moisture content is higher or lower than the desired level, corn silage still is an excellent feed. However, you should consider the moisture percentage when feeding this silage to obtain maximum results.

Fig. 1. Quality silage depends on management from planting to ensiling.

Dry Matter Value of Corn Silage

Dry matter content directly influences the actual dollar value of corn silage. One ton of alfalfa hay is usually considered to be equal in D.M. to three tons of corn silage. Thus, when alfalfa hay is priced at $36 per ton, a comparable value for corn silage is $12 or one-third the alfalfa hay price. An average silage of 30% D.M. contains 600 lb. D.M. per ton (.30×2000=600). Therefore, each pound of D.M. would be valued at 2¢ ($12÷600). This value (2¢/lb.) can be used to compare the actual value of corn silages (Table 2). Silage low in D.M. is of less value, while D.M. silage actually contains values above the average $12 per ton price. This variation in actual value of silage is more apparent when silages are purchased or sold in large amounts (Table 3).

Dry matter also is economically important to the livestock operator growing corn for silage. Corn silage low in dry matter results in: (1) less D.M. per cubic foot of storage (Table 4); (2) increased harvesting costs (Table 4); (3) excessive loss of nutrients (10 to 15%) from runoff; and, (4) less nutrients per pound (Table 5). These factors illustrate the economic value of striving to harvest corn near the 33% D.M. value.

Managing Silage Corn for Dry Matter

Silages near 33% D.M. can be obtained by: (1) planting early; (2) selecting varieties that mature to a hard dent in your area before frost; (3) harvesting at maturity;

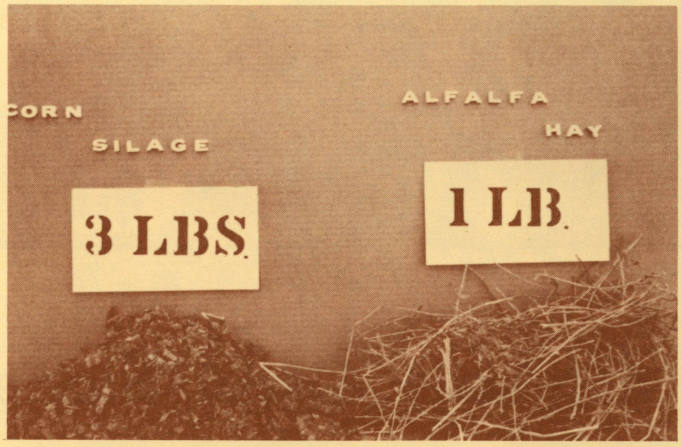

Fig. 2. On a dry matter basis, 3 pounds of corn silage is usually figured to be the equivalent of one pound of alfalfa.

(4) sampling corn during harvest for D.M. content; and, (5) proper addition of water. The additional management required to obtain the desired D.M. will be repaid by improved livestock performance in terms of meat and milk.

Table 1. Effect of stage of maturity of the corn plant at time of harvest for corn silage on its chemical composition.*

Days after planting	Yield D.M. per acre	D.M.	Maximum yield	D.M. basis: Crude protein	D.M. basis: Crude fiber
	lbs.	%	%	%	%
115	11,688	24.1	79.4	7.8	24.9
143	14,716	33.3	100.0	7.7	22.9
171	14,716	52.3	99.1	7.4	22.3

*Adapted from Caldwell, D. M. and T. W. Perry, J. of Dairy Science (1971), 54:535.

Table 2. The relative value of corn silages, as sampled in Canyon County, based on dry matter.

Sample No.	Dry matter	D.M. per ton	Value per ton	Tons silage needed to equal 1 ton alfalfa hay
	%	lbs.	$	
1	34	680	13.60	2.7
2	33	660	13.20	2.7
3	32	640	12.80	2.8
4	31	620	12.40	2.9
5	30	600	12.00	3.0
6	28	560	11.20	3.2
7	27	540	10.80	3.3
8	25	500	10.00	3.6
9	24	480	9.60	3.8
10	22	440	8.80	4.1

OTHER CONSIDERATIONS

Protein

Corn silage is relatively low in protein, around 2.4% on an as-fed basis. Livestock rations based on corn silage usually need supplemental protein. This is especially true in rations for high producing dairy cows and growing heifers and steers. The additional cost of protein may offset the value of heavy corn silage feeding and economics may favor substituting roughages higher in protein, such as alfalfa hay. Rations containing alfalfa hay at one-third of the roughage D.M. will usually provide the required protein.

Minerals

Calcium and phosphorus, the two most important minerals in livestock rations, especially dairy rations, are present in about equal amounts in corn silage. Actual levels vary slightly, but the calcium-phosphorus ratio is usually about 1:1. These two minerals are best used by animals when the ratio is near 2:1 in the total daily feed. Calcium addition, usually limestone, is needed when you feed corn silage as most of the roughage. Heavy grain feeding (15 to 20 lb.) to producing dairy cows

Table 3. Actual cost differential for 1000 tons of silage based on dry matter at 2¢ per pound.

Corn silage	Total cost @ $12/ton	Actual value: D.M. basis	Actual value differential
	$	$	$
34% D.M.	12,000	13,600	+1,600
30% D.M. (average silage)	12,000	12,000	
22% D.M.	12,000	8,800	−3,200

Table 4. Harvest cost and storage required for silages yielding 350 tons of dry matter.

% D.M. of silages	Tons dry matter	Tons water	Total tons harvested & stored	Harvest cost at $2.50/ton
35	350	650	1000	$2,500
30	350	817	1167	2,918
25	350	1050	1400	3,500

usually provides enough extra phosphorus to meet daily needs. The level of these minerals in corn silage is borderline in supplying the needs of growing ruminants. You should provide young cattle a calcium-phosphorus mineral.

Research suggests that you should add sulphur and iodine to heavy corn silage rations, especially when part of the protein is from non-protein nitrogen such as urea. Your feed dealer can suggest the amounts to add to your dairy mix. The remaining trace minerals are usually adequate in corn silage, but the use of trace-mineralized salt will prevent any deficiencies.

High Performance Rations

If you are feeding high-producing dairy or beef cattle, where high D.M. intake is required to provide adequate energy, the value of corn silage may be limited. When corn silage is the major roughage, these animals may not be able to eat enough D.M. to meet their energy needs. In these rations, feeds higher in D.M. usually increase the production of meat and milk. A comparison of feed cost and production will help you decide on the most profitable roughage program.

Silage from Frozen Corn

Frosted corn handled properly will yield excellent silage if the corn was mature before the killing frost. Frost usually will kill only the leaves of the corn plant. The nutrients in the leaves are only a small part of the total plant. The corn plant's moisture level will begin to drop after a severe frost. If you select varieties adapted to your area, they will usually mature before the first frost.

Corn that is 65% or lower in moisture at harvest is difficult to pack in the silo. You can use a fine chop and water (Table 6) to overcome packing problems and reduce spoilage.

Manure Kernel Loss

It is common to see whole kernels in the manure of livestock fed corn silage. This has been a major concern of beef and dairy operators feeding corn silage. The percentage of kernels passed depends on the silage grain content, maturity at harvest, length of cut and daily silage intake. These kernels, if completely intact, are relatively undigested with the major portion of the original nutrients present. However, the nutrient loss is usually minor when compared to the total intake of silage D.M. Most of the visible kernels are only particles or empty hulls with the nutrients completely digested. Research indicates that this kernel loss amounts to less than 2% D.M. by all corn silage fed cows. Recutting corn silage to reduce kernel loss has not improved animal performance.

Table 5. Feed value of 60 pounds of corn silages with different dry matter content.

	35% D.M. silage	25% D.M. silage
Dry matter (lb.)	21.0	15.0
Total digestible nutrients (lb.)	14.7	10.5
Digestible protein (lb.)	.99	.71
Calcium (g)	26.0	18.0
Phosphorus (g)	19.0	14.0

Grain vs. Silage Varieties

Grain provides most of the energy in corn silage. As corn approaches maturity, the leaf and stalk content remain relatively constant but the percentage of ear steadly increases to over one-half of the total D.M. Although percentage of ear is greatest in grain variety silage, these silages show little or no advantage in livestock performance. Research results suggest you should select a variety yielding the greatest D.M. tonnage per acre. Dry matter has the greatest influence on nutrient yield per acre and D.M. intake by livestock. When D.M. approaches 33%, the ears are mature and the crop yields the greatest amount of meat or milk per acre. Selecting a variety that will mature in your area before frost is the most important consideration in seed selection.

Silage from Sweet Corn Refuse

Cannery residues are commonly used for silage in some areas of Idaho. Nutrient content is comparable to regular silage on a D.M. basis, but cannery residue silage

Fig. 3. Corn silage provides low cost energy for most classes of livestock. Proper supplementation is required to maintain health and production of the dairy herd on major corn silage feeding programs.

is usually high in moisture (over 70%). This reduces its dollar value on an as-fed basis. Excessive moisture and seasonal availability are the major disadvantages of cannery residue silage in rations for livestock.

Corn stover silage can be used for livestock when feed supplies are limited. The stover – that portion of the sweet corn plant remaining after the ears and husks are removed for canning – is field chopped and ensiled. The loss of ears results in silage with lower levels of energy, total digestible nutrients and digestible protein. Modern picking of corn for canning usually mutilates the plant with a loss of moisture. The fodder should be harvested the same day or it will be too dry.

CONCLUSIONS

Dry matter is the most variable factor in corn silage and directly affects the dollar and nutrient value. Maximum nutrient yield and livestock performance occur from corn harvested and ensiled at 33% D.M. Management programs stressing time of planting, varieties and harvesting will result in the desired corn silage quality. The moisture and protein content of average corn silage may limit its value in some livestock rations.

Table 6. Water addition to dry crops harvested for silage.

Crop moisture	Desired moisture	Gallons water to add per ton*
%	%	
50	65	103
50	70	160
55	65	68
55	70	120
60	65	34
60	70	80

*Gallons calculated from following:
Gallons needed per ton=D.M. in corn−desired D.M.×2000÷-D.M. desired×8.3 (lb. water in one gallon).

Protein and calcium—and sometimes sulfur—are usually supplemented in rations consisting primarily of corn silage. A total nutritional program should be planned to meet the requirements of each class of livestock. Corn silage can provide a substantial part of the required daily nutrients in these feeding programs. The maximum value of corn silage and other feeds is obtained by a well-planned program that eliminates the need for costly supplementation.

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