12-1-1964

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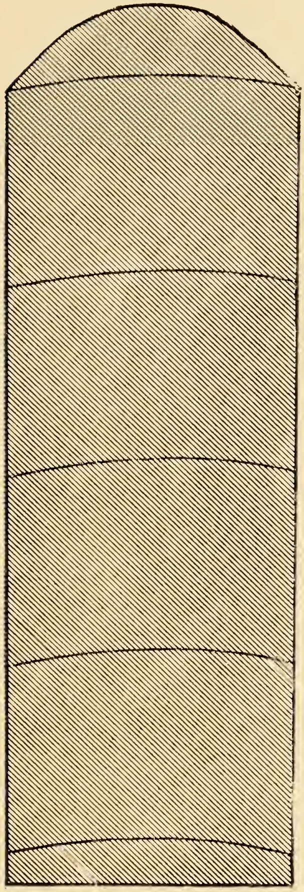
BULLETIN 699 DECEMBER 1964



Comparison of Silage and Haylage For Dairy Cattle

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SUMMARY

The work reported here indicates that wilted sudangrass (30-35% DM) silage can be successfully stored in conventional concrete tower silos with low dry matter losses from spoilage and fermentation when proper technique is used.

This study further shows that wilted sudangrass silage and direct-cut grain sorghum silage from conventional storage compare favorably in chemical composition, digestibility, and feeding value with the same forages stored under gas tight conditions.

There is little doubt that greater attention to ensiling detail is required if high quality forages with low storage losses are to be attained with conventional storage than with gas-tight storage. However, factors such as selection of crop, stage of maturity and proper harvesting procedures would appear to be more important to the quality of silage than the type of storage structure used.

COMPARISON OF SILAGE AND HAYLAGE FOR DAIRY CATTLE

By C. B. BROWNING AND J. W. LUSK

During recent years there has been an increased interest in haylage for dairy cattle. Haylage may be defined as a wilted "hay crop silage" that contains 45% or more dry matter stored in a "gastight" silo. However in common usage the term haylage has come to refer to any wilted hay crop silage regardless of the dry matter content or the type of silo used for storage. Although there is no definite percentage of dry matter that a wilted forage must contain to be termed "haylage" probably a more correct designation for ensiled forages containing between 30 and 40% dry matter would be "low-moisture silage."

The practice of wilting hay crop silages is not new and has been a standard recommendation for many years. It is the feeling of most authorities that a hay crop for silage must be wilted or have 150 to 200 lb. of crushed ear corn or some similar material added per ton of green forage at ensiling to insure good results.

The renewed interest in wilted silage and the new interest in gastight storage prompted the Dairy Science Department to initiate studies designed to answer basic questions concerning these practices for Mississippi livestock producers.

The objectives of the studies conducted during the past two years and reported here were (1) to determine if there were differences in the quality of forages stored in concrete tower silos and the same forages stored in gas-tight structures (2) to measure relative storage losses between the two types of structures.

Direct comparisons have been made between conventional storage (concrete tower silos) and gas-tight storage (Harvestores[1]) with four forages. During 1962 RS610 grain sorghum silage and Greenleaf sudangrass silage were ensiled under both systems. During 1963 Sudax (SX11) and Greenleaf sudangrass forages were ensiled under both systems. During both years the sudangrass and the Sudax were cut at 36 to 40 inches in height, crimped, wilted, finely chopped and ensiled. The RS610 was direct-cut in a milk to dough stage of maturity.

The chemical composition of these eight forages is given in Table 1, which shows no apparent differences among the chemical components of the forages that could be related to the type of structure used for storage. Attention is called to the relatively high ash content of the sudangrass forages which resulted from soil picked up on the forages during harvesting following wilting. The sudangrass harvested during 1963 was less mature than that harvested during 1962. It was higher in crude protein, slightly lower in crude fiber, and contained less foreign material as evidenced by the lower ash content.

Silage Quality

A three treatment double reversal type feeding trial with 18 lactating cows was used to compare the relative feeding value of three forages harvested during 1962. The forages compared were RS610 grain sorghum silage from conventional storage and Greenleaf sudangrass from conventional as well as gas-tight storage. Results of this feeding trial are given in Table 2. The cows fed RS610 silage from conventional storage consumed more silage and produced significantly more 4% milk than the cows fed either of the sudangrass forages. There was no difference in the consumption of sudangrass from conventional storage and that stored in the Harvestore, nor was there a difference in the daily milk production

[1]Two 17 x 40' Harvestores were donated to the Dairy Science Department by the Harvestore Division, A. O. Smith, Inc., Arlington Heights, Ill.

Table 1. Comparison of the average chemical composition at feeding of four forages stored in conventional and gas-tight silos.

Year and forage	Structure	Dry Matter	Chemical Composition CP Crude Protein	CF Crude Fiber	EE Crude Fat	NFE Nitrogen Free Extract	ASH
1962	Concrete	26.6	9.4	28.7	2.7	52.5	6.6
RS610	Gas-tight	27.5	9.4	27.9	3.0	53.1	6.5
1962	Concrete	38.7	11.1	30.2	2.9	40.8	15.0
Sudan	Gas-tight	52.0	10.5	29.6	3.1	41.2	15.6
1963 SX11	Concrete	30.7	12.5	32.4	3.5	41.8	9.8
(Sudax)	Gas-tight	40.4	12.6	32.3	3.3	43.2	8.9
1963	Concrete	30.5	13.6	27.7	3.5	43.0	12.3
Sudan	Gas-tight	56.4	12.1	30.6	2.8	43.1	11.4

Table 2. Summary of 1962-63, 1963-64 results from two trials (36 cows) comparing RS610 grain sorghum silage stored in a concrete silo and Greenleaf sudangrass stored in a concrete silo and a Harvestore.

Measurement	Year	RS610 Concrete silo	Sudangrass Concrete Silo	Sudangrass Harvestore
Daily 4% prod./cow (lb.)	1962	38.0[1]	36.4	35.5
	1963	40.7	42.2	38.2
Fat test (%)	1962	4.8	4.3	4.2
	1963	4.2	4.2	4.2
Silage or haylage Intake DM/1000 lb. Body weight (lb.)	1962	17.8	15.6	16.0
	1963	17.1	15.0	13.9
Total forage DM Intake[2] (lb.)	1962	22.0	19.8	20.2
	1963	21.5	19.4	18.3
Silage or haylage DM (%)	1962	26.6	32.3	45.8
	1963	28.1	30.5	55.3

[1]Any two means not underscored by the same line are significantly different (.05).
[2]Includes 4.2 lb. of alfalfa hay fed daily per cow in 1962 and 4.4 in 1963.

for the cows receiving these forages.

A second feeding trial of identical design using the same forages produced the following year was conducted during the winter of 1963-64. As mentioned previously in the discussion on chemical composition, the sudangrass forage harvested in 1963 appeared to be superior to that harvested in 1962. Although the cows consumed significantly more dry matter when fed RS610 than they did when fed the sudangrass from conventional storage there was not a significant difference in average daily production. The cows consumed less sudangrass forage from the Harvestore and produced less milk than the cows fed either of the other two forages.

In an effort to further characterize the feeding value of forages stored under conventional and air-tight systems digestion trials were conducted. Table 3 gives the results of a digestion trial comparing RS610 and sudangrass from the two type of storage structures. In general there was no significant difference in the digestibility of the various fractions studied as a result of the type of storage used. The only exception was the low digestion coefficient for the crude protein fraction of the sudangrass from the gas-tight structure. This forage had a crude protein digestion coefficient of 35.3% as compared to the digestion coefficient of 50.0% for the same forage stored in a concrete silo. Of particular interest is the fact that the high dry matter sudangrass forage from the gas-tight structure (46.0% DM) was not consumed in greater amounts nor was it more digestible than the sudangrass forage from the conventional structure that contained forage with only 34.9% dry matter.

Research from other stations seems to indicate that alfalfa silage is consumed in greater quantities as the dry matter of the silage is increased from 30% to 50%. Based on the results of the two milk production studies previously discussed this does not appear to be true with sudangrass. The two-year average forage dry matter content was 31.4% for the sudangrass stored in the concrete silo and 50.6% for the sudangrass stored in the Harvestore. The two-year average for dry matter intake was 15.3 lb. per 1000 lb. body weight for the conventionally stored sudangrass and 15.0 for the sudangrass from the Harvestores.

Table 4 gives results of a digestion trial comparing the forages fed in the lactation study conducted during 1963-64 and the digestion coefficients of Sudax forage from a gas-tight structure. As in-

Table 3. Summary of results from a digestion trial comparing sudangrass and RS610 grain sorghum stored in gas-tight and concrete silos.

	RS610		Sudangrass	
Measurement	Concrete	Gas-tight	Concrete	Gas-tight
Dry matter as fed (%)	26.7	28.5	34.9	46.0
Voluntary intake DM/1000 lb. Body weight (lb.)	14.2[1]	14.1	14.4	12.4
Digestion Coefficients (%)				
DM	61.0	60.3	50.4	52.0
Cellulose	59.1	61.8	70.8	68.9
Crude protein	57.4	52.6	50.0	35.3
Energy	61.8	62.6	60.2	57.1

[1]Any two means not underscored by the same line are significantly different (.05).

Table 4. Summary of results from a digestion trial comparing forages stored in gas-tight and concrete silos.

	RS610	Sudangrass		SX11
Measurement	Concrete	Concrete	Gas-tight	Gas-tight
DM as fed. (%)	28.2	32.0	53.9	45.6
Voluntary intake DM/1000 lb. Body weight (lb.)	16.8[1]	17.9	17.1	15.3
Digestion Coefficients (%)				
DM	58.4	60.4	63.0	60.6
Cellulose	60.3	79.2	78.0	74.7
Crude protein	57.2	57.0	46.8	42.8
Energy	58.9	68.1	64.5	60.9

[1]Any two means not underscored by the same line are significantly different (0.5).

RS610 grain sorghum (above) and sudangrass (below) were used in this forage study.

dicated in the previous study, the crude protein digestion coefficient for the sudangrass forage from the gas-tight structure was significantly lower than the digestion coefficient for crude protein of the sudangrass forage from the conventional structure. The reason for the lowered digestibility of crude protein in some of the forages is not known. However at present it is thought to be more directly associated with the dry matter content of the forage at ensiling than with the type of storage used.

Storage Losses

Silage dry matter losses as a result of seepage, spoilage, and fermentation were determined for the several silages stored under conventional and gas-tight systems. Standard recommended ensiling practices were used in all cases. The silages stored in the concrete silos were well distributed during filling, were packed during the filling of the upper one-half of the silos and were capped with a plastic cover. The forages stored in the Harvestores were well distributed and the structures were sealed to maintain gas-tight conditions.

A summary of the storage losses encountered with the two systems is given in Table 5. The average dry matter loss for three hay crop silages stored in concrete silos was 6.9% of the total dry matter stored. This compares with a 5.3% dry matter loss for the same forages stored in gas-tight structures. Both of these figures are extremely low and represent what can be accomplished when the proper harvesting and ensiling techniques are practiced.

The RS610 grain sorghum silage (26.4% DM) ensiled in the Harvestore had a high seepage loss that amounted to 1.2% of the total dry matter stored. The seepage loss from the same RS610 stored in the conventional silo was not measured directly but was included in the fermentation loss. The total dry matter loss was 7.1% for the RS610 from the conventional silo and 9.8% for that from the Harvestore.

The Harvestore structures have been filled to capacity on four occasions with forages of different dry matter percentages. This gave the opportunity to compare their capacity as related to the dry matter content of forage at time of ensiling. When sudangrass containing approximately 52% dry matter was ensiled the capacity of a 17' x 40' Harvestore was 40.2 tons of dry matter, comparable figures for Sudax at 46% dry matter was 37.2 tons; RS610 at 26% dry matter 43.3 tons; and RS610 at 31% dry matter 45.5 tons.

Table 5. Comparative dry matter losses of four forages stored in concrete silos and Harvestores.

Year forage structure	Dry matter as ensiled	Dry matter losses			
		Top spoilage	Seepage	Fermentation[1]	Total
			—(%)—		
1962-63					
Sudangrass					
Concrete	38.1	0.50[2]	0	4.9	5.4
Harvestore	52.4	Nil	0	3.1	3.1
Grain Sorghum					
Concrete	25.8	0.43	[2]	6.7	7.1
Harvestore	26.4	0	1.2	8.6	9.8
1963-64					
Sudangrass					
Concrete	32.9	0.30	0	3.6	3.9
Harvestore	56.2	Nil	0	2.2	2.2
SX11 (Sudax)					
Concrete	36.5	0.50	0	11.1	11.06
Harvestore	46.6	Nil	0	10.6	10.6

[1]Fermentation loss determined by weigh-in and weigh-out measurements for the Harvestores and the "buried-bag" technique for the concrete silos.

[2]Seepage loss is considered in fermentation loss by the "buried-bag" technique.