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J. H. LONGWELL, Director

Digestibility of Wheat, Sudan Grass and Drouth Corn Silages by Wethers and Steers

W. H. PFANDER, DAVID ROBERTS, J. E. COMFORT
AND J. G. W. JONES

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SUMMARY.

Digestion trials using the total collection method were made with mature wethers to determine the digestibility of the organic matter, cellulose, and nitrogen of wheat, sudan grass and drouth corn silages. The respective coefficients were: wheat, 61.8, 50.9, 46.3; sudan grass, 56.2, 61.1, 49.1; drouth corn, 75.2, 74.9, 70.9.

The chromic oxide reference method, using a single "grab sample" was found to give values considerably lower than those obtained with the total collection method.

The average coefficient of digestibility of organic matter, cellulose, and nitrogen in steer-calf wintering rations, based largely on the same silages, was lower than corresponding values determined in sheep. The greatest depression occurred on the cellulose portions.

The estimated T.D.N. and digestible protein contents of the silages studied are given.

This bulletin is a report on Department of Animal Husbandry Research Projects 168, Ruminant Digestion and 236, Factors affecting Gains of Stocker Calves.

Digestibility of Wheat, Sudan Grass and Drouth Corn Silages by Wethers and Steers

W. H. Pfander, David Roberts, J. E. Comfort and J. G. W. Jones[1]

During the winter of 1954-55, feeding tests were conducted to study the value of rations based largely on drouth corn, wheat and sudan silages for wintering good to choice grade stocker calves. The weight gains of the calves were reported at the Spring Livestock Day (1955).

After the calves had been on the rations for at least a month, digestion trials were conducted to determine the digestibility of their rations. Concurrently, sheep were used to determine the digestibilities of the wheat, drouth corn and sudan grass silages.

MATERIALS AND METHODS

Rations

The drouth stricken corn silage was ensiled on August 20 in a trench silo. Wheat silage was prepared on June 7 from dough stage wheat that would have made about 35 bushels per acre. Forty pounds of blackstrap molasses per ton were added to the wheat silage when it was put in the silo. Sheep pastured the sudan grass early, eating the lower leaves. Most of the growth had recovered following this grazing period and the sudan grass was ensiled on September 21 without any preservative. The compositions of the silages and the corn and cottonseed meal used as supplements are shown in Table 1.

[1]King George VI Memorial Fellow, University of Missouri, 1954-55.

TABLE 1 -- COMPOSITION AND BACKGROUND OF FEEDS

Feed	Source	Composition as fed: Water %	Protein %	Fat %	NFE %	Fiber %	Cellulose %	Ash %	Ca %	P %	Cr_2O_3 %
Drouth corn silage	Mo. Bottoms yield 4 ton/acre ensiled August 20	71.95	3.31	.88	14.71	6.96	7.99	2.19	.05	.03	---
Sudan grass silage	Univ. Farms yield 3 ton/acre ensiled September 21	74.38	2.18	1.31	9.10	10.99	10.08	2.04	.08	.02	---
Wheat silage	Univ. Farms yield 4 ton/acre ensiled June 7	61.50	3.06	1.53	22.73	8.83	10.30	2.35	.07	.04	---
Cottonseed Meal + Cr_2O_3	blended	7.12	40.62	---	---	---	14.49	10.82	---	---	2.82
Corn	Univ. Farm	9.92	9.31	4.46	72.53	2.51	2.41	1.27	---	---	---

Steers

The studies with steers were made on lot-fed animals. During the time when feces samples were collected for digestibility studies, the average consumption was 22 pounds of wheat silage, 22 pounds of sudan grass silage, and 27 pounds of drouth corn silage.

Each steer also received 1 pound of cottonseed meal per day. The steers fed wheat silage received no corn; those on sudan and drouth corn silages, 2 pounds of corn per day.

Chromic oxide was mixed in the cottonseed meal and the supplement was carefully spread over the silage and turned with a fork before the cattle ate it.

After the steers had received this ration for ten days, grab samples of feces are obtained from each animal between 2 p.m. and 4 p.m. The feces were dried, ground, and analyzed for various nutrients.

Sheep

Six western wethers weighing 75 to 90 pounds were used to determine the coefficients of digestibility of the silages. The sheep were housed on concrete floored lots and had access to a shed open to the south. Rations were fed individually in two equal parts at 7:00 a.m. and 4:00 p.m. Each sheep received 8 grams steamed bone meal and 5 grams salt daily. They were offered 2000 grams of corn silage, 1800 grams of sudan silage, and 1600 grams of wheat silage, the approximate amounts that had been cleaned up in the preliminary period. Feed refusals were collected daily, dried, and analyzed. The residual amounts were subtracted from the amounts fed. Fourteen-day preliminary periods were followed by 6-day collection periods. Total fecal collections were made by use of plastic freezer bags. Samples were dried in a forced draft oven at 82° C, allowed to come to air dryness, ground, quartered and placed in air tight containers until analyzed. Two and one-half grams of chromic oxide were added through the fistula twice daily. On the day following the end of the total collection period, a single "grab sample" was obtained for the chromic oxide reference method. During the digestion trials, samples of the silage were obtained daily.

Nitrogen was determined by the method of the A.O.A.C. (1950); cellulose by the method of Crampton and Maynard (1938); organic matter by difference following the determination of moisture as water loss in a forced draft oven at 82° C; and ash as residual following ignition at 58° C. Chromic oxide was determined by the method of Gehrke, *et al.* (1950).

RESULTS AND DISCUSSION

The sheep were able to eat greater amounts of the corn silage than of the other silages; however, they consumed 632 grams dry matter from wheat, 561 grams from corn and only 461 from sudan grass silages.

The digestibilities of the silages by sheep are shown in Table 2. The digestibility of crude protein (N x 6.25) in drouth corn silage appeared to be higher than values currently in the literature (Schneider, '47). Part

TABLE 2 -- AVERAGE COEFFICIENTS OF DIGESTIBILITY OF THE ORGANIC MATTER, CELLULOSE AND CRUDE PROTEIN OF WHEAT: SUDAN GRASS AND DROUTH CORN SILAGES BY MATURE WETHERS.

	Coefficients of Digestibility		
Ration	Crude Protein	Cellulose	O.M.
1600 gms. Wheat silage	46.3	50.9	61.8
1800 gms. Sudan grass silage	49.1	61.1	56.2
2000 grams drouth corn silage	70.9	74.9	75.2
Sudan, Cr_2O_3 method	26.5	44.4	37.2
Corn, Cr_2O_3 method	60.6	65.3	----

of this difference may be due to the higher protein content of the corn forage and part to the care that was taken in drying the samples. Since immature plants and silages contain volatile, non-protein nitrogen compounds, the usual drying techniques could lead to loss of N from the sample and decreases in apparent digestibility. The digestibilities of organic matter and cellulose were similar to Schneider's values.

The digestibility calculations for the sudan grass silage were lower than values reported previously. The loss of leaf to grazing animals before the sudan was harvested is believed responsible for these low values.

No previous values for the digestibility of wheat silage have been reported. The results we obtained are similar to reported values for oat silage; however, the coefficient of digestibility for protein, 46, is lower than the value of 57 reported by Schneider ('47).

In agreement with other investigators, we find that the Cr_2O_3 reference method based on a single "grab sample" is not satisfactory with roughage rations, even if the Cr_2O_3 has been fed for several days. This is probably due to the separation of the roughage and the Cr_2O_3 in passage through the digestive tract.

The digestibilities of the rations fed to calves are shown in Table 3. A true picture cannot be obtained of the actual digestibility of silages since they were fed in conjunction with small amounts of concentrates. The organic matter of the steer rations was not as well digested as was the corresponding silage organic matter by sheep. This reduction was most striking for wheat silage organic matter. The coefficients of digestibility

TABLE 3 -- AVERAGE COEFFICIENTS OF DIGESTIBILITY OF THE ORGANIC MATTER, CELLULOSE AND CRUDE PROTEIN OF RATIONS FED HEREFORD STEER CALVES.

Lot	Ration	Coefficients of Digestibility		
		Crude Protein	Cellulose	O.M.
1	22 lb. wheat silage			
	1 lb. cotton seed meal	44.9	41.6	53.3
2	22 lb. sudan grass silage			
	2 lb. corn			
	1 lb. cottonseed meal	51.7	50.1	55.0
3	27 lb. drouth corn silage			
	2 lb. corn			
	1 lb. cottonseed meal	60.8	71.2	68.1

of nitrogen of wheat and sudan grass silages fed to steers were very similar to those obtained for sheep; the values obtained with steers are lower on the corn silage ration.

Digestibility of cellulose of the ration by steers was lower than digestibility of cellulose in corresponding silages by sheep; the greatest differences are in the wheat and sudan silages. This may reflect the more efficient digestion processes of the mature sheep over the yearling bovine, especially in the case of the more mature, lignified forages, or the beneficial effects of the phosphorus supplement given to sheep.

These values obtained with the reference technique are in general agreement with values obtained with similar feeds which have been recorded in the literature. This indicates that chromic oxide, properly mixed with concentrates and carefully mixed into silage rations, can give valid results with lot-fed cattle.

The fat content of the silages was very low. Most of the ether extract in silages occurs as pigments and organic acids, rather than as true fat. Therefore, the T.D.N. of the silages can be estimated from the digestible organic matter. The feeding values of the silages in terms of digestible protein and estimated T.D.N. are shown in Table 4.

Table 4—Feeding Values of the Silages

	D.M. %	D.P. %	T.D.N.[1] %
Drouth corn silage	28.0	2.2	19.2
Wheat silage, dough stage, 40 lbs. blackstrap molasses added per ton forage	38.5	1.4	21.7
Sudan grass silage, some leaves lost to grazing animals	25.6	1.1	13.9

[1]Based on digestible organic matter with the assumptions that the ether extract was digested to the extent of 80% and that ½ of the ether extract was true fat.

Although the drouth corn silage seems to contain more T.D.N. on a dry matter basis than wheat silage, it did not support the same good performance in the feed lot. This suggests that the wheat silage contained growth stimulating substances not now recognized or that the corn silage contained sub-lethal amounts of toxic substances.

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