

The Digestibility of Artificially
Dried Sudan Grass

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University of Vermont and State Agricultural College

Vermont Agricultural Experiment Station

BURLINGTON, VERMONT

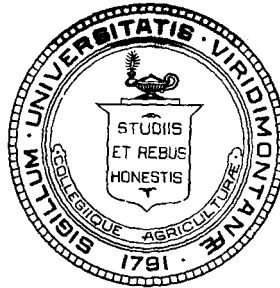
THE DIGESTIBILITY OF ARTIFICIALLY
DRIED SUDAN GRASS

By J. A. NEWLANDER

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BULLETIN 386: THE DIGESTIBILITY OF ARTIFICIALLY DRIED SUDAN GRASS

By J. A. NEWLANDER¹

Sudan grass is assuming an increasing importance as a hay and pasture crop in different sections of the country because of its superior ability over many plants in withstanding dry, hot weather conditions. Trials have been in progress at this Station for the past two years dealing with the feeding value of young sudan grass, artificially dried, for dairy cows. Digestion coefficients are available for sudan grass hay as obtained in the usual farm practice of cutting once a year, or occasionally twice, but none are available for the grass when cut more frequently and artificially dried; hence it was necessary to determine them as a preliminary to feeding trials.

The digestion trials were made on artificially dried sudan grass obtained from the first cutting of a 5.5-acre field, seeded May 25, 1933. Four cuttings were made on July 14, August 9, September 1 and October 6, the grass being cut often enough so that very little heading out occurred. The season was unusually dry and growth and yields were subnormal. Figure 1 shows the comparative growths made at the time of the four cuttings, average heights being about 30, 24, 18 and 18 inches. Yields and composition of the dried grass are given in table 1. The protein content was somewhat higher and the fiber content somewhat lower in the first two cuttings than in the last two but differences were really slight.

TABLE 1.—COMPOSITION OF SUDAN GRASS, ARTIFICIALLY DRIED

Date of cutting	Acre yields	Water	Dry matter	Ash	Crude protein	Crude fiber	Nitrogen free extract	Ether extract	(Dry matter basis)				
									Ash	Crude protein	Crude fiber	Nitrogen free extract	Ether extract
	lbs.	%	%	%	%	%	%	%	%	%	%	%	%
7/14	1,025.5	13.20	86.80	8.49	13.12	19.29	43.26	2.64	9.78	15.12	22.22	49.84	3.04
8/ 9	806.9	11.61	88.39	8.38	13.95	21.40	42.29	2.37	9.48	15.78	24.21	47.85	2.68
9/ 1	569.5	18.17	81.83	8.22	11.24	20.22	39.65	2.50	10.05	13.74	24.71	48.44	3.06
10/6	618.2	19.13	80.87	7.98	11.46	21.26	37.15	3.02	9.87	14.17	26.29	45.94	3.73

Concurrent with the digestion trials mineral balances (calcium and phosphorus) were determined in order to ascertain to what extent these minerals in dried sudan grass might be assimilated.

¹The chemical analyses incident to the trials were made by the station chemist and assistant chemists.

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PROCEDURE

The trial lasted three weeks, May 31 to June 21, 1934, but all calculations were made by weekly periods. The same general procedure was followed as obtained in previous digestion trials made at this

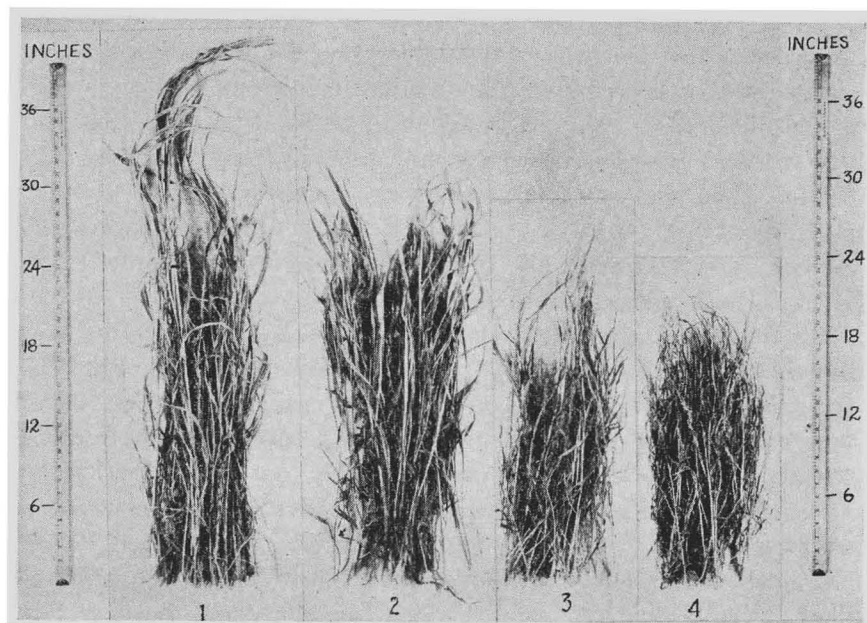


FIG. 1. Comparative growths made at the time of the four cuttings.

Station.¹ "The animals were exercised twice daily for 15-minute periods by leading in a yard, attendants following closely to catch excrement, if voided. Three men, in eight-hour shifts, were in constant attendance to collect and keep feces separate from the urine. The feces, as voided, were kept in tightly covered cans and weighed and sampled daily. Weekly composites were made by taking five percent portions daily and placing them in a tightly covered receptacle, 5 c.c. of chloroform being added daily with each new aliquot as a preservative. A 3,500-gram sample was taken for analysis from each well mixed composite and, as a check on possible nitrogen losses, a small daily sample of feces was subjected to immediate analysis for its nitrogen content.

"In order to obtain data touching mineral balances all voidings of urine were collected. A weekly composite was made by weighing

¹Newlander, J. A., and Jones, C. H. The Digestibility of Artificially Dried Grass. Vt. Sta., Bul. 348 (1932).

10 percent of each day's voiding into a can large enough to contain the seven aliquots. Chloroform—1 c.c. to 4 pounds—was used as a preservative and, in addition, the can was kept in ice water. The composite sample was mixed at the end of the week and two quarts used for analysis. Each day's milk was composited for a week and then analyzed, formalin being used as a preservative."

The allowance of dried sudan grass for each cow was weighed and sampled daily, a 100-gram sample being taken at each weighing and, later, composited by weekly periods for analysis.

The two cows used, Nos. 24 and 122, were, respectively, a registered 12 year old Ayrshire, dry and due to calve September 10, and a registered, 3 years, 4 months old Holstein, yielding 15 pounds milk daily and due to calve December 30. They were fed dried sudan grass for two weeks preceding the trial to accustom their systems to this feed and to ascertain how much they would readily consume, which quantity proved to be 20 pounds daily per cow. Applying the digestion coefficients obtained by the writer with artificially dried young grass, it appeared that from 15 to 20 pounds daily for each cow would supply their needs and, since each readily consumed 20 pounds and appeared quite contented, this amount was allotted to each cow daily, being fed five times a day. They licked their mangers clean at all feedings and at no time were "off feed."

They were weighed three consecutive days just preceding the trial and every other day during the experiment (table 2). The average

TABLE 2.—WEIGHTS OF COWS ON DIGESTION TRIAL

Date	No. 24	No. 122	Date	No. 24	No. 122
	lbs.	lbs.		lbs.	lbs.
5/28/34	1,181	991	6/ 7	1,197	965
5/29	1,189	1,003	6/ 9	1,227	1,028
5/30	1,188	1,001	6/11	1,210	1,018
Average	1,186	998	6/13	1,212	1,025
6/ 1	1,182	1,011	6/15	1,221	1,022
6/ 3	1,186	1,011	6/17	1,208	990
6/ 5	1,200	1,018	6/19	1,217	1,020
			6/21	1,256	1,021
Average				1,211	1,012

weight of each cow was greater during the trial period than was the average of the three preliminary weights. The weights taken during the trial were fairly constant, although in each case there was one erratic weight.

RESULTS

The composition of the artificially dried young sudan grass as fed by weekly periods is shown in table 3 and of the feces in table 4.

TABLE 3.—COMPOSITION OF DRIED SUDAN GRASS AS FED

Date	Water	Dry matter	Ash	Crude protein	Crude fiber	Nitrogen free extract	Ether extract	Calcium	Phospho
1934	%	%	%	%	%	%	%	%	%
5/31-6/7	12.09	87.91	8.98	14.28	18.82	43.48	2.35	0.744	0.280
6/7/14	14.16	85.84	8.33	13.92	18.87	42.22	2.50	0.715	0.271
6/14-21	14.55	85.45	8.64	14.31	18.55	41.62	2.33	0.759	0.328
Average	13.60	86.40	8.65	14.17	18.75	42.44	2.39	0.739	0.293

TABLE 4.—COMPOSITION OF FECES (BY WEEKS)

Cow	Date	Weight	Water	Dry matter	Ash	Crude protein	Crude fiber	Nitrogen free extract	Ether extract	Calcium	Phospho
	1934	lbs.	%	%	%	%	%	%	%	%	%
24	5/31-6/7	233.4	84.27	15.73	3.05	3.14	3.22	5.89	0.43	0.468	0.148
24	6/7-14	214.1	83.50	16.50	3.23	3.17	3.45	6.20	0.45	0.490	0.165
24	6/14-21	212.4	83.55	16.45	3.26	3.24	3.34	6.17	0.44	0.482	0.158
122	5/31-6/7	259.5	85.83	14.17	2.62	2.79	3.03	5.36	0.37	0.379	0.107
122	6/7/14	259.9	85.72	14.28	2.54	2.99	3.17	5.18	0.40	0.379	0.109
122	6/14/21	254.8	85.58	14.42	2.60	2.85	3.15	5.42	0.40	0.372	0.105

The amounts of the different nutrients eaten, voided and digested weekly by each cow, together with the coefficients of digestibility obtained, are given in table 5.

It will be noted that the coefficients of digestibility of the different nutrients agree very closely for both cows, which substantiates the generally recognized fact that differences in age, size, stage of lactation, etc., have little or no effect on digestibility. The same close agreement also holds in comparing the coefficients obtained in the different periods.

These results are a little lower than those secured in the previous trials with artificially dried grass clippings, excepting in case of the ether extract which was much less digestible in the dried grass than in the dried sudan grass, the respective coefficients being 46.4 and 70.6.

Applying the average coefficients of digestibility obtained in this trial (table 5) to the average composition of the dried sudan grass (table 3), it would appear that the digestible crude protein and total digestible nutrients of the dried sudan as fed (dry matter 86.40 percent) were 9.03 and 58.86 percents, respectively. The corresponding figures

TABLE 5.—DIGESTIBILITY OF ARTIFICIALLY DRIED SUDAN GRASS

	Dry matter	Ash	Crude protein	Crude fiber	Nitrogen free extract	Ether extract	Dry matter	Ash	Crude protein	Crude fiber	Nitrogen free extract	Ether extract
	gms.	gms.	gms.	gms.	gms.	gms.	gms.	gms.	gms.	gms.	gms.	gms.
	Cow 24—5/31-6/7/34						Cow 122—5/31-6/7/34					
Nutrients consumed	55,826	5,703	9,068	11,951	27,612	1,492	55,826	5,703	9,068	11,951	27,612	1,492
Excrement	16,650	3,228	3,324	3,408	6,234	455	16,679	3,084	3,284	3,567	6,309	436
Nutrients digested	39,176	2,475	5,744	8,543	21,378	1,037	39,147	2,619	5,784	8,384	21,303	1,056
Coefficients of digestibility	70.2	43.4	63.3	71.5	77.4	69.5	70.1	45.9	63.8	70.2	77.2	70.8
	6/7-14/34						6/7-14/34					
Nutrients consumed	54,512	5,290	8,840	11,983	26,811	1,588	54,512	5,290	8,840	11,983	26,811	1,588
Excrement	16,024	3,137	3,079	3,351	6,021	437	16,835	2,994	3,525	3,737	6,107	472
Nutrients digested	38,488	2,153	5,761	8,632	20,790	1,151	37,677	2,296	5,315	8,246	20,704	1,116
Coefficients of digestibility	70.6	40.7	65.2	72.0	77.5	72.5	69.1	43.4	60.1	68.8	77.2	70.3
	6/14-21/34						6/14-21/34					
Nutrients consumed	54,264	5,487	9,087	11,780	26,430	1,480	54,264	5,487	9,087	11,780	26,430	1,480
Excrement	15,849	3,141	3,122	3,218	5,944	424	16,663	3,004	3,293	3,640	6,263	462
Nutrients digested	38,415	2,346	5,965	8,562	20,486	1,056	37,601	2,483	5,794	8,140	20,167	1,018
Coefficients of digestibility	70.8	42.8	65.6	72.7	77.5	71.4	69.3	45.3	63.8	69.1	76.3	68.8
Average of coefficients	70.5	42.3	64.7	72.1	77.5	71.1	69.5	44.9	62.6	69.4	76.9	70.0
Average coefficient of both cows	70.0	43.6	63.7	70.8	77.2	70.6						

for the dried young grass (dry matter 90.17 percent) were 14.37 and 64.37 percents. Adjusting the sudan grass to the same dry matter basis as the young grass, its digestible crude protein would be 9.42 percent and its total digestible nutrients 61.42 percent, or 66 percent as much digestible crude protein and 95 percent as much total digestible nutrients as that contained in the dried young grass.

CALCIUM AND PHOSPHORUS BALANCES

Calcium and phosphorus balances were determined for each of the two cows on trial to note whether they assimilated sufficient minerals for their needs from a ration consisting solely of dried sudan grass. Of course, a three weeks feeding period is too short a time to yield definite

results but it should afford a general idea of the serviceability of the grass in this respect. The results are given in table 6. Both cows lost calcium and gained phosphorus. Cow 24, being dry, lost less calcium and gained more phosphorus than cow 122, but if allowance is made for the mineral content of the latter's milk it would appear that she made better use of the minerals in her food than did cow 24.

TABLE 6.—WEEKLY BALANCE OF CALCIUM AND PHOSPHORUS

Date	Intake and outgo	Cow 24			Cow 122		
		Intake and outgo—weights	Calcium	Phosphorus	Intake and outgo—weights	Calcium	Phosphorus
1934		gms.	gms.	gms.	gms.	gms.	gms.
5/31-6/7	Sudan	63,504	472.35	178.07	63,504	472.35	178.07
	Milk	.....	.....	.....	43,397	59.28	48.16
	Urine	135,558	2.43	1.53	96,072	1.65	1.27
	Feces	105,848	494.90	156.90	117,709	446.15	126.43
	Total outgo	.....	497.33	158.43	.....	507.08	175.86
	Balance	.....	-24.98	+19.64	.....	-34.73	+2.21
6/7-14	Sudan	63,504	454.20	172.30	63,504	454.20	172.30
	Milk	.....	.....	.....	48,671	58.41	47.45
	Urine	158,556	2.95	2.04	91,196	1.87	1.37
	Feces	97,116	475.60	160.15	117,891	447.30	128.15
	Total outgo	.....	478.55	162.19	.....	507.58	176.97
	Balance	.....	-24.35	+10.11	.....	-53.38	-4.67
6/14/21	Sudan	63,504	481.70	208.25	63,504	481.70	208.25
	Milk	.....	.....	.....	44,816	59.16	44.95
	Urine	166,698	2.87	2.25	121,111	2.83	1.37
	Feces	96,345	464.75	152.40	115,555	429.60	121.25
	Total outgo	.....	467.62	154.65	.....	491.59	167.57
	Balance	.....	+14.08	+53.60	.....	-9.89	+40.68
Balance, three weeks		.....	-35.25	+83.35	.....	-98.00	+38.22

SUMMARY

Artificially dried young sudan grass, as shown by a digestion trial with two dairy cows, contains 9.03 percent digestible crude protein and 58.86 percent total digestible nutrients on a basis of 86.40 percent dry matter. The average coefficients of digestibility were: dry matter 70, crude protein 63.7, crude fiber 70.8, nitrogen free extract 77.2 and for ether extract 70.6.

Mineral balances obtained in this digestion trial showed losses of calcium and gains of phosphorus, indicating that dried young sudan grass as the sole feed for a dairy cow may be deficient in calcium.