SORGHUM AND SUDANGRASS AS FORAGE CROPS IN NORTH DAKOTA

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Sorghum and sudangrass have been used as forage crops only on a limited scale in western North Dakota. In general, sudangrass has been planted only when the threat of a reduced hay or corn crop existed. Sorghums have had even more limited usage than sudangrass, perhaps because of their relatively recent introduction into this area. Corn silage has been of much greater and widespread importance than any of the previously mentioned forages and has received much more attention as a livestock feed. Experimental data concerning the value of corn as silage are well documented by the Dickinson Experiment Station (1).

Experimental work regarding possible adoption of sorghum and sudangrass as either supplements or replacements for corn have been carried out over a period of years at the Dickinson Station (2). Data from these trials indicated that corn was far superior to sorghum and sudangrass in forage yields. Reasons for poor performance by the sorghum and sudangrass were given as too low annual and seasonal rainfall, lower than optimum mean temperature during the growing season, too short a season to produce a high quality forage for silage, and difficulty of getting a satisfactory stand.

More recent limited studies have been carried out at the Dickinson Experiment Station with essentially similar results (3). The varieties employed by these investigations were of older vintage than those employed in the present trials (1967-1969), although the data collected have direct application. Seed production and nutritive content data were not collected from the varieties used in the present study. The 1967-1969 study included different rates of planting sorghum, a management treatment employing different dates and cutting heights of two varieties, and a yield testing phase consisting of several varieties of sorghum, sundangrass and corn. The study was cooperative with the Department of Agronomy, North Dakota State University, Fargo.

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Experimental Procedure

The three individual experimental trials were located on an Arnegard silt loam soil on the Agronomy Farm of the Dickinson Experiment Station. Land was summerfallowed each season prior to planting the trials. Planting was in late May or early June of each season. Each trial was laid out as a randomized block with four replications. The trials were planted in rows spaced 40 inches apart and were cultivated as required during the growing season. Rows were 20 feet long with three rows for each treatment. A 15-foot portion of the center row in each treatment and replication was harvested for forage yield. Forage samples for yield determinations were hand clipped and oven dried for 72 hours at 120 F.

The management trial consisted of two varieties of sorghum x sudangrass hybrids (Paymaster hybrid Sweet Sioux and DeKalb hybrid SX-11). The trial was uniformly planted at eight pounds of pure live seed per acre. The harvest dates for this trial were August 1 and September 6 of each season. Cutting height treatments leaving 2-, 6-, or 10-inch "stubble" heights were carried out on August 1. All treatments were harvested at the two-inch height on September 6 on the same plots to observe the effect of different degrees and time of defoliation on recovery and later yield of the sorghum. The rate-of-planting trial included one variety and eight different rates of planting. The variety yield trial included nine varieties of sorghum, sudangrass, and corn. Both trials were harvested leaving a two-inch stubble at the end of the growing season.

Results and Discussion

Management Trial

Data from the management trial are given in Table 1. The early cutting date of August 1 showed progressively smaller total yield with increase in stubble height for both varieties. However, at the final cutting date on September 6 the higher stubble height cutting showed a better recovery and

Table 1. Forage Yields of Two Sorghum Varieties Cut at Different Heights on August 1 and at a Uniform two-inch Height September 6.

Brand	Variety	Height	Dry weight yields - lbs/acre											
			August 1 Cutting				September 6 cutting				Total yield			
			1967	1968	1969	Avg.	1967	1968	1969	Avg.	1967	1968	1969	Avg.
Paymaster	Sweet Sioux (sorghum and sudangrass hybrid)	2"	693	718	191	[1]534[a]	1472	2690	3634	2599[a]	2165	3408	3825	3133[a]
		6"	539	176	142	286[b]	1459	2325	4144	2643[a]	2098	2501	4286	2962[a]
		10"	125	59	31	72[c]	1403	3161	4305	2956[a]	1528	3220	4336	3028[a]
		2" (Final harvest	[2]— a	— b	— c	—	3081 a	3608 b	4889 c	3859[b]	3081 a	3608 b	4889 c	3859[b]
DeKalb	DeKalb SX-11 (sorghum and sudangrass hybrid)	2"	607	679	151	479[a]	2170	2002	3565	2579[a]	2777	2681	3716	3058[a]
		6"	265	116	68	150[b]	2288	1988	3717	2664[a]	2553	2104	3785	2825[a]
		10"	128	22	19	56[c]	2321	2540	3558	2806[a]	2449	2562	3577	2863[a]
		2" (Final harvest	— a	— b	— c	—	3450 a	2984 a	4743 b	3726[b]	3450 a	2984 a	4743 b	3726[b]

[1]Values followed by same letter within heights not significantly different at the 0.05 level.
[2]Values followed by same letter within years not significantly different at the 0.05 level.

yield from the treatments cut in early August. The 1969 season yields were considerably lower at this early date than were the two previous seasons' yields. The September 6 cutting date indicated, however, that yields were greatest in 1969 at this date at all cutting treatments (Table 1). Adequate late summer precipitation allowed nearly complete recovery from the different levels of defoliation. Essentially similar results were obtained with both varieties in the study.

The data indicate a relatively small difference in total average yield over the three-year period for both varieties at the 2-, 6-, and 10-inch cutting heights. However, appreciably large variations were observed between the cutting height treatments and individual growing seasons for both varieties for a given date (Table 1). Statistical analyses indicated significant differences in both varieties between all years, and cutting heights at the early harvest date. At the late harvest date statistically significant differences in yield were found between the two-inch final harvest cutting and all other cutting heights in both varieties, between all years in the Paymaster hybrid Sweet Sioux, and between the 1968 and 1969 growing season in DeKalb hybrid SX-11. This would perhaps indicate that the plant response to defoliation is highly dependent on climatic conditions for a given growing season.

The single two-inch cutting at maturity produced substantially more forage than was realized from any of the other treatments. The increase in forage at this treatment was about 700 to 800 pounds per acre above the other treatments for both varieties. Total production was only slightly greater from the Paymaster hybrid Sweet Sioux than from DeKalb hybrid SX-11, averaging 3,859 and 3,726 pounds per acre, respectively. The statistical analyses indicated significant differences between the single cutting and varied cutting heights.

Rate-of-Seeding Trial

A single sorghum variety, Northrup King hybrid 145 (sorghum x sudangrass), was used in the rate-of-seeding trial. Rates of seeding were 2, 4, 6, 9, 12, 15, 18, and 21 pounds of pure live seed per acre. The highest average production for the three-year period was observed at the 21 pounds per acre rate, while the lowest was at the two pounds per acre rate (Table 2). The highest average increase in production for an added increment in seeding rate was about 1,000 pounds per acre between the two and four pound per acre rates. The average production data for the three-year period indicated that the four pounds per acre rate was perhaps the most economical in terms of seed input and forage production. Individual year statistical analysis indicated significant differences between the two, four, and six pounds per acre rate in 1967 and 1968, and only between the two- and four-pound rate in 1969. The average yield data indicated significant differences between the two- and four-pound rate. Significant differences between yields were found at the high seeding rate in 1967 and 1969 and within the average yield at the same rates for the three-year period. Data from this trial were highly variable and no definite conclusions were made. A con-

Table 2. Forage Yields of Northrup King Hybrid 145 (Sorghum and Sudangrass Hybrid) Seeded at Eight Different Rates, 1967-1969.

Rate of planting	Dry-weight yields - lbs/acre			
lbs/acre-seed	1967	1968	1969	Avg.
2	[1]1022[a]	3394[a]	3998[a]	2805[a]
4	1809[b]	5099[b]	4495[b]	3801[b]
6	2725[c]	3950[a]	4605[b]	3760[b]
9	2274[e]	4528[a]	5239[b]	4014[b]
12	2441[c]	4720[a]	5881[b]	4347[b]
15	2801[d]	4636[a]	5431[b]	4289[b]
18	2477[e]	4703[a]	5404[b]	4195[b]
21	3171[f]	4993[a]	6289[c]	4818[c]

[1]Values followed by the same letter within each year and average column not significantly different at the 0.05 level.

Table 3. Forage Yield Trial of Corn, Sorghum and Sudangrass, and Sorghum and Sudangrass Hybrids, 1967-1969.

Brand	Variety	Dry-weight yields - lbs/acre			
		1967	1968	1969	Avg.
Northrup King	Kingscrost hybrid 78 corn	2678	2111	—	[1]a2395[3]
Northrup King	Trudan I hybrid sudangrass	2465	2340	2707	a2504
	Piper sudangrass	2240	2286	3158	b2561
Sokota	250 hybrid Corn (95 day)	2108	2196	3750	b2685
Cargill	HS-50 hybrid corn (high sugar)	2871	2849	3456	c3058
DeKalb	SX-11 hybrid sorghum x sudangrass	2536	2572	4140	c3083
Northrup King	145 hybrid sorghum x sudangrass	2283	2981	4841	d3368
Pioneer	936 hybrid sorghum	2523	3435	5377	e3778
Northrup King	Kingscrost hybrid 411 corn	—	—	4121	4121[2]

[1]Values followed by same letter not significantly different at the 0.05 level.
[2]One-year data.
[3]Two-year data.

siderably longer period with field trials may be required in order to establish a definite seeding rate in this highly variable climatic zone.

Yield Trial of Corn, Hybrid Sorghum and Sudangrass, and Sorghum and Sudangrass Hybrids

A yield test of certain varieties of corn, hybrid sorghum, sorghum x sudangrass hybrids, and sudangrass hybrids was conducted, 1967-69. The trial included recommended apparently adapted varieties and inadequately tested varieties. A new corn variety, Northrup King Kingscrost hybrid 411, was included only in the 1969 season, while the data on the Northrup King Kingscrost hybrid 78 corn variety was lost due to rodent damage in the experimental plots. Corn was included in the trial, although the optimum seeding date for corn is earlier than the late May or early June planting of this trial. The yield performance data are, therefore, not directly comparable to earlier seeded corn.

Total average yields for all varieties showed that Northrup King Kingscrost hybrid 411 corn was the highest forage producer at 4,121 pounds per acre based on only a single season performance (Table 3). For the three-year period the data showed that Pioneer hybrid 936 (hybrid sorghum) was the top producer at 3,778 pounds per acre, followed by Northrup King hybrid 145 (sorghum x sudangrass hybrid) and DeKalb hybrid SX-11 (sorghum x sudangrass hybrid) at 3,368 and 3,083 pounds per acre, respectively. Piper sudan and Northrup King hybrid Trudan I (hybrid sudangrass) were the lowest yielding at slightly over 2,500 pounds per acre (Table 3). Statistically significant differences in average yields were observed between hybrid sorghums and sorghum and sudangrass hybrids.

The highest yielding corn variety tested all three years was Cargill hybrid HS-50 (high sugar) at 3,058 pounds per acre (Table 3). This was followed in descending order by Sokota hybrid 250 (95 day) at 2,685 pounds per acre and Northrup King Kingscrost hybrid 78 at 2,395 pounds per acre (Table 3). These yields were considerably lower than those of the higher yielding hybrid sorghum or sudangrass cross. Production varied appreciably for all varieties over the study period, although the higher yielding varieties remained consistently better regardless of the growing season.

Conclusions

Sorghum varieties (hybrids and sorghum x sudangrass hybrids) have forage potential in western North Dakota. The data for the three-year study period indicates a favorable performance based on yield and growth characteristics. Some of the most desirable characteristics are the relatively short growing season requirement and relative drought hardiness. In general, the varieties of Paymaster hybrid Sweet Sioux, DeKalb hybrid SX-11, Pioneer hybrid 936 and Northrup King Kingscrost hybrid 411 corn produced the most forage.

Management of sorghums may be important in realizing optimum production. From the data available, the highest yields were obtained from a single cutting at the end of the growing season. Other earlier defoliation treatments substantially reduced total yields each year of the study.

The rate-of-planting data indicate rather substantial yields may be realized with seeding rates as low as four pounds per acre of pure live seed. However, based on observations in the field, even a small loss in number of plants at this rate could greatly reduce the total yield. A wide variation in performance between the different seeding rates and years indicates a considerably longer period of time is required to adequately establish optimum seeding rates.

References

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