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Comparison of Corn and Sorghum Hybrids Grown for Silage Under Irrigated and Dryland Environments

R. M. JONES AND J. C. READ

Summary

Four sorghum and six corn hybrids were grown under irrigated and dryland conditions on Windthorst

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fine sandy loam. Irrigated corn and sorghum yields ranged from 3.7 to 5.4 and from 8.1 to 9.7 tons dry matter/A, respectively. There were significant differences in forage yield and crude protein percentage among corn and sorghum hybrids. Yield, crude protein content, and daily dry matter accumulation were significantly higher for sorghum than for corn under all conditions. Daily dry matter accumulations of T-E 6996 corn and three of the sorghum hybrids were the same under irrigation. Corn yields were significantly higher under irrigation, but sorghum yields were not.

Introduction

Dairymen in the West Cross Timbers of Texas have been increasingly interested in the use of corn silage due to improved handling methods, milk production value, and the potential for local production of acceptable forages for silage. Generally, corn has been shown to have a higher energy value and better performance than forage sorghum when fed to beef or dairy cattle. However, the rainfall and irrigation potential in the area may favor production of forage sorghum. Currently, alfalfa is used extensively in dairy rations and the conversion to the use of either corn or sorghum silage will ultimately depend upon profitability. The purpose of this study was to compare the productive potential, crude protein content, and in vitro dry matter digestibility of selected corn and forage sorghum hybrids under both irrigated and dryland conditions.

Procedure

Irrigated and dryland test sites on Windthorst fine sandy loam were separated by a buffer area of sweetcorn 82-feet wide to insure that irrigation water was not wind-blown or drained onto the dryland site. Six hybrids of corn (*Zea mays* L.) and four of sorghum [*Sorghum bicolor* (L.) Moench] were included in each test. Both sites were tilled and prepared in the same manner. Urea and 18-46-0 were applied March 8, 1984 at the rate of 270 and 130 lb/A, respectively, to provide a total of 148 lb/A nitrogen and 60 lb/A phosphorus (P_2O_5). Seeding rates were adjusted for germination and anticipated mortality to provide corn and sorghum populations of 24,000 and 72,600 plants/A, respectively. Corn and sorghum were seeded March 21 and April 27, respectively, in plots 9-feet (3 rows) wide and 15-feet long. Plots were arranged in a modified randomized complete block design so that corn and sorghum hybrids were separately grouped on the same side of each of the four replications in each test. Grouping facilitated the application of Dual 8E herbicide to the corn. The herbicide was applied broadcast at the rate of 2 pt/A within 24 hours after seeding. Weed control in the sorghum was by cultivation; the corn plots were also cultivated to maintain uniform conditions.

Irrigation water was applied through a solid-set sprinkler system. When plant height was sufficient to intercept the stream of water from the sprinkler nozzle, taller riser pipe was substituted. Water was then discharged over the crop canopy from a height of 7.5 feet above ground level. The corn plots received a total of 9.25 acre-inches of water (early applications of 0.75 and 1.5 inches and seven applications of 1.0 inch). Rainfall received by both the irrigated and dryland tests was 6.0 inches. A total of 14.48 inches of irrigation water was applied to the sorghum test, while rainfall contributed an additional 6.2 inches. Sorghum grown dryland also received 6.2 inches of rainfall. The average rainfall for the period of these tests is approximately 11.5 and 13.0 inches, respectively, for corn and sorghum.

Plants were cut 3 inches from ground level when the kernels reached the soft dough stage; however, dryland corn was cut at milk stage (roasting ear) because of leaf firing. Ten feet of plants were cut from the middle of the center row of each plot. Plants were weighed and cut into 8- to 10-inch sections; subsamples were taken for dry matter determination and laboratory analyses. Subsamples were first air dried in bins made of quarter-inch hail screen; final drying was done at 70°C in a forced draft oven. Dry plant material was ground to pass a 1 mm screen and analyzed for crude protein by the Kjeldahl method. In vitro dry matter digestibility analyses were not completed in time for this report.

Results and Discussion

Dry matter yields of corn hybrids ranged from 3.7 to 5.4 tons/A, while sorghum yields ranged from 8.1 to 9.7 tons/A under irrigation (Table 1). Yields of corn grown dryland ranged from 2.6 to 3.2 tons/A while sorghum yields ranged from 6.6 to 8.3 tons/A. Irrigated corn yields were significantly greater than dryland yields, but there was no significant difference between yield of irrigated and dryland sorghum. There was no statistical differences in yields of corn hybrids grown dryland or in sorghum hybrids grown under irrigation. Dry matter yield of irrigated corn hybrid 'T-E 6996' was significantly greater than the yield for 'NS-212'; crude protein percentage was not significantly different (Table 1). Yields of sorghum hybrids 'FS-25a+' and 'Pio.923' grown dryland were significantly greater than yields of 'Silo Fill 35' or 'FS 455', but protein content was not different among the four hybrids. Although yields of irrigated sorghum hybrids were not significantly different, the crude protein content was significantly greater where dry matter yield was lower. Crude protein content of irrigated T-E 6996, 'Pay. 7251', and NS-212 was significantly greater than that of 'Pio. 3165'. Sorghum yields were significantly greater than corn yields under both irrigated and dryland conditions.

Daily dry matter accumulation (DDMA) for sorghum and corn hybrids grown irrigated and dryland was primarily a function of the yield since most hybrids for each group were harvested on the same day (Table 2). However, DDMA for Silo Fill 35 harvested 9 days earlier than Pio. 923. This was significantly less than Pio. 923 under dryland conditions, but not different under irrigation. DDMA for irrigated T-E 6996 corn was significantly greater than for NS-212 and was a function of the yield. DDMA of sorghum hybrids was significantly greater than that of corn hybrids under both irrigated and dryland environments.

TABLE 1. DRY MATTER YIELD AND CRUDE PROTEIN CONTENT OF CORN AND SORGHUM HYBRIDS GROWN UNDER IRRIGATED AND DRYLAND CONDITIONS

		Irrigated*		Dryland*	
Hybrid	Company	DM[1]	CP[2]	DM[1]	CP[2]
Corn					
T-E 6996	Taylor-Evans	5.4 b	7.3 ab	3.2 c	8.6 a
Pio. 3165	Pioneer	4.8 bc	6.5 c	2.8 c	7.4 b
G4507 A	Funk	4.5 bc	7.1 abc	2.6 c	7.4 b
RA 1505	Ring Around	4.1 bc	7.0 bc	3.2 c	7.1 b
Pay. 7251	Paymaster	4.0 bc	7.3 ab	3.0 c	7.2 b
NS 212	Gro Agri	3.7 c	7.7 a	2.8 c	8.2 a
Sorghum					
FS-25a+	DeKalb-Pfizer	9.7 a	4.0 e	8.3 a	5.3 c
Pio. 923	Pioneer	8.8 a	3.9 e	8.4 a	5.3 c
Silo Fill 35	Ring Around	8.1 a	5.2 d	6.6 b	5.3 c
FS 455	Cargill	8.5 a	4.7 d	7.1 b	5.5 c

*Values in the same column followed by the same letter are not statisticaly different at the 0.05 probability level, Duncan's Multiple Range Test. Irrigated corn yields were greater than dryland yields (P=0.01). Differences in yield of dryland and irrigated sorghum were nonsignificant; but interaction between moisture regime and sorghum hybrid was significant (P=0.01).

[1]Tons per acre dry matter.

[2]Percent crude protein.

Dry matter accumulations per acre-inch of water (DMAAI) were different except for corn hybrids grown dryland (Table 2). DMAAI of FS-25a+ sorghum was significantly greater than for Silo Fill 35 sorghum and all corn hybrids. DMAAI of irrigated T-E 6996 corn was equivalent to that of sorghum hybrids Pio. 923, FS 455, and Silo Fill 35. Sorghum hybrids produced significantly greater DMAAI than corn hybrids under dryland conditions. The DMAAI for FS-25a+ and Pio. 923 grown dryland was significantly greater than that of FS 455 and Silo Fill 35.

Relatively high values of DMAAI indicate greater efficiency in conversion of water to dry matter (Table 2). The values of DMAAI for dryland sorghum average almost three times the DMAAI for irrigated sorghum and would be expected where yield differences between irrigated and dryland are small and water application differences are large. Dryland sorghum yields were statistically the same as irrigated yields; this indicates there might have been a limiting factor, such as nitrogen, under irrigated conditions and/or that dryland sorghum was more efficient than irrigated sorghum in water utilization. This may also be true for corn.

TABLE 2. DRY MATTER PRODUCTION AND DAYS TO HARVEST FOR CORN AND SORGHUM GROWN UNDER IRRIGATED AND DRYLAND CONDITIONS

	Irrigated[1]			Dryland[1]		
Hybrid	DM/Day[2]	DM/Acre-inch[3]	Days[4]	DM/Day[2]	DM/Acre-inch[3]	Days[4]
Sorghum						
FS-25a+	143 a	1,027 a	135	123 ab	2,669 a	135
Pio. 923	130 a	846 ab	135	125 a	2,705 a	135
FS 455	136 a	824 abc	126	104 b	2,272 b	136
Silo Fill 35	128 a	778 bcd	126	104 b	2,106 b	126
Corn						
T-E 6996	92 b	705 bcde	118	62 c	1,080 c	104
Pio. 3165	81 bc	621 cdef	118	53 c	915 c	104
G 4507 A	76 bc	584 def	118	51 c	877 c	104
RA 1505	70 bc	538 ef	118	62 c	1,068 c	104
Pay. 7251	68 bc	521 ef	118	58 c	1,005 c	104
NS-212	63 c	483 f	118	54 c	938 c	104

[1]Values within the same column followed by the same letter are not statistically different at the 0.05 probability level, Duncan's Multiple Range Test.

[2]Dry matter accumulation in pounds per acre per day.

[3]Dry matter production in pounds per acre-inch of water.

[4]Days from planting to soft dough, except dryland corn was cut at milk stage due to leaf firing.