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AGRONOMIC PERFORMANCE AND SILAGE QUALITY TRAITS OF FORAGE SORGHUM HYBRIDS IN 1992[1]

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Summary

Rainfall was much above and temperature much below normal during the 1992 growing season. Both whole-plant dry matter (DM) and grain yields were excellent for all 11 hybrids. The two short, mid-maturing, forage sorghums (Northrup King 300 and Golden Harvest H-45) had the highest silage and grain yields; the early-maturing (Cargill 200F) and male sterile (Golden Harvest H-1) forage sorghums and the grain sorghum (DeKalb DK 42Y) the lowest silage yields. A storm with high winds on October 7 and 8 caused severe lodging in all six mid- and late-maturing hybrids (earlier-maturing hybrids had already been harvested). The 10 forage sorghum hybrids differed significantly in three important silage quality traits—whole-plant DM, crude protein, and acid detergent fiber. Silage agronomic performance for four of the forage sorghums over 6 of the past 7 years is presented.

(Key Words: Forage Sorghum, Hybrid, Silage, Yield.)

Introduction

Forage sorghum has become an increasingly important silage crop for beef and dairy producers in the High Plains. In Kansas, almost 100,000 acres were harvested for silage in 1990, producing about 1,350,000 tons. In several earlier studies, we have shown that harvesting forage sorghums at the late-dough stage optimizes silage yields and nutritive values (KAES Report of Progress 623, page 65) and that the growing season has a tremendous effect on the agronomic traits of individual hybrids and varieties (KAES Report of Progress 568, page 12). The objective of this study was to continue to document the effects of hybrid and growing season on the agronomic performance and silage quality traits of forage sorghums.

Experimental Procedures

Ten forage sorghum hybrids were selected to represent a range of phenotypic characteristics and season lengths (Table 1). All were grown under dryland conditions near the Kansas State University campus. A grain sorghum hybrid (DeKalb 42Y) was included for comparison. The forage sorghum plots were planted on June 19, and each hybrid was randomly assigned to three replications. The grain sorghum was planted on June 8. The 6-row plots were in a Reading silt loam soil, and this was the first crop after a 5-year stand of alfalfa. No fertilizer was applied. Rows were 30 ft long with a 30-in. spacing, and plots were thinned to uniform stands of 34,800 plants per acre.

Hybrids were harvested at the late-dough stage of kernel maturity. The two outside rows in each plot were borders, and whole-plant DM yield was measured by harvesting the 2nd and 3rd rows with a precision chopper. All heads in the 4th and 5th rows were clipped for grain yield determination. A sample of the whole-plant material from each plot was analyzed for DM, crude protein (CP), and acid detergent fiber (ADF).

[1]Partial financial assistance was provided by The J.C. Robinson Seed Co., Waterloo, Nebraska.

Table 1. Agronomic Performance and Quality Traits of the 10 Forage Sorghum Hybrids and the Grain Sorghum

Hybrid	Days to half bloom[1]	Plant height, inches[2]	Harvest date	Whole-plant[3] DM, %	CP, %	ADF, %	DM yield, tons/acre	Grain yield, bu/acre[4]
DeKalb DK 42Y								
grain sorghum	55	54 (0)	Sept. 24	34.5	8.8	28.2	6.03	108
Cargill 200F	62	108 (2)	Sept. 24	36.9	7.4	37.0	6.95	105
DeKalb FS-5	65	115 (0)	Sept. 28	28.9	7.7	31.9	7.79	96
Pioneer 947	72	110 (0)	Oct. 5	37.5	7.5	31.7	8.10	133
Northrup King 300	76	72 (67)	Oct. 15	32.7	7.2	35.0	8.85	173
DeKalb FS-25E	81	125 (88)	Oct. 20	27.3	6.3	37.5	8.03	98
Golden Harvest								
H-1	---	107 (0)	Sept. 25	26.0	7.2	30.4	6.65	---
EX-1216	68	113 (13)	Sept. 28	26.5	7.1	31.4	7.77	102
H-45	76	71 (57)	Oct. 15	32.7	7.0	33.2	9.26	140
H-2	80	111 (82)	Oct. 20	29.9	6.4	38.3	8.72	133
H-68	82	125 (90)	Oct. 20	32.2	6.3	33.4	8.18	125
Mean[5]	74	106 (40)	Oct. 8	31.1	7.0	34.0	8.03	123
LSD (P < .05)[6]	2.4	6 (34)	---	2.1	.3	1.3	2.1	21

[1]Golden Harvest H-1 is a male sterile. Paper bags were placed over the emerging heads to prevent grain development in the two harvested rows. [2]Percent lodging on the day of harvest is shown in parentheses. [3]Crude protein (CP) and acid detergent fiber (ADF) are expressed on a DM basis. [4]Adjusted to 14.5% moisture. [5]Mean values include only the 10 forage sorghum hybrids. [6]The LSD (least significant difference) is valid only within a column.

Results and Discussion

Agronomic performance of the 11 hybrids is presented in Table 1. Days to half bloom for the 10 forage sorghums ranged from 62 to 82. The late planting date and the cool, wet weather in July, August, and September delayed the harvest for all hybrids. Plant heights were relatively tall and, as expected, two of the late-maturing forage sorghums (DeKalb FS-25E and Golden Harvest H-68) were the tallest ($P < .05$). The two dual-purpose hybrids (Northrup King 300 and Golden Harvest H-45) were the shortest ($P < .05$).

Five of the 10 forage sorghums were at least 32% in whole-plant DM at the late-dough stage harvest. This is important because hybrids with less than 30% DM are less efficiently preserved as silage and can produce large amounts of effluent during early fermentation.

The two short, mid-maturing, forage sorghums (Northrup King 300 and Golden Harvest H-45) had the highest silage and grain yields; the early-maturing (Cargill 200F) and male sterile (Golden Harvest H-1) forage sorghums and the grain sorghum had the lowest silage yields. A storm with high winds on October 7 and 8 caused severe lodging in all six mid- and late-maturing hybrids. Earlier-maturing hybrids had already been harvested.

As expected, the grain sorghum (DeKalb DK 42Y) had the highest CP (8.8%) and lowest ADF (28.2%). Among the 10 forage sorghums, CP ranged from 6.3 to 7.5% and ADF, from 30.4 to 38.3 percent. Also, there were no significant correlations between the three silage quality traits (whole-plant DM, CP, and ADF) and days to half bloom, plant height, and whole-plant DM and grain yields.

In 6 of the past 7 years (excluding 1991), a selected number of forage sorghum cultivars (hybrids and varieties) representing a wide range of silage agronomic and quality traits have been systematically evaluated using the same cropping practices. Four diverse hybrids have been included in all 6 years -- DeKalb FS-5, Pioneer 947, NK 300, and DeKalb FS-25E. Their silage agronomic performance is summarized in Table 2.

As expected, significant hybrid × year interactions occurred for the four agronomic traits reported. The 1986 growing season favored the early- to mid-maturing hybrids, but 1987 favored the late-maturing hybrid. Summer droughts in both 1988 and 1989 and an early frost in 1989 reduced the yields for all four hybrids. Above average rainfall during the 1990 and 1992 growing seasons produced excellent whole-plant silage and grain yields. Relatively high lodging scores occurred in 3 of the 6 years.

Table 2. Agronomic Performance of the Four Forage Sorghum Hybrids Compared in Six of the Past Seven Years

	Plant height, inches						Lodging score, %					
Hybrid[1,2]	1986	1987	1988	1989	1990	1992	1986	1987	1988	1989	1990	1992
DeKalb FS-5	111	90	82	73	122	115	1	0	3	0	5	0
Pioneer 947	116	85	80	73	117	110	28	0	3	0	54	0
NK 300	86	68	65	58	78	72	2	0	0	0	3	67
DeKalb FS-25E	141	105	100	103	127	125	73	3	3	2	18	88

	Whole-plant DM yield, tons/acre						Grain yield, bushels/acre[3]					
	1986	1987	1988	1989	1990	1992	1986	1987	1988*	1989	1990	1992
DeKalb FS-5	7.9	5.9	5.3	6.0	7.9	7.8	92	71	60	98	87	96
Pioneer 947	7.6	6.4	5.0	5.6	8.3	8.1	89	68	60	91	119	133
NK 300	8.0	7.0	4.2	5.5	7.4	8.9	82	79	75	77	105	173
DeKalb FS-25E	7.8	10.2	6.8	6.2	8.2	8.0	57	100	25	34	82	98

[1]Season length: DeKalb FS-5, early to middle; Pioneer 947, middle; NK 300, middle to late; and DeKalb FS-25E, late. [2]NK = Northrup King. [3]Adjusted to 14.5% moisture. *Estimated.