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ROW SPACING AND MATURITY OF FORAGE SORGHUM SILAGE IN NORTH CENTRAL TEXAS

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Summary and Application

Forage sorghum varieties (Brown midrib and conventional) were planted in early April at Stephenville during the 2001 and 2002 growing seasons at three row spacings (12, 18, and 36-in.). In 2002, varieties were harvested at six maturities (boot, early head, early dough, mid dough, late dough, and hard seed) to determine the effect on silage production. As row spacing decreased from 36, 18, and 12-in., total production at mid-dough stage increased from 16.0 to 19.1 and 24.0 tons/A @ 35% dry matter (DM), respectively in 2001; and from 15.7 to 19.0, and 21.4 tons/A @ 35% DM, respectively in 2002. Total production increased with maturity from boot, early-heading, early-dough, mid-dough, late-dough, and hard seed by 9.3, 12.7, 14.5, 18.7, 20.2, and 20.3 tons/A @ 35% DM, respectively. Forage sorghum silage nutritive value was highest (lowest ADF, NDF, and lignin) at the late dough stage. Therefore forage sorghum silage should be planted on narrow rows and be harvested a the late dough stage.

Introduction

Forage sorghum silage has the potential to replace more expensive corn silage in Texas dairy and beef feedlot industries. Producers are concerned, however, about sorghum yields if these are harvested early enough to have comparable quality. In an effort to address the low forage sorghum quality issue, seed companies have developed brown mid-rib (BMR) varieties with lower lignin. Lignin is an indigestible fiber component that often ties up other nutrients. The BMR varieties often have a lodging problem, however, since their stems are weakened by low lignification. The question of an ideal row spacing also affects yields and lodging of forage sorghum. This article reports the yields and lodging observed during two separate experiments (one irrigated, the other dryland) that compared lodging and yields of both conventional and BMR forage sorghums as affected by row spacing and maturity at harvest time in north central Texas.

Methods and Materials

The experiments took place at the Texas A&M University Agricultural Research and Extension Center at Stephenville (Erath County), on a Windthorst (fine loamy sand) soil. Three replications of fifteen forage sorghums (10 BMR and 5 conventional) were planted in 2001 under irrigation (25 in. irrigation and rainfall for the growing season) and three forage sorghums (2 BMR and 1 conventional, the best performers from 2001) were planted under dryland conditions in 2002 (20 in. rainfall for the growing season from Mar - July). Seeding rate was 8 lb pure live seed (PLS)/A in early April and row spacings tested were 36, 18, and 12-in. Plots were fertilized with P and K according to soil test and 150 lb N/A.

Forage sorghum yields were estimated by weighing hand-harvested material from 3 x 10 ft area from each plot (thus, one row from the 36 in. spacing, two rows from the 18 in. spacing, and three rows from the 12 in. spacing). A portion of the sample from each plot was chopped, using a leaf/branch chopper; and percent DM was calculated after being dried in a forced-air oven for 3

days at 140°F. Silage yields are reported at 35% DM. Lodging was measured throughout the season and was recorded as percent of plants lodging in the interior rows of each plot.

Results and Discussion

In 2001, the conventional forage sorghums generally had greater yields than the BMR varieties (Table 1). There were differences in percent lodging within the BMR's. Percent lodging of BMR 100, BMR 344, and BMR 110 was 61, 53, and 73%, respectively, while percent lodging of BMR Dairymaster, BMR Millenium, BMR 327-35, and BMR 327/36 was only 2, 3, 4, and 1%, respectively.

As row spacing decreased from 36, 18, and 12-in., total production increased from 16.0, 19.1, and 24.0 tons/A @ 35% DM, respectively in 2001; and from 15.7, 19.0, and 21.4 tons/A @ 35% DM, respectively in 2002 (Fig. 1).

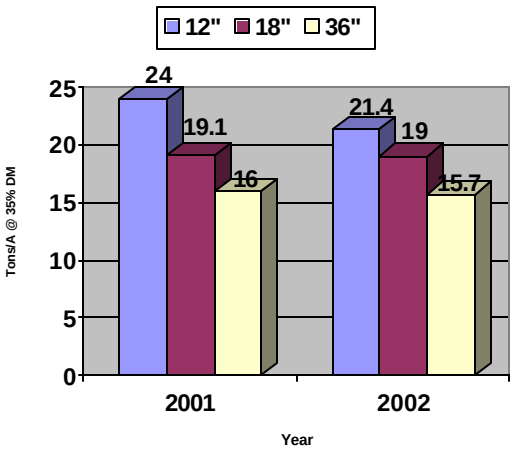

Fig. 1. Effect of row spacing on forage sorghum silage yield during the 2001 (irrigated) and 2002 (dryland) growing seasons averaged over varieties at the mid-dough maturity level.

In 2002, total production increased with increasing maturity from late-boot, early-heading, early-dough, mid-dough, late-dough, and hard seed by 9.3, 12.7, 14.5, 18.7, 20.2, and 20.3 tons/A @ 35% DM, respectively (Table 2). Crude protein (CP) concentrations tended to decrease with increasing maturity, and either decreased (boot, early-head, and late-dough) or remained unchanged (early-dough, mid-dough, and hard seed) after ensiling. Neutral detergent fiber (NDF) and acid detergent fiber (ADF) concentrations tended to decrease with increasing maturity and after ensiling. Lignin concentrations varied with stage of maturity and ensilage.

In 2002, row spacing did not affect DM % at any harvest stage of maturity (Table 3) or sorghum silage quality (data not shown). Total production was greatest for all stages of maturity at 12-in. row spacing, and at 18-in. row spacing for late-boot and hard seed stages of maturity. Total production was lowest for all stages of maturity at 36-in. row spacing. Total production increased with increasing maturity at all row spacings.

Conclusion

Conventional forage sorghum varieties generally had greater yields and less lodging than BMR varieties. However, varieties such as BMR 327/36 and BMR DairyMaster produced moderate yields (21.68 and 20.49 tons/A @ 35% DM, respectively) with low lodging % (1 and 2% lodging, respectively). Based on the results of this study, forage sorghum silage should be planted on 12 in. rows and harvested at the late dough stage due to greater production and higher silage nutritive value.

Table 1. Forage sorghum silage dry matter (DM) yields (adjusted to 35% moisture) and percent lodging under irrigation and harvested at the dough stage in 2001.

Varieties	**Company**	**DM %**	**Dough Stage**	**Tons/A @35DM**	**Lodging %**	**Rank**
Supersile20	Triumph	28	Early	24.47	0	1
FS-555	HyTest	28	Mid	23.35	5	2
333	Garst	28	Early	22.89	1	3
310/45	MMR	33	Mid	22.86	0	4
BMR 100	Seed Resource	32	Mid	21.83	61	5
BMR 327/36	MMR	28	Mid	21.68	1	6
BMR DairyMaster	Richardson	33	Mid	20.49	2	7
Silo600D	Richardson	34	Late	20.42	0	8
BMR 344	Garst	32	Late	20.41	53	9
BMR HT110	HyTest	32	Late	19.52	73	10
BMR Millenium	Moss	31	Mid	17.10	3	11
BMR 327/35	MMR	31	Mid	16.78	4	12
		n=9		n=9	n=9	
LSD				3.75	7.5	

Table 2. Effect of harvest maturity and ensilage on forage nutritive value averaged over three forage sorghum varieties and three row spacings at the Stephenville Experiment Station in 2002.

	Boot		**Early Head**		**Early Dough**		**Mid Dough**		**Late Dough**		**Hard Seed**	
Yield 35% DM	9.3		12.7		14.5		18.7		20.2		20.3	
	LSD Yield $_{0.05}$ = 0.9											
	Ensilage											
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
% DM	0.17	0.19	0.21	0.23	0.24	0.25	0.29	0.28	0.33	0.32	0.35	0.34
	LSD DM $_{0.05}$ = 0.02											
% CP	9.7	8.2	8.9	7.5	7.8	7.4	7.4	6.9	6.8	6.1	6.5	6.0
	LSD CP $_{0.05}$ = 0.5											
% NDF	69.3	64.6	66.1	62.8	61.6	58.8	60.0	58.5	55.6	56.0	57.8	56.2
	LSD NDF $_{0.05}$ = 1.25											
% ADF	40.6	38.4	38.0	37.2	35.4	34.8	33.4	35.1	31.1	32.2	32.4	32.8
	LSD ADF $_{0.05}$ = 0.75											
% Lignin	3.4	3.0	4.1	3.4	3.7	3.5	3.8	4.4	3.6	3.6	4.3	4.0
	LSD Lignin $_{0.05}$ = 0.25											

Table 3. Effect of row spacing and harvest maturity, averaged over three forage sorghum varieties planted dryland at 8 lb seed/A at the Stephenville Experiment Station in 2002.

	Boot		**Early Head**		**Early Dough**		**Mid Dough**		**Late Dough**		**Hard Seed**	
Row Spacing	DM %	Yield† 35%	DM %	Yield 35%	DM %	Yield 35%	DM %	Yield 35%	DM %	Yield 35%	DM %	Yield 35%
12 in.	17	10.5 a	22	14.8 a	25	16.6 a	29	21.4 a	33	22.2 a	35	22.5 a
18 in.	17	9.7 a	21	12.8 b	24	15.0 b	29	19.0 b	33	21.0 b	35	22.9 a
36 in.	17	7.7 b	20	10.4 c	24	11.7 c	29	15.7 c	32	16.9 c	34	17.3 b
LSD	n.s.	1.4	n.s.	1.7	n.s.	1.4	n.s.	1.0	n.s.	1.0	n.s.	2.6

† Yields are adjusted to 35% DM.