

TROPICAL CORN FOR SILAGE IN MULTIPLE CROPPING SYSTEMS

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ABSTRACT

This study compared the yield potential and inherent nutritive value and quality of tropical corn (*Zea mays L.*) with temperate corn and two forage sorghums [*Sorghum bicolor (L.) Moench*] for use in multiple cropping systems. Tropical corn showed high dry matter yield potential (19.3 Mg ha⁻¹) compared with a selected temperate corn (14.7 Mg ha⁻¹) or with an intermediate (8.5 Mg ha⁻¹) or taller growing forage-type sorghum (10.3 Mg ha⁻¹). Neutral detergent fiber concentration (g kg⁻¹) was lower for temperate corn (330) than for tropical (548) corn which had a concentration similar to the intermediate (497) and forage-type sorghums (543). Dry matter intake was similar among silages (1.83 kg+100 kg⁻¹ body weight) but apparent dry matter digestion was higher (P = 0.01) for temperate corn (64.0%) vs. tropical corn (59.8%). Tropical corn had similar digestion values to intermediate sorghum silage (61.4%) but lower than forage sorghum (64.5%).

KEYWORDS

Steers, silage, nutritive value, quality, sorghum, corn, yield

INTRODUCTION

In much of the U.S., corn silage forms the forage base in dairy enterprises as well as for beef and sheep enterprises in the more northern latitudes. Corn, as silage, has the advantage of being readily ensiled, high in nutritive value and well accepted by all classes of ruminant animals. In the Southeastern U.S., tropical-corn germplasm has shown agronomic potential for late June to July plantings and for use in double or triple cropping systems. This flexibility is attributed to its tolerance to high insect populations (W.K. Martin, 1991) and high temperatures during summer (Teare and Wright, 1991). The purpose of this study was to compare the inherent quality of tropical corn with a temperate, recommended corn cultivar and with a forage- and intermediate-type sorghum for its potential use in multiple cropping systems.

MATERIALS AND METHODS

A field each of temperate corn (cv. Pioneer 3156), tropical corn (cv. Pioneer X304C), intermediate-type sorghum (cv. Pioneer 841F) and forage-type sorghum (cv. Brandies) were seeded using conventional methods. The corn was seeded at 66,790 plants ha⁻¹ and sorghums at 11 kg ha⁻¹. The adapted corn (MC) was seeded 28 April, the sorghums 16 May and the tropical corn (TC) 15 June. All forages received 141 kg N ha⁻¹ and were irrigated when moisture stress occurred to reduce plant variation.

Harvest occurred when grain reached the late-dough stage [11 August for the MC, 27 September for TC, 5 September for the intermediate sorghum (IS), and 6 October for the taller forage sorghum (FS)]. Six strips (one row 3.1 m long) were randomly harvested from each field for yield determination. Two stalks from each strip were separated into component parts and dried in a forced-air oven (55°C) and the weights expressed as a percent of dry matter.

Beef steers (mean weight = 281 ± 7.5 kg) were confined on a raised, basket-weave steel platform equipped with Calan gates for a 28-day (14 days adjustment and 14 days of measurement) intake phase, then held in crates for a 12-day (7 days adjustment and 5 days total collection) digestion phase. Conventional procedures were used with

animals fed twice daily, assuring a 15% excess. A randomized complete block design was used with three steers per treatment.

RESULTS AND DISCUSSION

The dry matter (DM) yield of the four forages at time of ensiling shows the yield potential of TC (Table 1). Further, as a percent of DM, TC was numerically the leafiest (15%), but had a higher proportion of stem (44%) than MC (25%) or IS (31%) and a concurrent lower percentage of ear (28%). All forages fermented well (pH ranged from 3.7 to 3.9) and were high in lactic acid (56 to 81 g kg⁻¹). Only the MC and IS silages had adequate crude protein (CP) concentrations (Table 2) to give daily gains > 0.5 kg for the size of steers (NCR, 1984) used in this study. The TC had a neutral detergent fiber (NDF) concentration that was appreciably higher (66%) than MC, but similar to the sorghums.

Daily dry matter intake (DMI) for steers (Table 2) was similar among silages but differences approached significance (P = 0.16). The silages with the numerically lower DMI also had the lowest CP concentrations but were the intermediate to highest yielders. The apparent digestion coefficients for DM, CP and NDF differed among silages (Table 2). Silage from corn and sorghum were similar in apparent DM and CP digestion. The MC had higher DM digestion than TC, and FS had higher DM digestion than IS. The apparent digestion of NDF also differed among silages with corn averaging lower than sorghum and TC averaging higher than MC. Differences in NDF digestion of TC and MC may be associated with the differences in grain content (Table 1).

REFERENCES

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- NRC.** 1984. Nutrient requirements of domestic animals. Nutrient requirements of beef cattle (6th ed.), p. 77.
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Table 1

Dry matter yield and plant characteristics of corn and sorghum forages

Item	Corn		Sorghum		SE
	Temperate	Tropical	Intermediate	Forage	
Yield (Mg ha ⁻¹) ^a	14.7	19.3	8.5	10.3	1.10
Plant Height (M) ^a	2.67	3.72	1.5	2.3	0.07
Stalk Weight (g) ^a	807	1169	123	270	41.2
Plant Parts (percent of DM) ^b					
Leaf	11.0	15.0	8.7	11.1	
Stem	25.3	43.9	30.7	65.5	
Head	—	—	—	60.3	20.9
Husk	7.1	8.6	—	—	
Ear	56.3	28.4	—	—	
Grain					
% of ear	81.9	66.8			
% of DM	46.1	19.0			
Cob					
% of ear	18.1	33.2			
% of DM	10.1	9.4			
Tassel	0.4	1.2	—	—	
Dead	0.0	2.9	2.5	2.5	

^aCultivars and Pioneer 3156 and Pioneer X304C for the temperature and tropical corns and Pioneer 841F and Brandies for the intermediate-type and taller forage-type sorghums.

^bMeans of six random yield strips harvested within each forage.

^cValue represents a composite sample of 12 stalks (two stalks selected at random from six yield strips).

Table 2

Composition, dry matter intake (DMI), and apparent digestion of dry matter (DM) crude protein (CP) and neutral detergent fiber (NDF) of corn and sorghum silages.

Item	Composition		DMI	Digestion		
	CP	NDF		DM	CP	NDF
	19 kg-1		(kg+100 kg-1 BW)	%		
Corn silage						
Adapted (MC)	90a	330a	1.99b	64.0b	51.1b	20.8b
Tropical (TC)	73	548	1.76	59.8	49.0	47.1
Sorghum silage						
Intermediate (IS)	118	497	2.06	61.4	59.1	49.1
Forage (FS)	60	543	1.50	64.5	32.2	53.2
Mean	85	480	1.83	62.4	47.8	42.5
Significance:						
Treatments			0.16	0.02	<0.01	<0.01
MSD ^c			—	2.9	9.3	9.1
Contrasts						
Corn vs. sorghum			—	0.23	0.15	<0.01
MC vs. TC			—	0.01	0.61	<0.01
IS vs. FS			—	0.04	0.01	0.32
SE	1	6	0.14	0.7	2.3	2.3
CV (%)			15.3	2.3	9.7	11.0

^aValues are the mean of three samples representing the forage fed to each of three steers.

^bValues are the mean of three steers.

^cMinimum significant difference from the Waller Duncan K ratio 't' test (I=100).