Agronomic Comparison, Heterosis and Hydrocyanic Acid Potential (HCN-p) of Sudangrass-Sorghum and Sudangrass-Sudangrass Hybrids and Their Parents[1]

A. Sotomayor-Ríos and S. Torres-Cardona[2]

ABSTRACT

Cytoplasmic male-sterile sudangrass, A Rhodesian (*Sorghum arundinaceum*), was crossed with two sudangrasses (Sweet Sudan and Piper) and six forage sorghums (Sugar Drip, Brawley, Roma, Collier, Sumac and Meridian 55-1). The eight F_1 hybrids and their male parents were compared for yield of green forage (GF), dry forage (DF), and crude protein (CP); dry matter (DM) and CP contents; plant height, leaf area, number of tillers, leaf/stem ratio and hydrocyanic acid potential (HCN-p). The first cutting was made 60 days after planting and the two subsequent cuttings at a 60-day interval. The second harvest had the greatest DF yields but a lower CP content when compared to the first harvest. The F_1 hybrids were significantly superior than male parents for all traits except HCN-p at 45 and 60 days, leaf/stem ratio and DM and CP contents at each of the three harvests. Combined data for the three cuttings show that the F_1's of A Rhodesian × Sumac and A Rhodesian × Roma produced the greatest DF yields among hybrids. The DF yields of Sugar Drip were the highest among male parents. The average DF yield for F_1 hybrids was 19% more than for the male parents. The DF yields of about 19 t/ha of the best hybrids compared favorably with other high yielding forage sorghums. Heterosis was observed for the most important traits, F_1 hybrid A Rhodesian × Piper exhibiting the greatest value, 60 and 97% more DF than the midparent and high parent, respectively. The excellent DF yields, relatively low HCN-p values and high protein content of hybrids when A Rhodesian sudangrass was the female parent, make them potentially valuable genotypes for utilization in an intensive management program in the tropics. As in a previous study, A Rhodesian sudangrass proved to be a potentially useful male-sterile line in the development of superior F_1 forage sorghum hybrids in Puerto Rico.

INTRODUCTION

The excellent potential of sorghum-sudan (*Sorghum bicolor* × *S. sudanense*) hybrids as forage producers has been demonstrated in Puerto Rico (7, 9, 11, 13). Previous studies have shown[3] (12) that hybrids such as CK-60 × Florida 357 sudangrass, ATx624 × Common sudangrass, and others are able to produce over 20 t/ha of dry forage in 180 days of growth. It appears from these studies that cytoplasmic male-sterile lines CK-60 and ATx624 are excellent female lines for the development of high yielding forages.

Only one report is available in Puerto Rico concerning the utilization

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[2] Research Agronomist and Agronomist, Tropical Agriculture Research Station, Mayagüez, Puerto Rico, S & E, RS, Southern Region, USDA.

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of a cytoplasmic male-sterile line sudangrass for the development of forage sorghum hybrids. In 1981, Sotomayor-Ríos and Santiago (9) reported excellent dry forage yields (20 t/ha in 135 days of growth) when A Rhodesian sudangrass (*S. arundinaceum*) was crossed to a series of forage and sudangrass lines. Craigmiles and Stacy (3), at Georgia, reported the excellent production of "Suhi-1", an F_1 hybrid developed from A Rhodesian × Tift, a sudangrass. Hybrid "Suhi-1" produced 31% more forage than the average sudangrass tested and 22% more than Piper and Tift, the highest yielding commercial varieties in the test.

The utilization of heterosis in F_1 hybrids is generally the ultimate aim in forage breeding (2). In sorghum, heterosis includes earlier blooming, more tillering, and taller plants with increased forage yield (8). In a previous study by Sotomayor-Ríos and Torres-Cardona (11) significant increases in dry forage yields were attributed to heterotic effects when CK-60 was used as female parent in crosses with other forage and sudangrass lines.

In addition to yield and other agronomic characters the toxic potential of dhurrin [(S)-p-hydroxymandelonitrileβ-D-glucopyranoside] which yields hydrocyanic acid (HCN) when hydrolyzed enzymatically in disrupted plant tissues or in the rumen of consuming animals (5), needs special consideration. Various studies conducted in Puerto Rico (11, 13) indicate that when forage sorghum hybrids are harvested every 60 days, the HCN value seldom exceeds the "threshold of danger" of 200 p/m (13). It has been generally assumed that the sorghum forage containing 750 p/m of HCN is safe to graze (4).

The objective of this study was to evaluate single cross forage sorghum hybrids obtained from the cross of a single female parent A Rhodesian sudangrass with eight male parents in terms of yield, potential, heterosis, HCN-p and other agronomic characters.

MATERIALS AND METHODS

In 1979 hand crosses were made between A Rhodesian sudangrass developed by Craigmiles in Georgia (1) and eight parents. The male parents were two sudangrasses: 'Sweet sudan' (Tx372) and 'Piper'; and six forage sorghums: 'Sumac', 'Sugar Drip', 'Brawley', 'Roma', 'Meridian' (Mer.) 55-1 and 'Collier'. The male parents were selfed for at least three generations before crossing to A Rhodesian sudangrass.

The male parents, B Rhodesian and the hybrids were sown at the Isabela Experiment Farm of the Tropical Agriculture Research Station (TARS), USDA, ARS, S&E, April 27, 1981, at a population density of about 125,000 plants/ha. The experimental design was a split plot arrangement of randomized complete blocks with four replications. The whole plots were the genotypes; the subplots, the harvest dates. Plots

consisted of two rows spaced 1 m apart and 6 m in length. Sampling areas was 10 m^2.

The Coto clay soil (Oxisol) at the site has a pH of about 5.2. Immediately after planting, propazine [2-chloro-4,6-bis(isopropylamino)-s-triazine] was applied at a rate of 2.5 kg of active ingredient/ha. At planting and after each cutting, a 15-5-10 fertilizer was applied at the rate of 560 kg/ha. Plants were irrigated as needed to prevent moisture stress.

The first cutting was at 60 days after planting, and two subsequent harvests were at a 60-day interval. Before each cutting, measurements were made of plant height (from the ground to the midpoint of the upper leaf blade), and number of tillers (counting four plants/plot chosen at random). Leaf blade area was determined from the second leaf blade from the top and multiplying maximum length × maximum width × 0.747 × number of leaves/plant. This calculation has been reported to give a close approximation to leaf area as determined by a planimeter (11). Yields of green forage (GF), dry forage (DF), and crude protein (CP), tillers/plant and leaf/stem ratio were calculated for each harvest. Samples were analyzed for dry matter (DM) and crude protein (CP) contents, and HCN-p.

Leaf tissue was analyzed for HCN-p with the spectrophotometric method of Gorz et al. (5) with modifications in sample preparation as reported by Torres-Cardona et al. (13). Data were subjected to analysis of variance and significant treatment differences identified with the Duncan's multiple range test. Estimates of heterosis relative to the average of the two parent varieties (midparent), and to the high parent, were calculated as follows:

$$H_1 = (F_1 - [(P_1 + P_2)/_2])/[P_1 + P_2)/_2] \times 100$$

$$H_2 = [(F_1 - P_1)/P_1] \times 100$$

where H_1 = heterosis relative to the average of the two parent varieties (midparent)
H_2 = heterosis relative to the high parent variety
F_1 = mean of F_1 hybrid
P_1 = mean of pollinator parent
P_2 = mean female parent[4]

RESULTS AND DISCUSSION

Table 1 shows the mean GF, DF, and CP yields; DM and CP contents; plant height, leaf area, number of tillers, leaf/stem ratio and HCN-p of F_1 hybrids and male parents at each harvest. As in previous studies

[4] B Rhodesian instead of A Rhodesian included in the planting scheme was used for the heterosis comparisons only.

TABLE 1.—*Mean comparison of green and dry forage, and crude protein yields; contents of dry matter and crude protein; mean height, leaf area, tillers/plant, leaf/stem ratio and hydrocyanic acid potential in eight F_1 hybrids of sorghum and their parents at Isabela, Puerto Rico*

Trait	Mean of F_1's and male parents at 60-day harvest interval								
	60 days			120 days			180 days		
	F_1	F_1's vs MP	MP	F_1	F_1's vs MP	MP	F_1	F_1's vs MP	MP
Green forage yield, t/ha	30.11	*[1]	26.60	46.35	*	37.96	36.96	*	28.77
Dry matter content, %	15.42		15.70	14.88		15.15	14.91		15.35
Dry forage yield, t/ha	4.64	*	4.18	6.89	*	5.74	5.51	*	4.42
Crude protein yield, t/ha	0.62	*	0.55	0.59	*	0.56	0.47	*	0.40
Crude protein content, %	13.19		13.11	8.47		9.68	8.46		9.17
Plant height, cm	268	*	227	280	*	255	246	*	229
Leaf area, cm^2	5,781	*	4,790	5,794	*	4,723	6,009	*	4960
Tillers/plant, no.	3.04	*	2.74	7.51	*	5.09	5.98	*	4.21
Leaf/stem ratio	0.4488	*	0.5000	0.4371	*	0.5065	0.4263	*	0.4985
HCN-p									
45 days	357		359	240		249	286		298
60 days	259		248	196		189	196		190

[1] Significant at the 0.05 probability level. Indicates difference between F_1's and male parent (MP) heterosis.

conducted at Isabela (9, 11, 13), the forage yields were the highest at harvest 2. The CP yields and CP content were higher in harvest 1, decreasing considerably in harvests 2 and 3. Hybrids were significantly superior than male parents for all traits except HCN-p at 45 and 60 days, leaf/stem ratio and DM and CP content at each of the three harvests. These results are in accordance with those reported earlier by Sotomayor-Ríos and Torres-Cardona (11) at Isabela, Puerto Rico.

COMBINED HARVESTS

Table 2 shows the analysis of variance of all traits (combined harvest) and the partitioning of genotypes and genotypes × harvests mean squares. Significant genotypic differences existed among hybrids and among male parents for all traits except DM content for the latter. A significant male parents × hybrids interaction was obtained for all traits except DM and CP content and HCN-p at 60 days. The significant genotype × harvest interaction indicates that the genotypes responded differently at the different hybrids for all traits except leaf/stem ratio and that the genotype performance should be measured in more than one harvest.

The F_1 hybrids yielded more GF, DF, and CP; were taller, had more leaf area, greater numbers of tillers/plant and less HCN-p at 45 days of growth than the male parents. However, the male parents produced more CP content, greater leaf/stem ratio and less HCN-p at 60 days of growth (table 3).

The F_1's of A Rhodesian × Sumac and A Rhodesian × Roma produced the highest GF and DF yields among hybrids, although the DF yields of A Rhodesian × Roma were not significantly different to those of A Rhodesian × Sweet Sudan. Sugar Drip was the highest DF yielder among male parents, although not significantly different to those of Sumac and Roma. The average DF yield for F_1 hybrids was 19% more than for parents. The DF yields of the best hybrids compared favorably with other high-yielding forage sorghums previously studied at Isabela, (9, 11, 13, 14). The CP yields of about 2 t/ha produced by A Rhodesian × Sumac in about 180 days, are considered excellent and also compare favorably with top-yielding tropical grasses at Isabela (10). The average CP yield was 10% greater for F_1 hybrids than for parents, whereas the latter exceeded in CP content by only 6% (table 4).

A Rhodesian × Sweet sudan and Sugar Drip were significantly taller than the remaining genotypes. F_1 hybrids were 10% taller than their parents. The F_1 hybrids A Rhodesian × Sumac, A Rhodesian × Piper and A Rhodesian × Sugar Drip significantly exceeded the remaining genotypes in leaf area. Sugar Drip had significantly more leaf area than the remaining male parents. Tillers/plant ranged from 6.64 to 4.33 and

TABLE 2.—*Mean square values for the combined analysis of green, dry forage and crude protein yields; dry matter and crude protein contents; tillers/plant, height, leaf area, leaf/stem ratio and hydrocyanic acid potential (HCN-p) of sorghum parents and hybrids across three harvests*

Source	Green forage yield	Dry matter content	Dry forage yield	Crude protein content	Crude protein yield	Tillers/ plant	Height	Leaf area	Leaf/stem ratio	HCN-p	
										45 days	60 days
Genotypes	33.98*[1]	2.88*	24.52*	5.03*	10.12*	42.75*	57.65*	131.25*	100.27*	7.72*	6.19*
Male parents	23.00*	2.95	18.56*	3.83*	14.70*	77.98*	46.20*	47.68*	111.61*	26.96*	9.22*
Hybrids	182.83*	6.00*	101.29*	12.30*	16.12*	194.81*	64.42*	628.48*	203.00*	1.91*	1.36*
Male parents × hybrids	15.47*	0.84	11.60*	1.95	7.82*	38.53*	12.02*	76.36*	109.36*	6.38*	1.61
Harvests	257.83*	6.34*	165.84*	350.99*	52.38*	228.62*	72.98*	11.78*	1.93	71.77*	43.98*
Genotypes × harvests	9.29*	1.73*	6.28*	2.74*	4.69*	8.18*	10.47*	7.37*	1.28	6.84*	2.21*

[1] Significant at the 0.05 probability level.

from 8.41 to 2.22 among F_1 hybrids and male parents, respectively. Male parent Piper had the highest number of tillers/plant among all genotypes. Tillers were 37% more numerous for F_1 hybrids than for parents. A Rhodesian × Brawley had the highest leaf/stem ratio among F_1 hybrids. Sugar Drip and Sumac had the highest leaf/stem ratio among parents. The average leaf/stem ratio exhibited by male parents was 15% more than that of F_1 hybrids. The F_1 hybrids, as well as the male parents all had HCN-p values over the "threshold of danger" of 200 p/m when sampled at 45 days of growth. The values are higher than those reported by Sotomayor-Ríos and Torres-Cardona (11) when Sudan grass male

TABLE 3.—F *values and coefficients of variation (c.v.) for 11 traits of sudangrass-sorghum hybrids and their parents across three harvests at Isabela, Puerto Rico*

Trait	F_1's	Male parents	F_1's vs male parents	C.V.
	$\bar{X}$	$\bar{X}$		%
Green forage yield, t/ha	113.42*[1]	93.33*	*	8.55
Dry matter %	15.07*	15.40		4.69
Dry forage yield, t/ha	17.04*	14.34*	*	9.79
Crude protein	10.04*	10.65*		8.80
Crude protein yield, t/ha	1.67*	1.52*	*	15.13
Tillers No.	5.51*	4.01*	*	16.38
Height, cm	259*	236*	*	5.65
Leaf area, cm^2	5,861*	4,824*	*	4.46
Leaf/stem ratio	0.4374*	.5017*	*	6.61
HCN-p 45 d.	294*	302*		15.29
HCN-p 60 d.	217*	209		17.28

[1] Significant at the 0.05 probability level. Indicates difference between F_1's and male parent (MP) heterosis.

parents and CK-60 hybrids were evaluated under similar conditions at Isabela, Puerto Rico. At 60 days of growth the F_1 hybrid and male parents had on the average, similar HCN-p values slightly exceeding the "threshold of danger" of 200 p/m (table 5). Among the F_1 hybrids A Rhodesian × Sumac and A Rhodesian × Roma and A Rhodesian × Sweet Sudan combined high potential and relatively low HCN-p. Male parents Roma, Sumac and Sweet Sudan were among the lowest in HCN-p and were also excellent DF producers. Brawley was lowest in HCN-p although this male parent was not among the top yielders. Leaf area and height were positively correlated (P = .05) with GF, DF and CP yields (as shown below). As in previous studies (9, 13) the association of height and leaf

area with yields, is consistent, which indicates that these two traits might become important selection criteria in the improvement of forages.

Yield	Leaf area	Height
Green forage	0.47*[5]	0.62*
Dry forage	0.47*	0.62*
Crude protein	0.31*	0.50*

TABLE 4.—*Mean yields of green, dry forage and crude potein; and contents of dry matter and crude protein of eight F_1 hybrids of sorghum and their parents across three harvests at Isabela, Puerto Rico*[1]

Genotypes	Green forage yield	Dry forage yield	Dry matter content	Crude protein yield	Crude protein content
	t/ha	*t/ha*	%	*t/ha*	%
F_1's					
ARhodesian × Sumac	125.00 a	19.30 a	15.33 a	1.95 a	10.48 ab
ARhodesian × Roma	123.83 a	18.75 ab	15.01 ab	1.76 ab	10.01 bc
ARhodesian × Sweet sudan	114.63 b	17.27 bc	15.05 ab	1.91 a	11.09 a
ARhodesian × Piper	112.67 bc	16.87 c	15.00 abc	1.64 b	9.87 bc
ARhodesian × Brawley	110.17 bc	16.93 c	15.42 ab	1.61 bc	9.89 bc
ARhodesian × Sugar Drip	108.73 bc	16.74 c	15.40 ab	1.72 ab	10.28 abc
ARhodesian × Collier	107.47 bc	15.64 cd	14.72 bc	1.39 c	9.19 c
ARhodesian × Mer. 55-1	104.87 c	14.81 d	14.31 c	1.37 c	9.52 bc
$\bar{X}$	113.42	17.04	15.07	1.67	10.04
C.V. (%)	7.87	8.34	5.18	13.10	7.96
Male parents					
Sugar Drip	109.27 a	17.12 a	15.67 a	1.72 a	10.16 c
Sumac	104.97 a	16.09 ab	15.33 a	1.59 a	10.06 c
Roma	104.60 a	15.83 ab	15.91 a	1.78 a	11.32 ab
Sweet sudan	100.37 a	15.14 bc	15.16 a	1.74 a	11.60 a
Mer. 55-1	99.77 a	15.04 bc	15.15 a	1.67 a	11.04 abc
Collier	86.10 b	13.17 d	15.27 a	1.32 b	10.27 bc
Brawley	83.47 b	13.41 cd	16.01 a	1.36 b	10.11 c
Piper	58.23 c	8.95 e	15.32 a	0.94 c	10.68 abc
$\bar{X}$	93.33	14.34	15.40	1.52	10.65
C.V. (%)	9.38	11.49	4.35	17.00	9.46

[1] Means within F_1's and means within male parents were compared by Duncan's multiple range test. Means within each group followed by the same letter do not differ significantly at the 0.05 probability level.

In most crosses, a significant positive heterosis for mid-parent and high parent was manifested for GF and DF yield; leaf area and height, while a negative heterosis was evident for CP content. Inconsistent values were evident for midparent and high parent heterosis in leaf/stem ratio. Heterosis for DM content was not observed in any of the crosses except

[5] Significantly different from zero at P = 0.01 (152 d.f.).

in two cases. There was evidence of heterosis for HCN-p at 45 and 60 days. High parent heterosis resulted in higher DF yields for most of the hybrids studied.

The F_1 hybrid of A Rhodesian × Piper exhibited the greatest hybrid vigor or heterosis. It produced 60 and 97% more DF than the midparent and high parent, respectively (table 6). Most of the F_1 hybrids also

TABLE 5.—*Mean height, leaf area, tillers/plant, leaf/stem ratio and hydrocyanic acid potential (HCN-p) in eight F_1 hybrids of sorghum and their parents across harvests at Isabela, Puerto Rico*[1]

Genotypes	Plant height	Leaf area	Tillers/ plant	Leaf/stem ratio	HCN-p	
					45 days	60 days
	cm	*cm²*			*p/m*	
F_1's						
ARhodesian × Sweet sudan	304 a	5,256 d	6.58 a	0.3642 e	264 e	217 bc
ARhodesian × Sumac	288 b	6,560 a	5.50 b	0.4444 bc	244 e	200 cd
ARhodesian × Piper	270 c	6,469 a	5.92 ab	0.3282 f	318 b	249 ab
ARhodesian × Sugar Drip	268 c	6,429 a	5.31 b	0.4393 c	414 a	265 a
ARhodesian × Roma	255 d	5,317 cd	4.33 c	0.4726 b	263 e	214 c
ARhodesian × Mer. 55-1	242 d	5,553 bc	5.42 b	0.4419 c	293 c	213 c
ARhodesian × Brawley	226 e	5,624 b	4.39 c	0.6018 a	268 de	203 cd
ARhodesian × Collier	219 e	5,682 b	6.64 a	0.4068 d	290 cd	175 d
$\bar{X}$	259	5,861	5.51	0.4374	294	217
C.V. (%)	5.11	3.23	11.62	6.89	15.55	14.29
Male parents						
Sugar Drip	291 a	5,859 a	2.64 e	0.6390 a	359 a	251 a
Sweet sudan	262 b	4,716 c	6.11 b	0.4133 d	313 bc	210 ab
Sumac	250 b	4,689 c	2.64 e	0.6338 a	298 bc	208 ab
Roma	248 b	5,173 b	3.22 d	0.6091 b	274 cd	188 bc
Collier	217 c	5,152 b	3.17 d	0.4523 c	246 d	189 bc
Brawley	211 c	4,616 c	2.22 e	0.3832 e	294 bc	147 c
Piper	206 c	3,258 d	8.41 a	0.4339 cd	331 ab	247 a
Mer. 55-1	202 c	5,129 b	3.69 c	0.4490 c	302 bc	232 ab
$\bar{X}$	236	4,824	4.01	0.5017	302	209
C.V. (%)	6.11	5.80	20.56	6.39	15.49	19.21

[1] Means within F_1's and means within male parents were compared by Duncan's multiple range test. Means within each group followed by the same letter do not differ significantly at the 0.05 probability level.

showed heterosis in height and leaf area, two important plant characters associated with yield.

Most of the sudangrass forage hybrids performed highly satisfactorily. Their potential for forage production in the tropics is confirmed by earlier reports (7, 9, 11, 13). The high DF yields, relatively low HCN-p values and high protein content make of some of these hybrids potentially useful genotypes for tropical conditions. The results herein obtained also

TABLE 6.—*Percent increase or decrease of F_1 hybrids over or under mean of midparent and high parent values across three harvests at Isabela, Puerto Rico*

Trait	ARhodesian × Piper		ARhodesian × Sumac		ARhodesian × Roma		ARhodesian × Sugar Drip	
	Midparent	High parent	Midparent	High parent	Midparent	High parent	Midparent	High parent
GF yield	66.07*[1]	101.66*	36.04*	17.79*	33.87*	16.74*	16.04*	−0.02
DM %	−3.39	−1.86	0.14	1.82	−2.46	−0.40	−1.97	−1.67
DF yield	60.20*	96.97*	36.42*	20.14*	32.11*	17.07*	13.93*	−1.58
CP %	−11.18*	−7.52	−2.65	4.63	−12.59*	−11.74*	−4.76	3.57
CP yield	41.68*	83.11*	34.99*	26.64*	11.99	1.22	10.34	2.53
Tillers/plant	−10.25*	−28.47*	37.75*	95.89*	0.42	43.78*	36.64*	101.01*
Height	39.66*	31.23*	33.62*	15.36*	18.95*	3.10	13.33*	−7.73*
Leaf area	86.57*	99.78*	59.26*	49.46*	20.09*	3.13	35.04*	9.98*
Leaf/stem ratio	−12.38*	−24.12*	−6.22*	−29.75*	2.67	−21.92*	−7.79*	−31.13*
HCN-p 45 days	3.16	−2.36	−17.69*	−17.02*	−3.93	6.98	34.46*	30.63*
HCN-p 60 days	2.38	1.70	−13.67	−4.54	0.60	19.24	7.32	5.55

[1] Significant at the 0.05 probability level.

Table 6 *Continued*

Trait	ARhodesian × Mer. 55-1		ARhodesian × Brawley		ARhodesian × Sweet sudan		ARhodesian × Collier	
	Midparent	High parent	Midparent	High parent	Midparent	High parent	Midparent	High parent
GF yield	17.42*	8.99	35.85*	31.96*	29.54*	21.52*	30.25*	24.22*
DM %	−7.51*	−5.61	−3.21	−4.07	−2.65	−0.58	−4.96*	−3.25
DF yield	−8.74	3.37	31.27*	26.47*	26.34*	20.02*	22.68*	20.04*
CP %	−15.65*	−13.44*	−9.85*	−2.81	−3.69	−4.34	−15.79*	−10.77
CP yield	−9.70	−10.40*	16.84*	22.09*	21.40*	16.14	3.02	6.72
Tillers/plant	21.28*	51.48*	18.55*	95.09*	21.50*	14.12	53.20*	95.27*
Height	26.84*	21.68*	15.24*	7.49	37.04*	16.16*	10.28*	1.46
Leaf area	26.36*	8.74*	35.65*	22.11*	25.24*	12.15*	28.91*	10.76*
Leaf/stem ratio	15.67*	−1.35	72.86*	59.23*	0.28	−11.58*	6.10*	−9.98*
HCN-p 45 days	−0.96	−2.44	−8.84	−6.34	−9.07*	−8.16*	9.83	20.28*
HCN-p 60 days	−5.34	3.24	5.32	43.75*	−2.92	7.92	−18.82*	−7.36

confirmed a previous finding (9) which indicates that A Rhodesian sudangrass is a male-sterile line with potential for use in the development of superior F_1 forage-sorghum hybrids in Puerto Rico.

RESUMEN

La línea androestéril de sorgo A Rhodesian (*Sorghum arundinaceum*) se cruzó con dos yerbas sudán (*S. sudanense*) "Sweet Sudan" (TX 372) y "Piper", y seis sorgos forrajeros (*S. bicolor* (L.) Moench), "Sugar Drip", "Brawley", "Roma", "Collier", "Sumac" y "Meridian" (Mer.) 55-1. Los ocho F_1 y los ocho progenitores masculinos se evaluaron en términos de forraje verde (GF), forraje seco (DF), materia seca (DM), proteína bruta (CP), número de cañas, altura de la planta, proporción de hoja a caña y potencial de ácido cianhídrico (HCN-p) a los 60 días. El análisis de HCN-p se hizo a los 45 días. Se cortó tres veces: el primero a los 60 días de sembrar y los siguientes cada 60 días. La heterosis se estudió en todos los caracteres.

Las producciones de GF y DF fueron más altas en el segundo corte de 60 días en todos los genotipos al compararlas con las del primer corte. La CP fue más alta en el primer corte. Los híbridos fueron los mejores productores en todos los cortes; fueron superiores a los progenitores masculinos en casi todos los caracteres, excepto la proporción hoja/tallo, CP y HCN-p, a los 45 y 60 días. Al combinarse los tres cortes, el análisis de varianza mostró diferencias significativas entre genotipos en todos los caracteres, excepto DM en el caso de los progenitores masculinos. Los híbridos F_1 de A Rhodesian × Sumac y A Rhodesian × Roma fueron los mejores productores en términos de GF y DF. El sorgo forrajero Sugar Drip fue el mejor productor entre los progenitores masculinos. La producción de DF de los híbridos sobrepasó la de los progenitores masculinos en un 19%. La producción de DF de aproximadamente 19 t/ha de los híbridos arriba indicados compara favorablemente con los mejores sorgos forrajeros disponibles. Se observó heterosis en los caracteres más importantes. El híbrido F_1 A Rhodesian × Piper, arrojó los valores más altos, 60 y 97% más DF que el promedio de los padres y del padre con la heterosis mayor, respectivamente. Los altos rendimientos de DF, el bajo contenido de ácido cianhídrico y el excelente contenido de proteína de los mejores híbridos, hace de estos genotipos material con un buen potencial para usarlos en un programa de cultivo intensivo en el trópico. Según se demostró en un estudio anterior, la yerba sudán a Rhodesian mostró ser una línea androestéril con excelentes potencialidades para usarla en el desarrollo de híbridos de sorgo forrajero en Puerto Rico. Este trabajo se llevó a cabo en la finca experimental de la Estación de Investigaciones en Agricultura Tropical del Departamento de Agricultura de los Estados Unidos en Isabela, Puerto Rico.

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