Effects of Regrowth on the Agronomic Traits and Yields of Forage Sorghum(1)

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Abstract

The objective of the experiment was to determine the effects of regrowth on the agronomic traits and yield of sudangrass (*Sorghum sudanense* Stapf). Two sudangrass hybrid lines, 632A x Tifton and 219A x Tifton were used to compare with sudangrass CV. Taishi No. 1. Taishi No. 1 was used as check cultivar (CK). The experiments were conducted in Changhua, Tainan and Pingtung from 1998 to 1999, respectively. The results showed that the CK had the highest fresh forage yield of 233.7 mt/ha among the three entries in Changhua, while 632A x Tifton produced the highest fresh forage yield of 115 mt/ha in Tainan and 171.7 mt/ha in Pingtung, respectively. 219A x Tifton produced only 104.2 mt/ha in Tainan and 162.2 mt/ha in Pingtung, respectively. The results showed that the yields of the 2nd and the 3rd harvests were the highest among 5 harvests and the yields of the 4th and the 5th harvests decreased drastically in whole year.

Key words：*Sorghum sudanense*, Regrowth, Forage yield.

Introduction

Sudangrass (*Sorghum sudanense* Stapf) is a short period forage species with high forage yield, drought tolerance, tillering ability and fast regrowth. It has high contents of crude protein, low contents of crude fiber and hydrocyanic acid. It adapts to growth in tropic and subtropic areas. *Sorghum* spp. has been used for forage in some countries with well developed animal industry for a long time (Sotamyor-Rios and Torres-Cardona, 1984; Goodrich and Meiske, 1985).

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Sudangrass is a new imported forage species in Taiwan. Breeding of sudangrass was conducted at the Taiwan Livestock Research Institute （TLRI）, Council of Agriculture and one line was selected and named Sudangrass Taishi No.1 in 1995. Sudangrass can be harvested once a season to produce 40 mt/ha fresh forage yield（Shaug *et al*., 1997）. *Sorghum* spp. has cytoplasmic male sterile lines and male fertile restoring lines. Many hybrid lines could be obtained by natural crossing between these two lines. Forage yield and quality could be improved by the hybrid system (Craigmiles, 1961; Quinby, 1963; Shaug, 1994; 1997).

Information related to the changes of agronomic traits and forage yield after successive cutting and regrowing of sudangrass is very limited. The objective of this study was to determine the effects of regrowth of sudangrass on the agronomic traits and forage yield of the grass.

Materials and Methods

Both 632A and 219A lines are male steriles. Hybrid lines 632A x Tifton and 219A x Tifton were obtained and used in the experiment.

The seeds were sowed in Chunghua, Tainan and Pingtung in March of 1998 and 1999, respectively. The experimental design was randomized complete block design (RCBD) with 4 replications. Each block area was 4 m x 5 m. The agronomic traits including plant height, stem diameter, brix, lodging percent and resistance to target leaf spot disease were determined at milk stage. The target leaf spot disease was divided into 5 levels, *i.e.*, 0（0-10%）, 1（10-30%）, 2（30-50%）, 3 (50-75%) and 4（75-100%）as presented by Sharma（1978）.

The plants were harvested at milk stage of seed. The stem was left 5-10 cm high after cutting. The plants were allowed to regrow to reach milk stage and were harvested again.

Results and Discussion

The agronomic traits of the three lines of sudangrass evaluated at different locations were shown in Table 1. The plant heights of the hybrid lines were lower than CK and the fresh forage yields of the hybrid line were higher than CK in Tainan and Pingtung. However, no significant differences were observed for the plant heights and the fresh forage yields among the three entries in Chunghua. The resistance to target leaf spot disease of two hybrid lines was 0 - 1 degree, respectively. The lodging percents of three entries were almost 0 %. Gourley and Luck（1977） could elevate the silage quality by the brix value. In this experiment, no significant difference was observed for the brix among the three lines at all the locations.

Table 1. Agronomic traits of three entries of forage sorghum for the 1st harvest at different locations

Location	Line	Plant height	Stem diameter	Brix	Fresh forage yield	Dry matter percent	Lodging percent	Resistance to target leaf spot disease@
		cm	mm	◦	mt/ha	%		
Changhua	632A×Tifton	279[a*]	15.4[a]	8.7[a]	66.7[a]	12.0[b]	0	1
	219A×Tifton	294[a]	14.9[a]	9.0[a]	61.0[a]	11.8[b]	0	0
	CK	280[a]	12.4[b]	10.1[a]	76.3[a]	17.9[a]	0	1
Tainan	632A×Tifton	162[c]	12.6[a]	13.0[a]	25.2[a]	30.3[a]	1	0
	219A×Tifton	175[b]	10.6[a]	12.7[a]	27.8[a]	30.7[a]	1	1
	CK	187[a]	11.5[a]	14.3[a]	20.8[b]	29.7[a]	0	0
Pingtung	632A×Tifton	187[ab]	9.3[a]	13.1[a]	19.2[a]	23.7[c]	0	0
	219A×Tifton	169[b]	7.9[a]	12.4[a]	19.7[a]	25.8[b]	0	0
	CK	198[a]	8.5[a]	13.5[a]	17.2[b]	28.6[a]	0	0

* Means with the same letter within the same location in the same column are not significantly different at 5 % level.

@ The data show the levels of resistance to target leaf spot disease as follows： 0（0-10%）, 1（10-30%）,2（30-50%）,3 (50-75%) and 4（75-100%） respectively.

Table 2. Agronomic traits and forage yields of three entries of forage sorghum for five successive harvests in Changhua in a whole year

Line	Successive harvest	Plant height	Stem diameter	Brix	Fresh forage yield	Dry matter yield	Dry matter percent
		cm	mm	◦	mt/ha		%
632A×Tifton	1st	279.2[a*]	15.4[c]	8.7[d]	66.7[a]	12.0[a]	18.0[d]
	2nd	292.6[a]	18.5[a]	12.2[bc]	47.3[b]	8.8[b]	18.7[cd]
	3rd	297.7[a]	16.0[ab]	10.3[cd]	61.3[a]	12.9[a]	21.0[b]
	4th	177.9[b]	12.5[c]	16.2[a]	9.5[c]	2.4[c]	25.0[a]
	5th	79.3[c]	5.7[d]	13.5[b]	2.6[d]	0.5[d]	20.7[bc]
	Total	—	—	—	187.4	23.7	—
219A×Tifton	1st	293.7[a]	14.9[b]	9.0[d]	61.0[ab]	11.8[ab]	19.3[b]
	2nd	307.8[a]	17.5[a]	13.4[b]	54.0[b]	9.9[b]	18.0[b]
	3rd	289.3[a]	14.9[b]	11.0[c]	69.8[a]	14.2[a]	20.3[b]
	4th	183.5[b]	11.8[c]	17.6[a]	16.0[c]	4.2[c]	26.7[a]
	5th	80.2[c]	5.6[d]	13.0[b]	5.0[d]	1.0[d]	20.7[b]
	Total	—	—	—	189.8	31.3	—
CK	1st	280.4[b]	12.4[a]	10.1[b]	76.3[a]	17.9[a]	23.3[a]
	2nd	314.7[a]	13.1[a]	11.4[ab]	70.3[a]	17.8[a]	25.0[ab]
	3rd	317.0[a]	12.5[a]	10.2[b]	69.8[a]	16.1[a]	23.0[ab]
	4th	151.6[c]	9.3[b]	14.1[a]	14.8[b]	4.5[b]	29.7[a]
	5th	108.9[d]	4.8[c]	11.6[ab]	2.5[b]	0.5[b]	17.7[b]
	Total	—	—	—	233.7	56.8	—

* Means with the same letter within the same line in the same column are not significantly different at 5% level.

Agronomic traits and forage yields of the three entries of forage sorghum for five successive

harvests in Changhua, Tainan and Pingtung were shown in Table 2, 3 and 4, respectively. The plant heights and the forage yields of the three entries for the 1st , the 2nd and the 3rd harvests were higher than those of the 4th and the 5th harvests in Changhua (Table 2). Similar results were observed in Tainan (Table 3). However, the plant heights and forage yield of the three entries for the 2nd and the 3rd harvests were higher than those of the 4th and 5th harvests in Pingtung (Table 4). It showed that both plant heights and forage yields decreased drastically at the 4th and the 5th harvests for all the entries in Chunghua, Tainan and Pingtung.

Table 3. Agronomic traits and forage yields of three entries of forage sorghum for five successive harvests in Tainan in a whole year

Line	Successive harvest	Plant height	Stem diameter	Brix	Fresh forage yield	Dry matter yield	Dry matter percent
		cm	mm	◦	———— mt/ha ————		%
632A × Tifton	1st	162.2b*	12.6a	13.0c	25.2b	7.7b	30.3a
	2nd	234.3a	12.1a	15.7ab	43.6a	11.9a	27.1ab
	3rd	168.9b	11.4a	14.5bc	24.0b	6.6bc	27.3ab
	4th	127.3c	8.7b	17.5a	6.3d	1.6d	26.5b
	5th	128.1c	7.6b	14.2bc	15.9c	4.0cd	25.1b
	Total	—	—	—	115	31.8	—
219A × Tifton	1st	175.3b	10.6bc	12.7b	27.8ab	8.6a	30.7a
	2nd	214.0a	12.9a	13.8ab	35.1a	9.9a	28.0bc
	3rd	182.5b	10.6bc	12.2b	22.0bc	6.2b	28.3bc
	4th	124.1c	8.7d	15.5a	6.5d	1.9b	28.9bc
	5th	128.2c	8.2b	13.8ab	12.8cd	3.1b	24.5b
	Total	—	—	—	104.2	29.7	—
CK	1st	187.3ab	11.5a	14.3a	20.8b	6.2b	29.7ab
	2nd	203.7a	10.3ab	14.3a	35.0a	10.4a	29.7ab
	3rd	182.6b	9.3bc	14.3a	18.5b	5.4bc	29.3ab
	4th	133.7c	7.7cd	16.0a	3.1c	1.0d	33.0a
	5th	118.9c	6.4d	14.3a	7.8c	2.1cd	27.4b
	Total	—	—	—	85.2	25.1	—

* Means with the same letter within the same line in the same column are not significantly different at 5 % level.

Table 4. Agronomic traits and forage yields of three entries of forage sorghum for five successive harvests in Pingtung in a whole year

Line	Successive harvest	Plant height	Stem diameter	Brix	Fresh forage yield	Dry matter yield	Dry matter percent
		cm	mm	o	——— mt/ha ———		%
632A×Tifton	1st	187d*	9.3cd	12.9b	19.2d	2.6c	13.7b
	2nd	288a	14.6a	13.1b	50.6a	12.6a	24.9a
	3rd	262bc	13.0ab	14.7ab	52.6a	13.2a	24.9a
	4th	195b	11.4bc	16.3a	27.7b	6.3b	22.3a
	5th	131f	8.6d	13.2b	21.6c	4.6b	21.2a
	Total	—	—	—	171.7	39.3	—
219A×Tifton	1st	169c	7.9b	12.6ab	19.7c	5.1b	25.8a
	2nd	281a	13.6a	14.1a	46.1a	11.6a	24.8a
	3rd	256b	12.7a	12.3ab	46.2a	10.4a	22.5b
	4th	195c	9.5b	15.4a	27.7b	6.0b	21.6b
	5th	122d	7.7b	13.9a	22.5c	5.7b	25.6a
	Total	—	—	—	162.2	38.8	—
CK	1st	198d	8.5b	14.2a	17.2d	3.2b	18.6c
	2nd	296a	12.2a	14.5a	51.1a	13.9a	27.1a
	3rd	266bc	10.9a	14.3a	41.9b	11.3a	27.1a
	4th	167e	7.7bc	15.9a	25.8c	5.9b	23.0b
	5th	134f	6.8c	15.1a	21.1c	5.2b	24.7b
	Total	—	—	—	157.1	39.5	—

* Means with the same letter within the same column in the same line are not significantly different at 5 % level.

Three entries were sown at three locations in March of 1998 and 1999, respectively. It had the highest yields for the 2nd or the 3rd harvest among 5 harvests. The forage yields decreased drastically at the 4th and the 5th harvests（Table 2, 3 and 4）. In Changhua（Table 2）, the fresh forage yields of the CK were higher than the other two hybrid lines. However, those of the CK were lower than the other two hybrid lines in both Tainan（Table 3） and Pingtung （Table 4）. Some reporters showed that the male sterile and male fertile could increase forage yield and quality （Endrizzi, 1957; Craigmiles, 1961; Craigmiles, 1966; Quinby, 1963; Shaug, 1994; 1997). Rana *et al*. (1984) indicated that the best plant height was 175 cm for forage sorghum. Based on the results obtained, we found that the 1st, the 2nd and the 3rd harvests of the three entries of forage sorghum were higher than those of the 4th and the 5th harvests. Forage yields of all the entries for the last two harvests in three locations decreased remarkably. It was suggested that forage sorghum sown in March be harvested 3 times to obtain high yield.

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再生對芻料高粱農藝性狀及產量之影響(1)

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摘 要

爲瞭解芻料高粱連續宿根，再生後其農藝性狀與產量之變化，本試驗以 632A × Tifton及 219A × Tifton 兩個雜交F_1品系及蘇丹草台畜草一號（*Sorghum sudanense* Stapf）爲對照，於 1998 及 1999 年春季開始分別於彰化、台南新化及屏東內埔等地進行。結果蘇丹草台畜草一號一年約可收穫五次，整年鮮草產量以彰化地區表現最佳，尤其對照鮮草年產量 233.7 公噸/公頃最大。在台南及屏東皆以雜交品系 632A x Tifton較 219A x Tifton及蘇丹草台畜草一號年產量高，可達 115 及 171.7 公噸/公頃，219A x Tifton只有 104.2 及 162.2 公噸/公頃。三地區連續再生，結果三個參試材料產量皆於第二次及第三次再生時較其他次來得高，至第四次產量劇降，第五次再降。結果顯示雜交或自交芻料用高粱第一次至第三次的生長均具高產潛力，第四次及第五次產量已呈現逐漸下降趨勢，品質亦有所影響。

關鍵詞：蘇丹草、再生、產量。

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