

BREEDING TO IMPROVE YIELD AND QUALITY IN NAPIERGRASS

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ABSTRACT

The breeding program has been conducted to improve the production and quality of napiergrass by crossing with related species or intra-species. CV. TLG2 with high yields and water soluble carbohydrates have been selected and released. It produced 20% more forage yields and water soluble carbohydrates than cultivar, CV. A146 and persisted well at least for five years. Good silage was obtained when the CV. TLG2 was harvested at the right time. Milking ability is improved by use of silage and/or green chopping whole year round.

KEY WORDS

Breeding, yield, quality, napiergrass

INTRODUCTION

Napiergrass (*Pennisetum purpureum*) is one of the most important forage grasses in Taiwan. It has high herbage yields, strong competition and persistence, however, the herbage quality is fair and the forage yield is uneven throughout the year. Its feeding quality is not totally satisfactory. Many scientists (Boddorff and Ocumpaugh, 1986; Burton and Powell, 1986; Cheng, et al., 1992; 1995; Flores et al; 1993; Hanna, 1986; Hanna et al, 1984; Muldoon and Pearson, 1979) have studied the hybridization of inter or intra-species of pennisetum to produce a high quality and high yielding perennial fodder plant. The purpose of this study was to improve the production and quality of cultivated napiergrass.

METHODS

Napiergrass CV. A146 and CV. A149, widely grown by farmers in Taiwan, were used as the parents. The hybrids were obtained by open-pollination. From hybrid clones, 7 clones were selected for regional trial at five locations around Taiwan. At one of the locations in the regional trial, a persistence trial was conducted for seven years. After the regional trial, the best strain was used to make silages and feed dairy cows. Fresh and dry matter yields, crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), water soluble carbohydrate (WSC), and in vitro dry matter digestibility (IVDMD) were determined in regional and persistence trials. Volatile fatty acid contents of silage were determined and Flieg's score was used to evaluate silage quality. The milk yields and milk fat of dairy cows were determined in feeding trials.

RESULTS AND DISCUSSION

Forage yield and quality in regional and persistence trial: The regional trial was conducted at five locations from 1987 to 1989. The results are shown in Table 1. TLG2 has the highest yields in fresh and dry matter weight among all entries at five locations. It produces 20% more fresh yield and 30% more dry matter yield than CV. A146.

The persistence trial was conducted from 1987-1993 for seven years. The highest forage yield appeared in the second growth year. After that, the forage yield decreased gradually. For forage quality, TLG2 is similar to CV. A146 in crude protein, ADF, NDF, and IVDMD with higher WSC. The results showed that TLG2 would persist well for five years at least and has high water soluble carbohydrates which is better for silage quality. In bermudagrass, Tifton 85' is the latest cultivar that has been released by the USDA-ARS program at Tifton (Burton et al, 1993) and it represents a remarkable breeding achievement. It is possible to significantly improve both DM yields and forage digestibility by breeding.

Silage quality of different growth intervals without additives:

The results are shown in Table 1. There were significant differences in CP, ADF and NDF among different growth intervals. However, no difference was observed in volatile fatty acid contents and Flieg's score. It was suggested that TLG2 might be harvested from 60 days to 70 days to produce more dry matter, and to make a better quality of silage without any additives. Water soluble carbohydrates are generally present in higher concentrations in TLG2 than others, therefore the quality of silage is better than CV. A146. It was suggested that the silage quality could be improved by adding corn meal or wheat bran (Hsu *et al*, 1990).

Milk yield and milk composition of dairy cows: Seventy dairy cows were fed green chop and silages of TLG2. The concentrates were provided based on milk production at 2.25:1 ratio. Forage is consumed at 40-45 kg per day per head. It provided 31-36% of needs in CP and 41-46% of TDN (Table 2).

The average milk yield and milk fat of eight months were 20.6 kg and 0.75 kg per day per head, respectively. It showed that the milk yield and fat were stable when the TLG2 is offered as green chop and silages with concentrate.

From the results of this study, the improvements in both forage yield and quality were achieved by direct selection for both traits. The outstanding characteristics of TLG2 are high forage yield and WSC. Harvesting the TLG2 at right time to make good quality silages, and feeding the cows a total mixed ration by use of silage and/or green chopping year round, shows that milking ability is improved.

REFERENCES

- Boddorff, D. and W.R. Ocumpaugh.** 1986. Forage quality of pearl millet x napiergrass hybrids and dwarf napiergrass. *Soil Crop Sci. Soc. Fla. Proc.* **45**:170-173.
- Burton, G.W. and J.B. Powell.** 1986. Pearl millet breeding and cytogenetics. *Adv. Agro.* **20**:48-89.
- Burton, G.W., R.N. Gates and G.M. Hill.** 1993. Registration of Tifton 85 bermudagrass. *Crop Sci.* **33**:644-645.
- Cheng, Y.K., C.F. Wu, K.T. Lo, C.C. Tarng, S.C. Chang, W. Chen, Y.S. Hwang and R.H. Buu.** 1992. Breeding of napiergrass. *Taiwan Livestock Res.* **25**(2):151-170.
- Cheng, Y.K., C.F. Wu and C.S. Chen.** 1995. Breeding on yield and chemical composition of dwarf napiergrass. *Taiwan Livestock Res.* **28**(4):285-294.
- Flores, J.A., J.E. Moore and L.E. Sollenberger.** 1993. Determinants of forage quality in pensacola bahiagrass and Mott elephantgrass. *J. Anim. Sci.* **71**:1606-1614.
- Hanna, W.W.** 1986. Notice of release of dwarf Tift N75 napiergrass germplasm. USDA, ARS and Georgia Agric. Exp. Stn Memo.
- Hanna, W.W., T.P. Gaines, B. Gonzalez and W.G. Monson.** 1984. Effect of ploidy on yield and quality of pearl millet x napiergrass hybrids. *Crop. Sci.* **76**:969-971.

Hsu, F.H., K.Y. Hong, M.C. Lee and K.C. Lee. 1990. Effects of cutting height on forage yield, forage and silage quality of napiergrass. J. Agr. Assoc. China. **151**:77-89.

Muldoon, D.K. and C.J. Pearson. 1979. The hybrid between *Pennisetum americanum* and *Pennisetum purpureum*. Herbage Abst. **49**:189-199.

Table 1

The forage yield and quality in regional and persistence trials, and silage quality of different growth intervals of TLG2.

	Regional		Persistence		Silage		
	TLG2	A146	TLG2	A146	45	70	95(days)
Fresh W., mt/ha	276.4 ^a ± 82.6	225.6 ^b ± 39.5	340.3 ^a ± 68.9	262.2 ^b ± 31.6			
Dry W., mt/ha	49.0 ^a ± 17.1	37.3 ^b ± 7.8	59.2 ^a ± 17.2	44.2 ^b ± 6.2			
Dry M., %					15.0 ^a	18.0 ^b	23.0 ^c
CP, %	8.3 ^a	8.1 ^a	9.3 ^a	8.6 ^a	10.4 ^a	7.6 ^b	5.2 ^c
NDF, %	70.3 ^a	71.4 ^a	72.1 ^a	73.6 ^a	69.8 ^b	70.2 ^b	75.3 ^a
ADF, %	38.6 ^a	40.4 ^a	39.4 ^a	41.3 ^a	41.8 ^b	42.4 ^b	47.4 ^a
WSC, %	8.9 ^a	7.6 ^b	8.8 ^a	7.4 ^b			
IVDMD, %	61.1 ^a	59.3 ^a	63.2 ^a	61.4 ^a			
pH					4.5 ^a	4.2 ^a	4.3 ^a
Flieg's score					66.2 ^a	72.3 ^a	68.8 ^a

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

Table 2

Composition of diet, feed intake, milk and fat yield of dairy cows.

	Composition			Intake			Yield	
	DM	CP	TDN	DM	CP	TDN	Milk	Fat
	%			Kg/head/day ^o				
TLG2	18.7	8.5	60	7.5~8.5	0.64~0.72	4.5~5.1		
Concentrate	88.0	16.0	73	8.8~7.9	1.40~1.27	6.4~5.8		
Total				16.3~16.4	2.04~1.99	10.9	20.6	0.75
TLG2(%)				46.0~51.8	31.4~36.2	41.3~46.8		