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Short Communication

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Analysis of Competitive Ability among Clones of the Palisade Grass, *Brachiaria brizantha* (Hochst. Ex. A. Rich.) Stapf.

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With 2 tables

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Abstract

Four clones of palisade grass, *Brachiaria brizantha* (Hochst. Ex. A. Rich.) Stapf., were studied in a diallel competition trial to investigate their competitive relationship in clonal mixtures. Clone X associate interactions were observed for plant height, number of tillers per plant and dry matter yield per plant. Both general and specific competitive abilities were observed for tiller number and dry matter yield. Clone X associate interaction for plant height was mainly due to the specific competitive ability of individual combinations. The most competitive clone observed was CIAT 6387. Competitive abilities of local clones were low compared to the imported clones. Local clones (RU 127 and RU 139) yielded more than imported clones (CIAT 6387 and PI 292185) under low competitive stresses. General and specific competitive abilities should be taken into consideration when mixing clones of palisade grass.

Key words: *Brachiaria brizantha* — competitive ability — clonal mixtures

The growing of mixtures of clones on the same area of land is a common practice in pasture management (CROWDER and CHHEDA 1982). The beneficial or detrimental effects of using mixtures of grasses as compared to a monoculture therefore need to be assessed. In some cases the yield of a variety is increased compared with monocultures and in other cases the yield falls (MCGILCHRIST 1965). The importance of the competitive relationship among genotypes of grasses has been mentioned by many workers (WRICKE and WEBER 1986, WRIGHT 1983), but little information is available on the competitive ability of tropical grasses. A knowledge of the competitive relationship among clones is important in combining clones to produce mixtures for farmers. Therefore the competitive ability among selected clones of palisade grass, *Brachiaria brizantha* (Hochst. Ex. A. Rich.) Stapf., was studied in this experiment.

Two Sri Lankan clones of palisade grass (RU 127 and RU 139), one from South Africa (PI 292185) and another from CIAT, Cali, Colombia (CIAT 6387) were selected for this study. These four clones exhibited marked morphological differences. RU 127 and RU 139 had short leaves and were densely tillering with a prostrate growth habit. PI 292185 had short leaves and was very low tillering with an erect growth habit. The clone CIAT 6387 had long leaves and was dense tillering with an erect growth habit.

The diallel competition studies of these four clones were commenced in November 1986 at the Faculty Farm, University of Ruhuna, Matara, Sri Lanka. The four clones were grown in a monoculture and were used to generate the six possible binary mixtures, representing a 1 : 1 ratio. Four monocultures and six binary mixtures were grown in a randomized complete block design with three replications. The plot size for each treatment was 0.8 m × 0.8 m,

Table 1. Analysis of variance for dry matter yield, plant height and tiller number in a diallel competition study over cuts (transformed data)

Source	d.f.	Dry matter yield M.S.	Plant height M.S.	Tiller number M.S.
Blocks	2	0.6257***	0.0863***	0.4718***
Clones	3	441.9094***	49.4064***	82.0872***
Associates	15	9.1266***	1.3338***	3.3748***
Clones × associates	45	1.1401***	0.2296***	0.7659***
Heterogeneity between regressions	3	7.0526**	0.3052 N.S.	5.8863**
Residual deviations	42	0.7179***	0.2242***	0.4002***
Error	126	0.0491	0.0079	0.0247

N.S. non significant; ** $P < 0.01$; *** $P < 0.001$.

with 10 cm spacing between plants. Extra rows of grasses were planted along the border of each block to avoid border effects. Within the plots, nylon thread was used to keep the individual plants separate from each other.

Four harvests were obtained, starting six weeks after planting in mid-December. The interval between each two harvests was five weeks. Observations were recorded for 36 competitive plants out of the 64 plants in each plot. The characters studied were plant height (cm), number of tillers per plant and dry matter yield per plant (g). Two days after each harvest, fertilizer was applied at the rate of 25 kg N per ha.

The regression analysis proposed by YATES and COCHRAN (1938) was used and the data were transformed into a 10 × log 10 scale because of the high correlation between means and variance for each character. Each associate value in each cut was used as an estimate of associate effect (competitive stress). An analysis of variance was done over cuts including 16 associate effects (4 associates × 4 cuts).

Significant differences were observed for both clones and associates with the effect of clones exhibiting the greater difference (Table 1). The interaction of these effects was also significant so that the clones and associate effects were not additive. A significant proportion of the total clones × associates interaction for dry matter yield and tiller number was attributable to differences between the slopes of the linear regressions. This was defined as general competitive ability (BREESE and HILL 1973). High significance of the residual item when tested against the experimental error showed that there was a degree of non linearity in the clone associate relationship. This could be due to the interactions which were specific to individual combinations. BREESE and HILL (1973) defined those interactions as specific competitive ability. In this study the specific competitive ability was of major importance.

CIAT 6387 was the strongest competitor in both dry matter yield and tiller number (Table 2). Its regression coefficients showed that it could give a higher yield than the others under the high competitive stresses and it showed greater vigour than the other clones (Table 2). PI 292185 was a relatively weak

Table 2. Mean and regression coefficients for dry matter yield, plant height and tiller number in a diallel competition study over cuttings

Clone	Dry matter yield (g)			Plant height (cm)	Tiller number		
	Mean	b[1]	SE.(b)[1]	Mean	Mean	b[1]	SE.(b)[1]
RU 127	15.61	1.33	0.1254	32.50	15.91	1.74	0.1615
RU 139	18.70	1.32	0.1427	35.65	15.48	1.36	0.1762
CIAT 6387	40.25	0.36	0.1419	48.74	21.76	0.23	0.0548
PI 292185	7.44	0.98	0.0819	28.26	10.51	0.67	0.1369

[1] Calculated from transformed data.

competitor, but its low regression coefficients showed that it could also give a higher yield than the two local clones under high competitive stress. Significant residual deviations from linear regressions for all characters were due to the outstanding competitive ability of CIAT 6387 and to its specific competitive ability with other clones.

Even though the two local clones were naturally selected for local environmental conditions, they had not been selected for competitive ability. Therefore under competitive conditions, those two clones did not give a higher yield. But their high regression coefficients showed that they could give a higher yield than the other two clones under less competitive stress. The two foreign clones which had already been selected for high yield and competitive ability showed better results under high competitive stress.

The heterogeneity between regressions for plant height was not significant (Table 1) but residual deviations were highly significant when tested against the experimental error. This showed that the interaction between clones and associates for plant height was mainly due to specific competitive ability of individual combinations.

The competitive ability of these clones would help the breeder in combining clones for clonal mixtures. CIAT 6387 was the most promising clone and could easily compete with local clones. More studies are needed to investigate the best specific combinations of clones which are most adapted to the local clones.

Zusammenfassung

Bestimmung der Konkurrenzkraft von Klonen des Palisadengrases, *Brachiaria brizantha* (Hochst. Ex. A. Rich.) Stapf.

Vier Klone des Palisadengrases, *Brachiaria brizantha* (Hochst. Ex. A. Rich.) Stapf., wurden in einem diallel angelegten Konkurrenzversuch geprüft, um ihr Durchsetzungsvermögen in Klonmischungen zu untersuchen. Die Klon × Nachbarklon-Wechselwirkungen wurden für die Merkmale Pflanzenhöhe, Zahl der Halme je Pflanze und Trockenmasse je Pflanze bestimmt. Es wurde sowohl das allgemeine als auch das spezielle Durchsetzungsvermögen in bezug auf diese Eigenschaften ermittelt. Für die Pflanzenhöhe war die Wechselwirkung vornehmlich abhängig von der spezifischen Konkurrenzkraft in individuellen Klon-Kombinationen. Der Klon mit dem stärksten Durchsetzungsvermögen war Klon CIAT 6387. Im Vergleich zu den eingeführten Klonen waren die heimischen Klone weniger konkurrenzfähig. Unter schwachem Konkurrenzdruck waren die Erträge der heimischen Klone (RU 127 und RU 139) höher als die der importierten Klone (CIAT 6387 und PI 292185). Wenn Klone des Palisadengrases in Mischung angebaut werden, sollten die allgemeine und die spezifische Konkurrenzfähigkeit berücksichtigt werden.

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