FORAGE YIELDS OF SIMPLE MIXTURES OF SELECTED GENOTYPES OF GRASSES AND ADAPTED HERBACEOUS LEGUMES IN SOUTHWEST NIGERIA

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ABSTRACT
Three tropical grasses viz. Guinea grass (*Panicum maximum* Jacq), elephant grass (*Pennisetum purpureum* Schum) and star grass (*Cynodon nlemfuensis* Vanderyst) and three herbaceous legumes viz. Verano stylo (*Stylosanthes hamata* (L) Taub), centro (*Centrosema pubescens* Benth) and tropical kudzu (*Pueraria phaseoloides* (Roxb) Benth) were evaluated for their dry matter (DM) yield potential in mixtures and sole stands. Annual DM yields of Verano stylo in mixtures with star grass, Guinea grass and elephant grass as well as tropical kudzu mixtures with Guinea grass and elephant grass varied between 13.2 and 14.2 t/ha. These yields were similar to those of the respective grasses in sole stands fertilized with 200 kg N/ha/yr. The DM yields of the mixtures were significantly higher than those of the respective unfertilized grasses. The mixtures also had adequate level (30 - 45%) of legume in the total herbage.

KEYWORDS
Guinea grass, star grass, elephant grass, centro, tropical kudzu, Verano stylo, Dry matter, N fertilizer

INTRODUCTION
Past research efforts at improving feed production and animal nutrition on pastures in southwest Nigeria demonstrated the potential of grass-legume mixtures to support ruminant production. However, these studies utilized unspecified genotypes or mixtures of such genotypes. Most of these studies also did not ascertain the contributions of the legumes in the mixtures since they did not establish sole stands of the component species. In the present study, specific genotypes of Guinea grass, elephant grass and star grass with high forage yields in sole stands (Chheda et al., 1974; Aken'Ova and Saleem, 1982; Aken'Ova and Chheda, 1986) were utilized. The productivity of simple mixtures of these grasses and three adapted herbaceous legumes were compared with the grass yields with or without inorganic N fertilizer. The contributions of the legumes to overall herbage yields and yield stability were also determined.

MATERIALS AND METHODS
The study was conducted on the Teaching and Research Farm of the University of Ibadan, Ibadan (7° 20'N, 3° 50'E; 200 m above sea level), Nigeria. The soil of the experimental site was a loamy sandy Alfisol. In June/July 1987, the nine possible mixtures among the three grasses, viz., star grass cv. *Cynodon* Ib8, elephant grass cv. S9 and Guinea grass cv. Ntchisi, and three legumes, viz. Verano stylo, centro and tropical kudzu were established along with sole stands of the grasses (with or without 200 kg N/ha/yr) and legumes. A basal dressing of 300 kg/ha of 15:15:15 fertilizer was broadcast on the entire area at planting. There were thus 18 treatments in all. They were arranged in a randomized complete block design with four blocks. Five harvests were taken at six-weekly intervals at 15 cm above ground level during the rainy seasons (April - October) of 1988, 1989, and 1990. Plants were not cut during the dry season. At each harvest, total fresh yield from a net plot of 4.5 x 2 m area was recorded. Samples were taken and separated into the component species and each weighed fresh. The samples were oven-dried at 100°C to constant weight for the determination of DM matter content and thence DM yields.

RESULTS AND DISCUSSION
The total DM yields of the mixtures were generally significantly higher than those of the unfertilized sole grasses, but not significantly different from the yields of the N-fertilized grasses (Table 1). This is a major reason why grass-legume mixtures are considered highly desirable compared to grass or legume swards. In elephant grass, the mixtures produced significantly higher DM yields than the N-fertilized grass and there was also no significant difference between the DM yields of the N-fertilized and unfertilized grass. Low response of elephant grass to applied N has also been reported in other studies and is attributable to an apparent inability to utilize applied N (Aken'Ova and Chheda, 1986; Ezenwa, 1995).

The total DM yields of Verano stylo with sod-forming star grass increased while the yields of its mixtures with the tall grasses, i.e. Guinea grass and elephant grass declined over time. In the case of tropical kudzu, the yields of the mixtures with the tall grasses recorded increases over time while those of its mixture with star grass declined. The total DM yields of centro mixtures with all the grasses declined with time. Except for N-fertilized star grass, the DM yields of the sole stands of the grasses declined over time and more rapidly in the case of the tall grasses, especially with N fertilization.

Among the sole legume stands, Verano stylo out-yielded tropical kudzu which in turn out-yielded centro in each year of cutting. Compared to the first year, the DM yields of centro declined by 62% by the third year while those of Verano stylo and tropical kudzu increased by 43 and 10%, respectively. In the third year, sole Verano stylo produced the highest DM yield of all treatments and its mean yield was among the highest.

The proportionate contributions of Verano stylo and tropical kudzu in mixtures remained at the same level or increased over time (Table 1) owing to their self-seeding ability and aggressive vine growth habit, respectively. In the case of centro, the proportions in the mixtures declined with time. All the legumes maintained higher proportions with star grass than with the tall grasses. The proportionate contributions of the legumes to yields in the mixtures were within the 30 to 50% considered desirable in grass-legume mixtures (Crowder and Chheda, 1982). The reported promising performance of centro in other trials was not realized in the present study owing to leaf blight caused by *Rhizoctonia solani* (Ezenwa, 1995).

There was significant grass x N source interaction for annual grass DM yields. Thus, the annual DM yield of N-fertilized star grass was 154% higher than its annual yield when unfertilized while the corresponding increases in Guinea grass and elephant grass were 51% and 22%, respectively (Table 2). The high DM-producing ability of star grass is more marked at high levels of fertilization because of its efficient nutrient uptake (Saleem and Chheda, 1977). Among N sources, N fertilization resulted in the highest grass DM yields. The legumes did not significantly influence grass DM yields. The superior yields of the mixtures must therefore simply be due to the additive effects of the grass and legume yields. Averaged over the N sources, Guinea grass produced the highest DM yield with star grass the least.

In conclusion, Verano stylo mixtures with star grass, Guinea grass and elephant grass as well as tropical kudzu mixtures with Guinea grass and elephant grass are suitable for forage production in southwest Nigeria.

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Table 1
Total dry matter yields of grass-legume mixtures, N-fertilized and unfertilized sole grass and legume stands in the rainy seasons of three years (1988-1990).

Treatment	1988	1989	1990	% change*	Mean
		t/ha			t/ha
Star grass with:					
Verano stylo	14.0 (41)**	11.6 (41)	14.9 (46)	+6	13.5 (44)
Centro	10.9 (47)	8.7 (26)	9.0 (34)	-17	9.5 (36)
Tropical kudzu	11.6 (44)	9.8 (40)	11.0 (51)	-5	10.8 (45)
N fertilizer	13.3	12.0	14.4	+8	13.2
No fertilizer	6.3	3.7	5.5	-13	5.2
Elephant grass with:					
Verano stylo	16.6 (31)	13.4 (28)	12.7 (37)	-23	14.2 (32)
Centro	13.9 (29)	12.3 (22)	11.0 (22)	-21	12.4 (24)
Tropical kudzu	12.8 (36)	12.9 (40)	13.9 (41)	+9	13.2 (39)
N fertilizer	13.0	9.2	7.8	-40	10.0
No fertilizer	10.4	6.9	7.2	-31	8.2
Guinea grass with:					
Verano stylo	15.7 (31)	12.4 (38)	13.1 (44)	-17	13.7 (37)
Centro	15.2 (32)	11.9 (16)	9.2 (16)	-39	12.1 (21)
Tropical kudzu	13.4 (31)	15.0 (33)	13.7 (45)	+2	14.0 (36)
N fertilizer	17.2	16.8	11.8	-31	15.3
No fertilizer	11.7	9.4	9.2	-21	10.1
Sole Legumes:					
Verano stylo	11.5	12.2	16.4	+43	13.4
Centro	7.8	2.6	3.0	-62	4.5
Tropical kudzu	8.8	7.6	9.7	+10	8.7
LSD (0.05)	2.8	1.9	2.1		1.8

*Based on values in 1988 and 1990.
**Values in parentheses are percent contributions of the legumes.

Table 2
Dry matter yields of grass with herbaceous legumes and nitrogen fetilizer as nitrogen sources during the rainy season of three years (1988 - 1990).

N sources	Star grass	Elephant grass	Guinea grass	Nsource means
		t/ha		
Verano stylo	7.5	9.7	8.6	8.6[b]
Centro	6.0	9.4	9.3	8.3[b]
Tropical kudzu	5.9	8.8	8.9	7.6[b]
N fertilizer	13.2	10.0	15.3	13.5[a]
No fertilizer/legume	5.2	8.2	10.1	7.8[b]
Grass means	7.6[c]	9.1[b]	10.4[a]	

LSD (P<0.05) for Grass x N source means = 1.8
[ab]Values in a row or column with different superscripts are different, P<0.05.

Figure 1
Population of funal pathogens in the soil