Effects of method of sowing *Stylosanthes* on forage production of a *Panicum-Stylosanthes* mixture

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Abstract

Verano stylo (*Stylosanthes hamata* cv. Verano)-guinea grass (*Panicum maximum* cv. Ntchisi) mixtures were established by drilling stylo seeds in single rows or broadcasting between 2 grass rows spaced 1 m apart (single row pattern) at Ibadan, in the humid zone of south-west Nigeria. Other treatments consisted of drilling in 2 rows or broadcasting the seeds between grass rows spaced 1.5 m apart (double row pattern). Stylo was sown at the same time as or 20 days before or after the grass was established vegetatively. The objective of the study was to determine the most effective procedures for establishing this grass-legume mixture. Only the effects of pattern of sowing on grass and legume dry matter (DM) yields were significant in both the first and second years of harvesting. Stylo produced 53% more DM with double rows than with single rows (2.6 vs. 1.7 t/ha/yr). However, on average, 12% more total (grass + legume) forage DM yield was produced with single (7.3 t/ha) than with double row. The results indicate that guinea grass-Verano stylo mixture can be established by drilling or broadcasting the legume seed between grass rows spaced 1.0 m apart at the same time as or about 20 days before or after the grass is planted.

Introduction

Although pasture establishment is the most uncertain stage in pasture development ( Humphreys 1987), few studies have specifically addressed the issue in tropical Africa. In south-west Nigeria, as in most other parts of tropical Africa, procedures for establishing grass-legume mixtures have been based not on experimental evidence but on previous experiences of the individual workers and adaptations of research results from other regions and intercropping systems (Adegbola 1964; Aken’Ova 1993). Studies of grass-legume mixtures in other regions indicate that pasture establishment success and productivity are influenced by agronomic variables such as sowing method, relative time of planting, the components of the mixture, and spacing and density of the component species (McIvor 1983; Graham and Muller 1985; Onifade and Akinola 1986).

Our experiment was initiated to determine the effects of method and relative time of pattern of sowing Verano stylo (*Stylosanthes hamata* cv. Verano), a forage legume widely utilised in Nigeria, in mixtures with guinea grass (*Panicum maximum* cv. Ntchisi). The results should provide indications of appropriate establishment procedures to ensure high forage DM yield and a desirable proportion of legume in the mixture.

Materials and methods

A factorial experiment was conducted on the Teaching and Research Farm of the University of Ibadan, Ibadan, Nigeria (7° 20’ N, 3° 50’ E; 200 m above sea level). The mean annual rainfall of 1200 mm falls mainly between April–October. Ibadan has bimodal rainfall distribution and therefore 2 planting seasons, viz. April–July and August–October. Rainfall totals during the study were 1215, 1515 and 1151 mm for 1989, 1990 and 1991, respectively. Mean minimum and maximum temperatures were 24°C and 34°C, respectively. The soil was a sandy loam Alfisol with 0.07% N; 62.9 mg/kg available P; 0.02 cmol/kg exchangeable K; 0.51% organic C; 2.64 cmol/kg effective cation exchange capacity; and pH (H₂O) of 5.9.

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The treatment factors were:

(a) Method of sowing the legume
   (i) drilling
   (ii) broadcasting;
(b) Relative time of sowing the legume
   (i) 20 days before the grass
   (ii) same day as the grass
   (iii) 20 days after the grass; and
(c) Sowing pattern
   (i) legume seed drilled in single rows or broadcast between grass rows spaced 1 m apart
   (ii) legume seed drilled in double rows 0.5 m apart or broadcast between grass rows spaced 1.5 m apart.

A split-split plot design with main plots arranged in a randomised complete block design with 3 blocks was adopted. Sowing method was the main plot, time of sowing was the subplot and pattern of sowing was the sub-subplot. Sub-subplot size was 4.5 x 3 m.

The plots were established at the beginning of the late rainy season between August 31–September 19, 1989. Guinea grass was established from crown splits and stylo from seed, sown at 6 kg/ha. Before sowing, stylo seed was scarified by soaking in boiled water for 1 min. Stylo seed was drilled in shallow grooves about 0.5 cm deep and covered. Broadcast seed was not covered. Compound fertiliser (NPK 15:15:15) was broadcast as a basal dressing at 300 kg/ha during land preparation, which consisted of ploughing and harrowing.

All plots were cut at 15 cm above ground level early in the following rainy season on March 29, 1990 and the herbage discarded. Subsequently, the plots were harvested 4 times in 1990 and 5 times in 1991, every 6 weeks between May–November. At each harvest, fresh herbage from an area of 9 m² per treatment was weighed and 500 g samples were taken and separated into component species viz. grass, legume and weeds. The samples were oven-dried at 100°C to constant weight for the determination of DM concentration. Data were subjected to analysis of variance and statistical differences established by the Least Significant Difference (LSD) technique (Steel and Torrie 1980).

### Results and discussion

The effects of pattern of planting the legume on grass and legume DM yields persisted during the first and second years of harvesting. In both years, higher (P<0.05) grass DM yields were obtained with the single than the double row pattern, while the reverse was the case with legume DM yields (Table 1). These results corresponded with their planting proportions in the mixtures and are similar to the findings of Onifade and Akinola (1986) with a Chloris gayana- Stylosanthes guianensis cv. Cook mixture. Total forage and weed DM yields were not affected by planting pattern in Year 1, but single row planting gave more (P<0.05) total forage and less (P<0.05) weeds than double row planting in Year 2. Onifade and Akinola (1986) also reported that total DM yields of grass-legume mixtures with varying proportions of grass and legume are normally similar in the first year, since increases in legume DM yield in a mixture result in proportional decreases in yields of grass and vice versa.

Data in Table 1 indicate that grass DM yield increased by 33% with both single and double

### Table 1. Effects of pattern of sowing Verano stylo on herbage dry matter yields of mixtures of guinea grass and Verano.

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Grass (kg/ha)</th>
<th>Legume (kg/ha)</th>
<th>Total forage (kg/ha)</th>
<th>Weed (kg/ha)</th>
<th>Grass (kg/ha)</th>
<th>Legume (kg/ha)</th>
<th>Total forage (kg/ha)</th>
<th>Weed (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single row</td>
<td>4.8</td>
<td>2.4</td>
<td>7.2</td>
<td>0.5</td>
<td>6.4</td>
<td>1.0</td>
<td>7.4</td>
<td>0.7</td>
</tr>
<tr>
<td>Double row</td>
<td>3.4</td>
<td>3.5</td>
<td>6.9</td>
<td>0.6</td>
<td>4.5</td>
<td>1.7</td>
<td>6.2</td>
<td>1.1</td>
</tr>
<tr>
<td>LSD (P&lt;0.05)</td>
<td>0.55</td>
<td>0.85</td>
<td>ns</td>
<td>ns</td>
<td>0.66</td>
<td>0.30</td>
<td>0.78</td>
<td>0.13</td>
</tr>
</tbody>
</table>

Note: Total forage = grass + legume.
row patterns in the second year, while corresponding decreases for legume DM yields were 57% and 51%, respectively. These reductions were reflected in the significant 31% and 68% increases in weed DM yields in the respective patterns in the second year. Legumes obviously play a more important role in controlling weeds in mixtures under these planting regimens than grasses. This is in agreement with the findings of Ezenwa (1995) who reported that the legume component in a grass-legume mixture contributes more to weed suppression than the grass component.

The average herbage DM yields of the components in the guinea grass-stylo mixture for all treatment combinations are shown in Table 2. For overall yields, double row planting of legume generally increased legume yields (P<0.05) and decreased (P<0.05) grass yields, with a tendency to decrease total forage yield. This is understandable with the wider row spacing for the grass and higher proportion of legume seed planted.

There was little consistency in the effects of establishment method on yields of components of pasture or total yield. In some instances, drilling gave higher yields of legume than broadcasting and, in other instances, the reverse was the case. There was no consistent effect of time of planting on any of the components of the pasture. There was no significant method x pattern x time of planting interaction effect on weed yield. Averaged over time and method of planting, higher weed yield was recorded with double row (0.8 t/ha/yr) than with single row pattern of planting (0.6 t/ha/yr).

The results indicate that a guinea grass-Verano stylo mixture can be established successfully by drilling or broadcasting the legume seed at the same time as or about 20 days before or after planting the grass in rows spaced 1.0 m apart. There is, however, need for further studies on the effects of time of planting in the rainy season (early or late) and the overall long-term effects of treatment factors.

Acknowledgement

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**Table 2.** Average annual dry matter yields of guinea grass-Verano stylo mixtures as influenced by method, time and pattern of sowing the legume.

<table>
<thead>
<tr>
<th>Sowing method</th>
<th>Time</th>
<th>Single row</th>
<th>Double row</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grass</td>
<td>Legume</td>
<td>Total1 forage</td>
</tr>
<tr>
<td>Drilling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before</td>
<td>4.7</td>
<td>1.6(25)2</td>
<td>6.3</td>
</tr>
<tr>
<td>Same</td>
<td>6.0</td>
<td>2.1(26)</td>
<td>8.1</td>
</tr>
<tr>
<td>After</td>
<td>5.9</td>
<td>1.1(16)</td>
<td>7.0</td>
</tr>
<tr>
<td>Broadcasting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before</td>
<td>5.7</td>
<td>2.3(29)</td>
<td>8.0</td>
</tr>
<tr>
<td>Same</td>
<td>5.3</td>
<td>1.2(20)</td>
<td>6.6</td>
</tr>
<tr>
<td>After</td>
<td>6.0</td>
<td>1.5(20)</td>
<td>7.5</td>
</tr>
</tbody>
</table>

LSD (P<0.05) for comparing sowing method means for same or different sowing time and pattern:
Grass = 1.10
Legume = 0.97
Total forage = 1.14
Weed = ns

1Total forage = grass + legume.
2Values in parentheses are proportions (%) of legume in total forage.
References


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