Research note: Nutritive value of four accessions of *Stylosanthes scabra* in the derived savanna zone of Nigeria

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Abstract

Dry matter yields and nutritive value at 10 weeks of age of 4 accessions of *Stylosanthes scabra* (cvv. Fitzroy and Seca, and Accessions 140 and 441D) were assessed in the derived savanna zone of Nigeria. Dry matter intakes by West African dwarf goats of conserved hays from the 4 accessions were measured as well as dry matter degradation characteristics of the material in 3 rumen-fistulated bucks in a separate study.

Herbage yields of Fitzroy (1973 kg/ha) were significantly (P<0.05) higher than the 1446, 1184 and 1524 kg/ha produced by Seca, 140 and 441D, respectively. Crude protein (CP) (14.7–15.1%) and crude fibre (31.8–33.1%) concentrations showed little variation among the accessions. Both DM and CP intakes were higher for Seca than for the remaining cultivars.

Introduction

In the derived savanna zone of Nigeria, poor ruminant production has largely been attributed to inadequate supply of good quality fodder in the dry season (Tarawali 1994a). The advantages of integrating forage legumes into cropping systems in the West African savanna have been widely studied and documented (Agishi 1985; Tarawali et al. 1989; Cobbina 1992). Legumes ameliorate soil physical and chemical properties (Larbi et al. 1996) and provide good quality forage that can be used as a supplement to low quality grass and crop residues (Nnadi and Hague 1988) during the dry season.

Legumes are normally sown as pure stands in protein banks or undersown in food crops. In smallholder crop–livestock systems where land is scarce, undersowing of a forage legume in food crops is common (Akinlade et al. 2002). *Stylosanthes scabra*, a shrubby, erect legume that produces moderately high biomass yield and tolerates drought conditions, is palatable and can be grazed as standing hay. Accession 441D showed promise as a substitute for *S. hamata* in fodder banks in Nigeria (Tarawali 1994b). This experiment was designed to evaluate the nutritive value of 4 accessions of *S. scabra* in the derived savanna zone of Nigeria.

Materials and methods

Site

The experiment was carried out at the Teaching and Research Farm of Ladoke Akintola University of Technology, Ogbomoso, in the derived savanna zone of Nigeria. The rainy season extends between April and November and the dry season from December to March giving a mean annual rainfall of 1250mm.

The soil is a well drained sandy loam with the following characteristics before sowing: pH(H2O,1:1) 5.81; total N 0.10%; total P 6.5 ppm; potassium 0.26meq/100g; sodium 0.66meq/100g; and organic C 0.99%. Wild sunflower (*Tithonia diversifolia*) had been previously cultivated on the site.

Experiment 1

Before sowing, the vegetation was removed and the soil manually prepared to a fine tilth. During the wet season, seed of 4 accessions of *S. scabra*
Stylosanthes scabra in Nigeria

Stylosanthes scabra (cvv. Fitzroy and Seca and Accessions 140 and 441D), purchased from the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, was planted into plots measuring 2.0 × 2.0 m laid out in a randomised complete block design with 6 replicates. The seed was drilled in rows at a spacing of 5 cm and covered with a thin layer of soil to enhance emergence. Plots were separated by borders 1 m wide. The plots were hoed 3 weeks after planting to remove weeds.

At 10 weeks of age, each accession was harvested by cutting to a height of 5 cm above ground level. The harvested forage from each accession was weighed and sub-samples were taken, weighed and oven-dried at 100°C to constant weight for dry matter determination. Further sub-samples were air-dried and manually chopped to 5–10 cm lengths and stored in a cool dry place for the feeding studies.

**Experiment 2**

Twenty male or female West African dwarf goats, 18 months old, with mean weight of 7±1.2 kg, were purchased from scattered markets. Three weeks before the study commenced, they were treated to control ectoparasites and endoparasites. The animals were randomly divided into 4 groups of 5 animals, which were allocated to different treatments at random.

Each animal was housed in a separate pen with a concrete floor covered with wood shavings. The roof was covered with asbestos and the walls were half open to provide adequate ventilation. The individual legumes were offered as the sole diet at 3% of initial body weight. Animals were fed once daily at 08.00 h and the quantity of feed offered and refusals were monitored daily. Fresh water and mineral salt licks were provided ad libitum. Data collection lasted for 4 weeks after an initial adjustment period of 2 weeks.

**Experiment 3**

Three rumen-fistulated West African dwarf goats, which were fed fresh Panicum maximum ad libitum and supplemented with a mixture of the 4 Stylosanthes accessions, were used to determine in vivo digestibility. A mineral salt lick and water were provided free choice to the animals.

Sub-samples of the stored material from the 4 accessions were oven-dried at 60°C for 48 h and ground to pass through a 2.5 mm screen for the determination of in sacco dry matter degradation using the nylon bag technique (Ørskov and McDonald 1979). About 3 g samples of the ground forages were weighed into nylon bags measuring 9 cm × 18 cm with a pore size of 41 μm. Bags were incubated in the rumens of the fistulated goats for 6, 12, 24, 72 and 96 h. Following removal, the bags were washed under tap water, oven-dried at 60°C for 48 h and weighed to determine dry matter loss. Degradation constants were estimated using the nonlinear model (Ørskov and McDonald 1979):

\[
Y = a + b \times (1 - e^{-ct})
\]

where \( Y \) = degradation value at time \( t \)
\( a \) = the time intercept
\( b \) = insoluble but fermentable fraction in time \( t \)
\( c \) = degradation rate constant of the \( b \) fraction
\( a + b \) = potential degradation.

Further sub-samples of the oven-dried forage were ground to pass a 1 mm screen for crude protein, crude fibre and ash analyses. Nitrogen was determined by the Kjeldahl method (AOAC 1990). Ash was determined by placing the samples in a muffle furnace at 600°C for 18 h.

**Statistical analyses**

Data on forage yield and chemical composition were analysed using a complete randomised block design, while the data on feed intake and degradation constants were analysed as a completely randomised design using the General Linear Model (GLM) of SAS (1988). Means were separated assuming a probability level of 5%.

**Results**

**Dry matter yields**

Stylosanthes scabra cv. Fitzroy produced more forage DM (1973 kg/ha) than all other accessions (P<0.05) (Table 1), with Accession 140 clearly the poorest DM producer (1184 kg/ha).

**Chemical composition**

Overall, differences in chemical composition among the accessions were small with crude
protein levels ranging from 14.7% to 15.1% (Table 1) and crude fibre concentrations from 31.8% to 33.1%.

Table 1. Herbage yields and chemical composition at 10 weeks of age of 4 accessions of Stylosanthes scabra in the derived savanna zone of Nigeria.

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>DM yield (kg/ha)</th>
<th>Chemical composition (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>CP</td>
</tr>
<tr>
<td>Fitzroy 1973</td>
<td>1973 a</td>
<td>15.1</td>
</tr>
<tr>
<td>Seca 1184</td>
<td>1446 c</td>
<td>15.1</td>
</tr>
<tr>
<td>140</td>
<td>1184 d</td>
<td>14.7</td>
</tr>
<tr>
<td>441D</td>
<td>1524 b</td>
<td>15.0</td>
</tr>
<tr>
<td>s.e.</td>
<td>5.89</td>
<td>0.12</td>
</tr>
</tbody>
</table>

1 Means within columns followed by different letters differ (P < 0.05).

Feed intake

When fed as the sole diet to goats, intakes of DM and crude protein, on a metabolic weight basis, were highest for Seca and lowest for Fitzroy and Accession 140 (P<0.05) (Table 2).

Degradation study

There were significant differences (P<0.05) in the dry matter degradation characteristics among the 4 accessions (Table 3). All showed similar potential degradation (a+b) levels and the rate of degradation (c) was similar among accessions.

Discussion

This preliminary study has shown that all of the S. scabra accessions tested will grow well under the conditions in Nigeria’s savanna, reinforcing the findings of Tarawali (1994b) with Accession 441, and are readily consumed by goats. They obviously have the potential to produce satisfactory yields of forage with moderate crude protein levels for feeding to livestock in this environment.

However, the dry matter yields obtained could be an underestimate of the yields which might be obtained in the long term. These shrubby stylos are slow to establish from seed and often do not produce maximum yields in the establishment year. In addition, they were only 10 weeks old at harvest. Being perennials, they should respond more rapidly from the established plants in the following years and should continue to grow for longer than 10 weeks, producing higher yields than we recorded. However, the extent to which this potential could be realised would depend on how well the various accessions persist over time and withstand attacks by insect pests and diseases (e.g. anthracnose Colletotrichum gloeosporioides) or regular cutting/overgrazing, with resultant lack of seed-set. While Fitzroy produced the highest yields in this establishment year, it is susceptible to anthracnose and might succumb to this disease in an environment receiving 1250 mm rain annually.

Table 3. Dry matter degradation characteristics of 4 accessions of Stylosanthes scabra in West African dwarf goats.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Fitzroy</th>
<th>140</th>
<th>Seca</th>
<th>441D</th>
<th>s.e.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a (%)</td>
<td>19.0c</td>
<td>17.2d</td>
<td>22.0a</td>
<td>20.4b</td>
<td>0.17</td>
</tr>
<tr>
<td>b (%)</td>
<td>47.3c</td>
<td>50.5a</td>
<td>47.3b</td>
<td>47.0b</td>
<td>0.11</td>
</tr>
<tr>
<td>c (%)</td>
<td>66.2d</td>
<td>68.0b</td>
<td>69.3a</td>
<td>67.4c</td>
<td>0.14</td>
</tr>
<tr>
<td>a + b (%)</td>
<td>0.03a</td>
<td>0.03a</td>
<td>0.03a</td>
<td>0.03a</td>
<td>0.004</td>
</tr>
</tbody>
</table>

1 Derived from equation of Orskov and McDonald (1979) Y = a + b(1 – e^-ct).

The crude protein levels obtained were much higher than would be contained in the natural grasses at this stage of growth. As such, the forages would serve a useful purpose as a supplement to increase the intake of the available native pasture material by grazing ruminants during the dry season. Further studies are
warranted to determine the most appropriate way to utilise this material (e.g. grazing vs cut-and-carry) and the responses in live weight and milk production that might be obtained. Using these forages as a supplement to low quality forage would seem to be a better approach than using it as the sole forage source as was done in Experiment 2.

**Conclusion**

These preliminary data suggest that all accessions would be suitable for use as supplementary feed for goats in Nigeria. Survival of the various accessions over time would have an important influence on how well this potential might be realised.

**References**


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