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“Marketing Opportunities for Agriculture and Forestry Products in the Greater Caribbean – A Challenge for the 21st Century”

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by
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ABSTRACT: Information on yield and nutritive value of forage sorghums planted on Vertisols is limited. Forage sorghum (FS) and sorghum x sudangrass hybrid (Sudax) were planted in 0.5-ha plots to determine date of harvest effects on dry matter yield (DMY) and chemical composition. The experimental design consisted of four replicates in a split-plot arrangement (sorghums as the main plots and harvest dates of 70 and 90 d as subplots). Soil type was a fine, smectitic, isohyperthermic Typic Haplusterts (of the Fraternidad series). At 70 and 90 d post planting, plant height was measured from 10 randomly selected plants in a 2-m² area. Plants in the 2-m² quadrat were clipped to 2.5-cm height and weighed. Subsamples (500 g) were dried in a 60° C air-forced oven, ground and analyzed for CP and P concentrations. Plant height was greater (P<0.05) for Sudax (1.2 m) than for FS (0.7 m) at the 70 d harvest and was also different at the 90-d harvest. There were cultivar effects and harvest date effects on DMY (P<0.05). Forage yield was greater for Sudax than for FS on d 70 and d 90. At 70 d, DMY of Sudax and FS averaged 4,134 and 2,832 kg/ha, whereas at 90 d the average was 6,791 and 4,724 kg/ha, respectively. But CP was greater (P<0.05) for FS than for Sudax only at the 70 d harvest (86.9 vs. 80.7 g/kg). The P concentrations were similar for both sorghums and did not differ by harvest date. There was a 62% increase in DMY of Sudax when harvested at d 90 and a 60% increase for FS. Considering their high CP at d 90, both sorghums are good alternatives for use in forage conservation systems in Puerto Rico.

Keywords: Forage sorghums, nutritive value
el promedio fue de 6,791 y 4,724 kg/ha, respectivamente. La PC fue mayor (P<0.05) para SF que para Sudax solamente a los 70 d de cosecha (86.9 vs. 80.7 g/kg). La concentración de P fue similar para ambos sorgos y no hubo diferencia por fecha de cosecha. Se observó un 60% de aumento en RMS para Sudax cuando se cosechó a los 90 días y un 60% para SF. Considerando su alta PC a los 90 días, ambos sorgos son una buena alternativa para utilizarse en un sistema de conservación de forraje en Puerto Rico.

Palabras clave: Sorgo forrajero, valor nutritivo

INTRODUCTION

Forage sorghums (FS) and sorghum x Sudangrass hybrid (Sudax) are warm-season annual grasses used for grazing, greenchop, haylage or silage. Sorghums have potential for developing year-round forage conservation (haylage) systems as they are suited for multi-harvests. Sorghum hybrids can also be direct cut and ensiled safely. High biomass yields have been reported, even under drought conditions, thus indicating high water use efficiency (Sanderson et al., 1992; Sanchez et al., 2002).

In Puerto Rico, information is limited on the date of harvest effects on dry matter yield and nutritive value of forage sorghums. The objective of this study was to evaluate two sorghums (FS and Sudax) and two harvest dates (70 d and 90 d post planting) effects on DMY and nutritive value and DMY at 35-d regrowth.

MATERIALS AND METHODS

A field study was conducted at the Lajas Agricultural Experiment Station, University of Puerto Rico, Mayagüez, during the months of December 2006 to April 2007. The soil type was of the Fraternidad series (fine, smectitic, isohyperthermic Typic Haplusterts). Rainfall during the experimental period was 230 mm. The design was a completely randomized in a split plot arrangement with sorghums as main plots and harvest dates of 70 and 90 d as subplots.

Both FS and Sudax were planted in 45-cm rows at a seeding rate of 44 kg/ha using a two-row planter. At 70 d and then at 90 d post planting, plant height was measured from 10 randomly selected plants in a 2-m linear area of each plot and then clipped to 2.5-cm stubble height and weighed. Sub-samples (500 g) were dried in a 60°C air-forced oven, ground and analyzed for N (Kjeldahl method) and CP calculated (N*6.25); NDF and ADF were determined according to the procedures of Van Soest et al. (1991). Effect of forage sorghums, harvest date, and their interaction on plant height, DM yield, and nutritive value were analyzed by using PROC Mixed (SAS, 1999).

RESULTS

For the variables plant height and DMY, there was a harvest date by sorghum hybrid interaction (P<0.05); therefore, plant height and DMY of FS and Sudax are discussed by harvest date. At 70 d harvest, plant height for FS and Sudax averaged 0.70 and 1.2 m, whereas at 90 d, plant heights averaged 0.84 and 1.73 m for FS and Sudax, respectively. There was also an increase in plant height for both sorghums for growth between 70 to 90 d (Table 1). There were also differences in DMY when the two sorghums were compared. At 70 d, DMY of FS and
Sudax, averaged 2,832 and 4,134 kg/ha, whereas at 90-d, DMY were 4,464 and 6,791 kg/ha for the FS and Sudax, respectively. There were also differences in DMY for FS between dates of harvest. Dry matter yield for FS at 70- and 90-d cuts averaged 2,832 and 4,724 kg/ha (a 1.8 Mg/ha increase in DMY for the additional 20 days of growth). For Sudax, there was also an increase in DMY (2.6 Mg/ha increase; Table 2). At 35-d regrowth, there were differences between FS and Sudax (1,169 vs. 2,214 kg/ha) suggesting that possibly a 70 d regrowth is necessary to maximize yields.

For chemical composition, there were differences between sorghums and also differences by harvest date (Table 2). For both P and CP, concentrations decreased as maturity increased (Table 2). This decrease, however, was less than one percentage unit for both sorghums. Neutral detergent fiber (NDF) and acid detergent fiber (ADF) concentrations were similar for both sorghums (68.2 and 70% for FS and Sudax, respectively), and for ADF an average 42%. Increasing harvest date did not affect either NDF or ADF.

Table 1. Plant height (m) and dry matter yield (DMY) of forage sorghum (FS) and Sudax at 70- and 90-d harvests.

<table>
<thead>
<tr>
<th>Harvest date (HD)</th>
<th>FS</th>
<th>Sudax</th>
<th>Sorghums</th>
<th>HD</th>
<th>S x HD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant height (m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>0.70</td>
<td>1.32</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>90</td>
<td>0.84</td>
<td>1.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DMY kg/ha</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>2,832</td>
<td>4,134</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>90</td>
<td>4,724</td>
<td>6,791</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Phosphorus (P) and crude protein concentrations (CP) of forage sorghum (FS) and Sudax at 70-and 90-d harvests.

<table>
<thead>
<tr>
<th>Harvest date (HD)</th>
<th>FS</th>
<th>Sudax</th>
<th>Sorghums</th>
<th>HD</th>
<th>S x HD</th>
</tr>
</thead>
<tbody>
<tr>
<td>P g/kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>70</td>
<td>1.90</td>
<td>1.85</td>
<td>0.44</td>
<td>&lt;0.09</td>
<td>0.43</td>
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<tr>
<td>90</td>
<td>1.80</td>
<td>1.55</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>CP g/kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>86.9</td>
<td>80.7</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>90</td>
<td>77.4</td>
<td>75.0</td>
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</tbody>
</table>

CONCLUSIONS

This study indicates that forage DM was higher for the hybrid Sudax than for FS at both harvest dates. Harvesting both FS and Sudax at 90 d resulted dramatic increases in DMY (1.8 and 2.6 Mg/ha for FS and Sudax, respectively. Fiber concentrations are not affected by harvest.
dates but are typical values for tropical forages. Multiharvest (maximum of three) is possible with these sorghums as weed encroachment is a problem thereafter. Additional studies are assessing plant density and in situ DM and NDF disappearance. Harvest dates (70-90 d) are recommended for both sorghums to make effective use of protein concentrations, particularly if used as total mixed rations for lactating cows. Both FS and Sudax are potential forages for use in forage conservation (haylage) or cut and carry systems in Puerto Rico.

ACKNOWLEDGMENTS

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REFERENCES


