The effect of planting date on the dry matter production of annual forage sorghum hybrids and hybrid millet cultivars.

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Introduction

The use of forage sorghum hybrids (Sorghum bicolor (L.) Moench x Sorghum sudanense) (Viaene and Abawi 1998) and hybrid millets (Pennisetum glaucum) as summer and autumn pasture have became very popular during recent years. This is because forage sorghums hybrids and hybrid millets have low water requirement, high dry matter (DM) productions and rapid growth over a short season (Renato et al. 2001; Butler et al. 2003). Unfortunately no information is available on when to establish these pastures and if some cultivars can be planted earlier than others. It is important during establishment to choose the most effective planting date to ensure optimal growth. The wrong planting date could lead to insufficient germination and uneven growth.

The aim of the study was to determine the effect of planting dates of different cultivars on the DM production of forage sorghum hybrids (Sorghum bicolor (L.) Moench x Sorghum sudanense) and hybrid millets (Pennisetum glaucum).

Table 1: The types of forage sorghum hybrids and hybrid millets and cultivars evaluated.

<table>
<thead>
<tr>
<th>Type of sorghum</th>
<th>Cultivar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional:</td>
<td></td>
</tr>
<tr>
<td>Late</td>
<td>Jumbo</td>
</tr>
<tr>
<td></td>
<td>Pac 8288</td>
</tr>
<tr>
<td>Early</td>
<td>Greengrazer</td>
</tr>
<tr>
<td></td>
<td>Super King</td>
</tr>
<tr>
<td>BMR</td>
<td>Revolution BMR</td>
</tr>
<tr>
<td>Sweet</td>
<td>Kow Kandy BMR</td>
</tr>
<tr>
<td>Hybrid millet (Pennisetum)</td>
<td>Hunnigreen</td>
</tr>
<tr>
<td></td>
<td>Betta Grazer</td>
</tr>
<tr>
<td></td>
<td>Hy Pearl Millet</td>
</tr>
<tr>
<td></td>
<td>Nutrifeed</td>
</tr>
</tbody>
</table>
Material and methods

An experiment using four different planting dates was conducted at Outeniqua Experimental farm with forage sorghum hybrids and hybrid millet cultivars. The farm is situated near George in the Western Cape (altitude of 210 m, 33° 58' 38" S and 22° 25' 16" E.) (Botha, 2003) with an annual rainfall of 730 mm (Anonymous 1990).

Ten cultivars were selected according to previous sorghum trail results (Gerber et al. 2006). The cultivars were planted at four different planting dates. The planting dates were 22 September 2006, 20 October 2006, 21 November 2006 and 20 December 2006. Table 1 indicates the different types of forage sorghums hybrids and hybrid millet cultivars that were selected.

The cultivars were planted on an Estcourt type of soil. Sixteen paddocks sized 138 m² each was each divided into 10 blocks. The size of these blocks was 11.5 m². Soils were sprayed with glyphosate (2 L/ha) 2 weeks before planting. Soils were tilled with a disc harrow (1.5m) followed by a kongskilde. Seeds were broadcasted on plots and then rolled with a land roller (2.33m width, 30 rollers, Cambridge type). The seeding rate of forage sorghums hybrids and hybrid millets were 30kg/ha and 15kg/ha respectively. Irrigation was scheduled according to a tensiometer reading. Irrigation commenced at a tensiometer reading of –25 Kpa and terminated at –10 Kpa (Botha 2003). Fertilizer was applied to raise the soil potassium (K) level to 80mg/kg, phosphorous (P) to 35mg/kg and pH (KCl) level to 5.5. Nitrogen (N) and K was applied before planting at a rate of 50kg LAN/ha and 150kg KCl/ha respectively. Four weeks after emergence a top dressing of 200kg/ha of 4:3:4 (33) was applied and after each cutting 200kg/ha LAN and 90kg/ha KCl were given.

Plants were harvested when 60% of plots reached a height of 1 meter. It was cut down with an Agria 5400 cutter (1.27m width) to a height of 100 mm. Sorghums were separated from weeds to determine plot weight. Samples of approximately 300g were taken from each plot to be weight and dried for 72 hours at 60º C, this was used to determine DM production (kg DM/ha), growth rate (kg DM/ha/day) and DM content (%).

The experimental design was a split-plot with 4 main plot treatments (planting dates) and 10 split plot treatments (cultivars). To select the treatments, which performed the best, a monthly average was calculated for each variable. An appropriate analysis of variance was conducted. Student's LSD (least significant difference) at a 5% significance level was used to compare the treatment means (Ott 1998) The assumption of normality of the residuals was tested by a Shapiro Wilk test before the analysis of variance could be called reliable and valid. The “LSTATS” module of SAS program version 8.2 was used to analyze the data (SAS 1999).

Result and Discussion

Table 2 indicates the total DM pro-
Table 2: The DM production (kg DM/ha) of frequently cut forage sorghum hybrids and hybrid millet cultivars planted during September 2006

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Cutting date</th>
<th>Total DM production</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11 Dec</td>
<td>8 Jan</td>
</tr>
<tr>
<td>Betta Grazer</td>
<td>440a</td>
<td>1615a</td>
</tr>
<tr>
<td>Hy Pearl Millet*</td>
<td>67e</td>
<td>453d</td>
</tr>
<tr>
<td>Nutrifeed*</td>
<td>117cde</td>
<td>803bc</td>
</tr>
<tr>
<td>Pac 8288</td>
<td>265bc</td>
<td>1204b</td>
</tr>
<tr>
<td>Greengrazer</td>
<td>281b</td>
<td>1143b</td>
</tr>
<tr>
<td>Super King</td>
<td>228bcd</td>
<td>1007b</td>
</tr>
<tr>
<td>Revolution BMR</td>
<td>46e</td>
<td>382d</td>
</tr>
<tr>
<td>Kow Kandy</td>
<td>12e</td>
<td>226d</td>
</tr>
<tr>
<td>Hunnigreen</td>
<td>78e</td>
<td>502cd</td>
</tr>
<tr>
<td>Jumbo</td>
<td>83de</td>
<td>531cd</td>
</tr>
<tr>
<td>LSD (0.05)</td>
<td>148.2</td>
<td>402.5</td>
</tr>
</tbody>
</table>

Figures with letters in common do not differ significantly (P>0.05)
*Hybrid millet

Table 3: The DM production (kg DM/ha) of frequently cut forage sorghum hybrids and hybrid millet cultivars planted during October 2006

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Cutting date</th>
<th>Total DM production</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>19 Dec</td>
<td>18 Jan</td>
</tr>
<tr>
<td>Betta Grazer</td>
<td>711a</td>
<td>1357a</td>
</tr>
<tr>
<td>Hy Pearl Millet*</td>
<td>206d</td>
<td>725d</td>
</tr>
<tr>
<td>Nutrifeed*</td>
<td>379cd</td>
<td>995c</td>
</tr>
<tr>
<td>Pac 8288</td>
<td>694a</td>
<td>1257ab</td>
</tr>
<tr>
<td>Greengrazer</td>
<td>462bc</td>
<td>1037bc</td>
</tr>
<tr>
<td>Super King</td>
<td>631ab</td>
<td>1031bc</td>
</tr>
<tr>
<td>Revolution BMR</td>
<td>303cd</td>
<td>747d</td>
</tr>
<tr>
<td>Kow Kandy</td>
<td>198d</td>
<td>400e</td>
</tr>
<tr>
<td>Hunnigreen</td>
<td>250cd</td>
<td>575de</td>
</tr>
<tr>
<td>Jumbo</td>
<td>446bc</td>
<td>1031bc</td>
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<tr>
<td>LSD (0.05)</td>
<td>226.8</td>
<td>243.1</td>
</tr>
</tbody>
</table>

Figures with letters in common do not differ significantly (P>0.05)
*Hybrid millet
Table 4: The DM production (kg DM/ha) of frequently cut forage sorghum hybrids and hybrid millet cultivars planted during November 2006

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Cutting date</th>
<th>1st cutting</th>
<th>2nd cutting</th>
<th>3rd cutting</th>
<th>4th cutting</th>
<th>5th cutting</th>
<th>Total DM production</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>11 Jan</td>
<td>8 Feb</td>
<td>15 Mar</td>
<td>4 May</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Betta Grazer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4293bc</td>
</tr>
<tr>
<td>Hy Pearl Millet*</td>
<td></td>
<td>1394abc</td>
<td>775b</td>
<td>1032bc</td>
<td>1172bc</td>
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<td></td>
</tr>
<tr>
<td>Nutrifeed*</td>
<td></td>
<td>1456ab</td>
<td>1543a</td>
<td>751bc</td>
<td>1095bc</td>
<td></td>
<td>4845b</td>
</tr>
<tr>
<td>Pac 8288</td>
<td></td>
<td>1597a</td>
<td>1712a</td>
<td>795b</td>
<td>1809b</td>
<td></td>
<td>5913a</td>
</tr>
<tr>
<td>Greengrazer</td>
<td></td>
<td>3031bcd</td>
<td>653bc</td>
<td>484d</td>
<td>654de</td>
<td></td>
<td>2822d</td>
</tr>
<tr>
<td>Super King</td>
<td></td>
<td>358bcd</td>
<td>770b</td>
<td>779abc</td>
<td>1031bcd</td>
<td></td>
<td>3538cd</td>
</tr>
<tr>
<td>Revolution BMR</td>
<td></td>
<td>357e</td>
<td>374c</td>
<td>217e</td>
<td>326ef</td>
<td></td>
<td>1274e</td>
</tr>
<tr>
<td>Kow Kandy</td>
<td></td>
<td>257e</td>
<td>398e</td>
<td>50f</td>
<td>74f</td>
<td></td>
<td>780f</td>
</tr>
<tr>
<td>Hunnigreen</td>
<td></td>
<td>264e</td>
<td>385e</td>
<td>194e</td>
<td>400ef</td>
<td></td>
<td>1244e</td>
</tr>
<tr>
<td>Jumbo</td>
<td></td>
<td>647de</td>
<td>621bcd</td>
<td>528cd</td>
<td>804cd</td>
<td></td>
<td>2599d</td>
</tr>
<tr>
<td>LSD (0.05)</td>
<td></td>
<td>459.0</td>
<td>371.1</td>
<td>259.8</td>
<td>383.9</td>
<td></td>
<td>1055.2</td>
</tr>
</tbody>
</table>

Figures with letters in common do not differ significantly (P>0.05)
*Hybrid millet

Table 5: The DM production (kg DM/ha) of frequently cut forage sorghum hybrids and hybrid millet cultivars planted during December 2006

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Cutting date</th>
<th>1st cutting</th>
<th>2nd cutting</th>
<th>3rd cutting</th>
<th>4th cutting</th>
<th>5th cutting</th>
<th>Total DM production</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 Feb</td>
<td>28 Feb</td>
<td>17 Apr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Betta Grazer</td>
<td></td>
<td>1397a</td>
<td>924b</td>
<td>1536ab</td>
<td>-</td>
<td>-</td>
<td>3856abc</td>
</tr>
<tr>
<td>Hy Pearl Millet*</td>
<td></td>
<td>1051ab</td>
<td>1579a</td>
<td>1583a</td>
<td>-</td>
<td>-</td>
<td>4213ab</td>
</tr>
<tr>
<td>Nutrifeed*</td>
<td></td>
<td>1188ab</td>
<td>1686a</td>
<td>1700a</td>
<td>-</td>
<td>-</td>
<td>4574a</td>
</tr>
<tr>
<td>Pac 8288</td>
<td></td>
<td>954b</td>
<td>957b</td>
<td>1325ab</td>
<td>-</td>
<td>-</td>
<td>3236bc</td>
</tr>
<tr>
<td>Greengrazer</td>
<td></td>
<td>1219ab</td>
<td>818b</td>
<td>804cd</td>
<td>-</td>
<td>-</td>
<td>2841c</td>
</tr>
<tr>
<td>Super King</td>
<td></td>
<td>961b</td>
<td>875b</td>
<td>1050bc</td>
<td>-</td>
<td>-</td>
<td>2886c</td>
</tr>
<tr>
<td>Revolution BMR</td>
<td></td>
<td>229c</td>
<td>290c</td>
<td>284e</td>
<td>-</td>
<td>-</td>
<td>802d</td>
</tr>
<tr>
<td>Kow Kandy</td>
<td></td>
<td>160c</td>
<td>148c</td>
<td>71e</td>
<td>-</td>
<td>-</td>
<td>379d</td>
</tr>
<tr>
<td>Hunnigreen</td>
<td></td>
<td>296c</td>
<td>319c</td>
<td>199e</td>
<td>-</td>
<td>-</td>
<td>814d</td>
</tr>
<tr>
<td>Jumbo</td>
<td></td>
<td>273c</td>
<td>394c</td>
<td>376de</td>
<td>-</td>
<td>-</td>
<td>1044d</td>
</tr>
<tr>
<td>LSD (0.05)</td>
<td></td>
<td>412.0</td>
<td>367.7</td>
<td>494.8</td>
<td>-</td>
<td>-</td>
<td>1067.8</td>
</tr>
</tbody>
</table>

Figures with letters in common do not differ significantly (P>0.05)
*Hybrid millet
duction (kg DM/ha) of frequently cut forage sorghum hybrids and hybrid millet cultivars planted during September 2006.

Betta Grazer produced the highest amount of DM during the first two cuttings. During the third and fourth cutting Betta grazer, Nutrifeed, Pac 8288 and Greengrazer produced similar amounts of DM. This resulted in Betta Grazer, Nutrifeed, Pac 8288 and Greengrazer to produce the highest total amount of DM per hectare (kg/ha).

Table 3 shows the total DM production (kg DM/ha) of frequently cut forage sorghum hybrids and hybrid millet cultivars planted during October 2006.

Betta Grazer, Nutrifeed, Pac 8288 and Super King had high DM productions throughout the majority of the first four cuttings. Nutrifeed produced the highest amount of DM during the fifth cutting. This resulted in Betta Grazer, Nutrifeed and Pac 8288 to produce a higher amount of DM/ha than most of the cultivars and only Super King could produce a similar amount of total DM/ha.

Table 4 indicates the total DM production (kg DM/ha) of frequently cut forage sorghum hybrids and hybrid millet cultivars planted on 4 different planting dates.

<table>
<thead>
<tr>
<th>Cultivars</th>
<th>22 September</th>
<th>20 October</th>
<th>21 November</th>
<th>20 December</th>
</tr>
</thead>
<tbody>
<tr>
<td>Betta Grazer</td>
<td>6409(^{xx})</td>
<td>6131(^{x})</td>
<td>4293</td>
<td>3856</td>
</tr>
<tr>
<td>Hy Pearl Millet*</td>
<td>2712</td>
<td>3145</td>
<td>4845</td>
<td>4213</td>
</tr>
<tr>
<td>Nutrifeed(^{\dagger})</td>
<td>5142</td>
<td>5805(^{x})</td>
<td>5913(^{x})</td>
<td>4574</td>
</tr>
<tr>
<td>Pac 8288</td>
<td>5582(^{x})</td>
<td>6052(^{x})</td>
<td>4034</td>
<td>3236</td>
</tr>
<tr>
<td>Greengrazer</td>
<td>4843</td>
<td>4346</td>
<td>2822</td>
<td>2841</td>
</tr>
<tr>
<td>Super King</td>
<td>4076</td>
<td>5125</td>
<td>3538</td>
<td>2886</td>
</tr>
<tr>
<td>Revolution BMR</td>
<td>1080</td>
<td>2359</td>
<td>1274</td>
<td>802</td>
</tr>
<tr>
<td>Kow Kandy</td>
<td>369</td>
<td>888</td>
<td>780</td>
<td>379</td>
</tr>
<tr>
<td>Hunningreen</td>
<td>1247</td>
<td>2090</td>
<td>1244</td>
<td>814</td>
</tr>
<tr>
<td>Jumbo</td>
<td>1872</td>
<td>3710</td>
<td>2599</td>
<td>1044</td>
</tr>
</tbody>
</table>

\(^1\)LSD (0.05) 1618.5 1109.0 1055.2 1067.8
\(^2\)LSD (0.05) 1193.0

\(^{xx}\)Highest value (P<0.05) LSD = 1193.0
\(^{x}\)Differ not from highest value (P>0.05) LSD = 1193.0
Hybrid millet*
cut forage sorghum hybrids and hybrid millet cultivars planted during November 2006.

During the first cutting Nutrifeed had a higher DM production than most of the cultivars and only Betta Grazer and Hy Peal Millet had a similar DM production. The fact that Nutrifeed had a higher DM production during each cutting than most of the other cultivars and only similar to that of Betta Grazer during the third cutting, resulted in Nutrifeed to produce the highest total amount of DM per hectare.

Table 5 shows the total DM production (kg DM/ha) of frequently cut forage sorghum hybrids and hybrid millet cultivars planted during December 2006.

Hy Pearl Millet and Nutrifeed produced similar amounts of DM during each of the three cuttings followed the December planting date. The similarity of DM produced by Betta Grazer compared to that of Hy Pearl Millet and Nutrifeed during the first and third cut resulted in these three cultivars to produce a higher total amount of DM per hectare than most of the cultivars.

Table 6 shows the total DM production (kg DM/ha) of frequently cut forage sorghum hybrids and hybrid millet cultivars planted on 4 different planting dates.

Insert Table 6

Betta Grazer planted during September produced a higher amount of total DM than most of the other cultivars. Only Pac 8288 planted during September or October, Nutrifeed planted during October or November and Betta Grazer planted during October could produce a similar amount of DM than Betta Grazer planted during September.

Conclusion

Cultivar had a significant influence on DM production. Betta Grazer, Nutrifeed, Pac 8288, Greengrazer, Hy Pearl Millet and Super King were the most prominent cultivars and produced a higher total DM production than most of the other cultivars if compared to planting date and the frequency of cutting. Betta Grazer, Nutrifeed and Pac 8288 are recommended for the September and October planting date, Nutrifeed for the November planting date and Nutrifeed, Hy Pearl Millet and Betta Grazer for the December planting date.

Acknowledgement

We would like to thank the Plant Production team at Outeniqua Experimental farm, as well as Mardè Booyse and Dalena Robertson for their help and support.

References


