Yield Characteristics of Sorghum (Sorghum bicolor (L.) Moench) and Sorghum x Sudan Grass Hybrids (Sorghum bicolor (L.) Moench x Sorghum Sudanense Staff.) Cultivated as Second Crop after Barley in Erciş-Van Ecological Condition

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Abstract: This study was conducted to find out the possibilities of growing some sorghum and sorghum x sudangrass hybrid cultivars as second crop after barley in Erciş-Van ecological condition in 2003. The experiment was designed as randomized complete block design with three replications. In the experiment, one sorghum cultivars (Rox) and seven sorghum x sudangrass hybrid cultivars (Grazier, Seward Sioux, GW-9110, Sugar Leaf, Grass-Il, 877 and Güzde-80) were used. Significant differences were determined among the cultivars used in the research. Average green herbage, herbage yields changed between 42000-82000 kg ha⁻¹, hay yield 9770-20 550 kg ha⁻¹, respectively. The highest herbage yield was obtained from Seward Sioux (82 000 kg ha⁻¹), followed by 877-cultivar (74 000 kg ha⁻¹). According to this results, Seward Sioux and 877 sorghum x sudangrass hybrid cultivars had the highest green herbage and hay yield, therefore these cultivars are suggested as second crop in Erciş-Van ecological condition.

Key words: Sorghum, sorghum x sudangrass hybrid cultivar, second crop, herbage yield, hay yield

INTRODUCTION

One of the most important issues of animal production in Van districts of the eastern Anatolia is insufficient hay. The hay deficit in winter season is more impossible than those of spring and summer seasons due to harsh climate conditions of these districts. Therefore, the most suitable plants for the region should be cultivated in order to minimize hay deficit in long winter months. For this aim, Sorghum can be cultivated as main product or after wheat, barley, vetich, gruel and rape in winter months cultivated in field areas, corn and sorghum plants can be cultivated as second crop in June and July months (İptiş, 1993).

In an investigation in Samsun province carried out by Aydın and Tokluoğlu (1986), it was reported that by using 40 cm row gaps, green forage yield obtained from Sorghums sown in waterless condition was found as 40 000 kg ha⁻¹.

Oğraş and Altunay (1986) reported that herbage averages of composite silage sorghum and hybrid silage sorghum were found as 55000 and 100000 kg ha⁻¹ in field experiment carried out using 40 cm row gaps in the second crop production conditions. Sağlamtimur et al. (1988) stated that plant height, herbage yield of sorghum varieties (for silage) cultivated as second crop ranged from 183-355 cm and from 32550-63800 kg ha⁻¹, respectively.

In a field study conducted to determine seed quantity of sudangrass and sorghum x sudangrass hybrids under Çukurova conditions sudangrass and seven sorghum x sudangrass hybrid cultivars, Tanrı (1989) determined that herbage and hay yields ranged from 47100-71580 kg ha⁻¹ and from 6720-22460 kg ha⁻¹, respectively.

Toscano et al. (1989), who studied on sorghum used for silage under Brazil condition, declared that hay yield ranged from 7 000-14 000 kg ha⁻¹.

Özbişen (1991), who examined the effects of various N fertilizer doses on some sorghum cultivars used for silage under Samsun ecological condition, mentioned that averages of wet hay yield, (dry) hay yield and plant height were determined as 60 110, 14 920 kg ha⁻¹ and 231 cm, respectively.

İptiş (1993), who worked on some agricultural characteristics on several sorghum cultivars under Tokat condition, reported that as regards data harvested at their early maturity periods averages of herbage yield, dry matter yield and plant height were determined as 65670, 17660 kg ha⁻¹ and 198 cm, respectively.

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Kara and Soya (1993) cultivated sorghum and sorghum x sudangrass hybrids as second crop under wetland conditions of Ege Region and then performed 2-3 harvests. The authors reported that herbage yield from these cultivars ranged from 70-80 Ton ha$^{-1}$.

Avroğlu and İptaş (1994) stated that the highest herbage and dry matter yields under Tokat Kazova condition were obtained from P-988, which is a Sorghum x SudanGrass hybrid. Aydın and Albayrak (1995) stated that averages of herbage and hay yields for Sorghum cultivars produced as second crop under Samsun conditions were determined as: 49500 and 9660 kg ha$^{-1}$, respectively.

Baytekin et al. (1995) found that average plant height and herbage yield of sorghum (for silage) produced as second crop under wetland conditions of Harran ova were 290 cm and 93090 kg ha$^{-1}$, respectively. In another study under same conditions, Baytekin and Şilbar (1996) reported that herbage yield and hay yield ranged from 45000-132000 kg ha$^{-1}$ and from 14170-16550 kg ha$^{-1}$, respectively. Yılmaz and Sağlamtirmit (1997) working on sorghum hybrids under wetland conditions of Amik ova found as 51240 kg ha$^{-1}$ for herbage yield and 6890 kg ha$^{-1}$ for hay yield.

Hosafişoğlu (1998) studied on Sorghum and Sorghum x SudanGrass hybrids (Grazer, Sugar Leaf, Gözdö-80, GW-9110, Rox) under Van wetland conditions and reported that their dry hay yields and plant heights ranged from 46610-59520 kg ha$^{-1}$ and from 51-138 cm. When yield and quality criteria were taken into consideration, the most suitable cultivars were found to be Grazer, Gözdö-80 and Sugar Leaf, respectively.

Güçük and Baytekin (1999), who studied to determine the effect of harvest time on yield and silage characteristics of corn-silage, Sorghum and Sorghum x SudanGrass hybrids cultivated as second product under Şanlıurfa Bozova-watery conditions, stated that herbage yield ranged from 74550-118080 kg ha$^{-1}$.

Gül and Başbağ (1999) reported that herbage yield, hay yield, and plant height values of Sorghum and Sorghum x SudanGrass hybrids for silage grown as second product under Diyarbakır watery conditions varied from 41560-52350 kg ha$^{-1}$, from 9340-13590 kg ha$^{-1}$ and from 148-267 cm, respectively.

Yılmaz (2000), who studied on yield characteristics of sorghum and sorghum x SudanGrass hybrids cultivated as main crop in Van conditions, reported that herbage yield, hay yield and plant height values varied from 36850-57380 kg ha$^{-1}$, from 10 210-19750 kg ha$^{-1}$ and from 114-249 cm, respectively. In another investigation on sorghum varieties for silage produced as main crop under Van wetary conditions, Yılmaz and Akdeniz (2000) stated that corresponding values were found to range from 33960-41860 kg ha$^{-1}$; from 12680-15 580 and from 177-179, respectively. Yılmaz et al. (2000) stated that corresponding averages was found to be 49990 kg ha$^{-1}$, 18040 kg ha$^{-1}$ and 221 cm, from sorghum sudangrass hybrids respectively. Oral (2001) stated that herbage yield, hay yield and plant height values of Sorghum and Sorghum x SudanGrass hybrids produced as second crop under same conditions ranged from 36660-66250 kg ha$^{-1}$, from 1036-1991 kg ha$^{-1}$ and from 235-263 cm, respectively.

Sevimay et al. (2001), reported that the highest herbage yields under Ankara wetary conditions were found to 33950 kg ha$^{-1}$ for the first year and 30 060 kg ha$^{-1}$ for the second year.

The aim of this study was to examine adaptation of some sorghum and sorghum x SudanGrass hybrids produced as second crop after barley to Erçiçek district conditions of Van located in the Eastern Anatolia and to determine the best cultivar (s) having the highest green herbage and hay yields.

**MATERIALS AND METHODS**

In present study, one sorghum (Rox) cultivar and seven sorghum x sudanotu hybrids (Grazer, Sweet Sioux, GW-9110, Sugar Leaf, Grass II, 877, Gözdö-80) from Agricultural Faculty University of Yuzuncu Yıl were used. 100 kg ha$^{-1}$ N, and 80 kg ha$^{-1}$ P$_2$O$_5$ were used for each plot. The field experiment was arranged at Randomized Complete Design with 3 replications. Each block was divided into 8 plots. The eight cultivars were assigned randomly into each block. Each plot set at 10 m$^2$ (2×5). The total experiment area was on (54×10 m) 540 m$^2$.

**Statistical analysis**: The experimental data were analyzed using randomized complete block design with three replications. Statistical Evaluation was performed using SPSS package program. Mean separation was tested by Duncan's Multiple Range Test (Düzgünüş et al., 1987).

**RESULTS AND DISCUSSION**

**Plant height**: Results of ANOVA on traits such as plant height, herbage yield and hay yield of Sorghum and sorghum x SudanGrass hybrids are presented in Table 1. As seen from Table 1, the effect of variety factor on plant height (p<0.05), herbage yield (p<0.01) and hay yield (p<0.01) were found to be significant. The effect of block on herbage yield was only significant (Table 1).

Table 2 presents results of average plant height and Duncan's Multiple Range Test of sorghum cultivar and sorghum x sudan grass hybrids. Plant height values
Table 1: ANOVA results for plant height, herbage yield and hay yield values of sorghum cultivar and sorghum x Sudan grass hybrids

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degrees of freedom</th>
<th>F-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block</td>
<td>1</td>
<td>1.70**</td>
</tr>
<tr>
<td>Variety</td>
<td>7</td>
<td>4.76*</td>
</tr>
<tr>
<td>Error</td>
<td>14</td>
<td>1.96**</td>
</tr>
</tbody>
</table>

*p<0.05  **p<0.01  *non-significant

Sorghum x Sudan grass hybrids under Van conditions along with those of Gül and Başbğ (1999) (148-267 cm) and İpş (1993) (198 cm). The findings were found to be lower than those of Oral (2001) (235-263 cm), Sağlamitürk et al. (1988) (183-355 cm) and Baytekin et al. (1995) (290 cm), but higher those of Hosafıoğlu (1998) (51-138 cm). The differences in literature may be arisen from environmental and genetics variations.

Herbage yield: Table 3 presents results of average herbage yields and Duncan’s Multiple Range Test of sorghum cultivar and sorghum x Sudan grass hybrids.

<table>
<thead>
<tr>
<th>Cultivars</th>
<th>Replication 1</th>
<th>Replication 2</th>
<th>Replication 3</th>
<th>Mean *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rox</td>
<td>84000</td>
<td>74000</td>
<td>62000</td>
<td>73300</td>
</tr>
<tr>
<td>Sugar leaf</td>
<td>74000</td>
<td>54000</td>
<td>52000</td>
<td>60000</td>
</tr>
<tr>
<td>GW-9110</td>
<td>60000</td>
<td>62000</td>
<td>58000</td>
<td>60000</td>
</tr>
<tr>
<td>Grass II</td>
<td>70000</td>
<td>72000</td>
<td>50000</td>
<td>64000</td>
</tr>
<tr>
<td>877</td>
<td>80000</td>
<td>72000</td>
<td>70000</td>
<td>74000</td>
</tr>
<tr>
<td>Güzde-80</td>
<td>50000</td>
<td>32000</td>
<td>44000</td>
<td>42000</td>
</tr>
<tr>
<td>Mean *</td>
<td>70250</td>
<td>63750</td>
<td>59500</td>
<td>64500</td>
</tr>
</tbody>
</table>

Hay yield: Results of averages of Hay yield and Duncan’s Multiple Range Test of sorghum cultivar and sorghum x Sudan grass hybrids are presented in Table 4. Hay yield of Sorghum cultivar and sorghum x Sudan grass hybrids varied from 9770-20550 kg ha⁻¹. Cultivar with the highest hay yield was determined as 877-cultivar (20550 kg ha⁻¹), but one having the lowest cultivar was determined as Güzde-80 cultivar. Our findings from the present paper were partly in consistent with findings of Yılmaz (2000), working with same genotypes, who found to range from 10210-19750 kg ha⁻¹ in Van condition. The author’s advantage order was determined Grass II, Sugar Leaf, Sewet Sioux and GW-9110. Our findings from the present paper was partly in consistent with findings of Yılmaz (2000), working with same genotypes, who found to range from 10210-19750 kg ha⁻¹ in Van condition. The author’s advantage order was determined Grass II, Sugar Leaf, Sewet Sioux and GW-9110. Our finding was in agreement with that of Oral (2001), who stated to range from 10360-9910 kg ha⁻¹. The findings on hay yield in the present paper were found to higher than the findings of Aydyın and Albayrak (1995) (9660 kg ha⁻¹); Gül and Başbğ (1999) (9340-13590 kg ha⁻¹), Özbiilen (1991) (13400 kg ha⁻¹), Teacenci et al. (1989) (7000-14000 kg ha⁻¹), but lower than the finding of Baytekin et al. (1995), who found as 23950 kg ha⁻¹.

of these hybrids ranged from 161-210 cm. As shown in Table 2, it obvious that Cultivar with the lowest plant height was found as Rox (161 cm). The one with highest plant height was determined as Grazer cultivar (210 cm).

These findings obtained from the present paper were partly in agreement with findings of Yılmaz (2000) (114-249 cm), who studied on same Sorghum and

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The differences in literature may be due to environmental and genetic factors.

As a result, it can be recommended Seweet Sioux and 877 cultivars among Sorghum x Sudangrass hybrids to farmers in Van conditions because they had the highest herbage and hay yield.

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