EVALUATION OF MILLET LINES FOR FODDER YIELD UNDER RAINFED CONDITIONS OF POTHOWAR REGION

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ABSTRACT
Nine indigenous and exotic millet cultivars were evaluated for green fodder yield and yield components during 2012 and 2013 at Fodder Research Programme, NARC, Islamabad. Out of nine cultivars of millet, two cultivars (18 BY and Sargodha Bajra) were used as check. The cultivars differed significantly from each other regarding leaf area (cm²), plant height (cm), number of leaves per tiller and green fodder yield t ha⁻¹. Varieties Badshah (Dual type selection) and NARC selection-8 excelled all other varieties in all the characters. There was positive correlation among plant height, leaves per tiller, tillers per plant and leaf area, contributing towards green fodder and dry matter yield per hectare. Maximum green fodder yield (45.37 t ha⁻¹) and (44.72 t ha⁻¹) was observed in lines “Dual type Sel (Badshah)” and “NARC-Sel-8”. It is recommended that “Badshah Dual type selection” and “NARC selection-8” have proved to be the best cultivars for cultivation in Pothowar area.

Key words: Pearl millet (Pennisetum americanum), agronomic characters, green fodder yield, cultivars

INTRODUCTION
In Pakistan, millet (Pennisetum typhoides L.) is grown on 438 thousand hectares with an annual production of 221 thousand tones, giving average green fodder yield of 508 kg per hectare (Anonymous, 2006). It is one of the most important fodder and seed crops grown during summer season in Pakistan. It is mainly cultivated throughout the world for the production of palatable and nutritious food and feed for consumption by human beings and livestock. Millet fodder possesses oxalic acid, prussic acid to some extent like sorghum crop. The improved varieties of millet have potential to produce three-fold green fodder and could feed double the number of animals per unit area as against the traditional fodder crops in the region (Haqqani et al., 2003). High temperature is required for its rapid growth especially at later stages of development. Tolerance to low rainfall depends mainly on fast growth and early maturation so that the plants escape the drought and complete their developmental phase before the rainy season ends. Although Pakistan basically has fertile soil and climate suitable for production of high yielding quality forage and fodder crops but average production per unit area is estimated to be ½ to 1/3 rd of the potential production (Shakoor et al., 1983). In Pakistan, it is also cultivated on sandy soils where other crops could not be grown. An important factor to improve grain and fodder yield of millet is to evolve or introduce high yielding varieties and to test them under local conditions. Shakoor et al. (1983) tested performance of 20 bajra varieties at NARC. Yield ranged from 13.82 t /ha for “HB-111” to 22.95 t/ha for “LYP-154”. Akmal, and Naeem (2002) also conducted a replicated trial consisting of nine varieties including C-47 as a check and found significant differences in yield.

Genotype versus environment interaction remain always a serious problem in crop production while recommending a variety for some region/area in the developing countries, especially environment for commercial cultivation cannot be changed but genotype can be modified by hybridization and bio-tech methods to suit to available soil and climate related environmental conditions. For this purpose breeders are always collecting and creating genetic variability in crops for development of varieties suitable for diverse agro-climate zones. One cultivar cannot be grown all over the country having multiple environments. Crop outcome is a product of the genotype and the environment in which crop has been grown. Ideal variety is always one, which passes general adaptation with higher yield potential (Finlay and Wilkinson 1963). Genotypes must be evaluated in a number of diverse environments, because dry matter yield and quality contents, which affect digestibility, are influenced by various ecological factors. There is need to obtain, identify and measure the differential response displayed by the millet genotype that respond well under favorable and unfavorable environments. Genotypic variation to soil and atmospheric environmental conditions has been observed in many field crops (Dadio 1975, Samson et al. 1978). Genotype mainly determines the nutrient composition of a feedstuff, but different factors like soil, fertility
status of a soil, location, temperature, season and stage of maturity of a crop also influence the chemical composition of a feedstuff. (Harris 1960). Millet being a short duration crop fits well in existing cropping system of Islamabad area and could provide high quality fodder to the grower. Hence present study was conducted to determine a suitable, high yielding millet cultivar for pothowar and allied areas having similar environmental conditions.

MATERIALS AND METHODS
Nine indigenous and exotic millet varieties (NARC Sel-10, NARC Sel-12, HBS, Dual type Sel (Badshah), NARC Sel-15, NARC Sel-3 and NARC Sel-8) including two check varieties "18 BY" and Sargodha Bajra were evaluated for green fodder yield and yield components at NARC during 2012 and 2013. The trial was conducted in RCBD with three replications. Plot size was 1.8 x 6 m² for each cultivar. Uniform seed rate of 10 kg ha⁻¹ was used in all treatments. The recommended fertilizer dose of 60 N: 60 P kg ha⁻¹ was applied at the time of seedbed preparation. The crop was planted with the help of hand drill keeping 30 cm row-to-row spacing. Green fodder and dry matter yields were recorded at 50% flowering stage. Data on various parameters like plant height, number of leaves per tiller, number of tillers per plant, leaf area was collected from three plants at the same time. One kg green fodder sample at harvesting time was collected at random for estimating dry matter yield from each plot. The collected samples were weighed, dried in an oven at 60°C up to a constant weight and again weighed to calculate the dry matter yield for each treatment. The data collected was subjected to Fisher's analysis of variance technique and LSD Test at 5% probability level was applied to compare the differences among treatments means (Steel and Torrie, 1984).

RESULTS AND DISCUSSIONS
The results presented in the Table-1 are discussed as under:

Plant Height (Cm)
Significant differences were observed in plant height of different millet varieties. As plant height gets prime importance while determining the fodder yield. Therefore Dual type Sel. (Badshah) line produced tallest plants (201 cm.) and statistically at par with a line NARC Sel-8 (192 cm). The lowest plant height was recorded in variety NARC Sel-3 (135 cm). The greater the height, the greater is the fodder yield per unit area. Rodriguez (1973) reported that plant height was significantly correlated with yield and leaf-stem ratio. Shakoor et al. (1999) also reported that green fodder yield increases with increases in plant height.

Leaves Tiller¹
Number of leaves per tiller plays a vital role in enhancing the green fodder yield. Data presented in Table-1 indicate significant differences in number of leaves per tiller among lines/varieties. Dual type Sel. (Badshah) and NARC Sel-8 produced highest and similar number of leaves (11) per tiller. The lowest number of leaves per tiller was recorded in a check variety 18 BY (8). Shakoor et al. (1983) tested nineteen varieties of millet and reported that the varieties which were having significantly greater number of leaves per plant yielded significantly higher fodder yield.

Leaf Area (Cm²)
There are significant differences in leaf area of different millet varieties. Highest leaf area was recorded in variety NARC Sel-8 (319 cm²) and statistically at par with Dual type Sel. (Badshah) (301 cm²) whereas lowest was seen in line NARC-Sel 10 (163 cm²). It was observed that leaf area has positive association with green fodder yield and dry matter yield. Shakoor et al. (1999) also reported that green fodder yield and dry matter yield increases with increases in leaf area.

Green Fodder Yield (t ha⁻¹)
The millet cultivars/lines included in the study differed significantly from one another in green fodder yield. According to the results, the line Dual type Sel. (Badshah) produced the significantly maximum green fodder yield with amount of 57 t/ha and statistically at par with NARC Sel-8 by producing the green fodder yield 54 t/ha. The lowest green fodder yield was recorded in variety NARC-Sel 3 (31 t/ha). Dual type Sel. (Badshah) and NARC Sel-8 produced more green fodder yields, than the other lines/varieties because of contribution of higher plant height and leaf area. These differences among the cultivars were attributed to variability in their yield components. These findings are in conformity with those of Andreev et al. (1984), Abdul et al. (1992) and Taran et al. (1998) who also reported fodder yield as varietal character. It can also be assessed that new cultivars possessed high genetic potential for higher fodder production as also reported by Solanki (1977, Naeem, et al. 2005 and Zaman, Q et al. 2004).
Dry Matter Yield (t ha⁻¹):
The new cultivars which produced highest green fodder yield also gave maximum dry matter yield. Dry matter is the most important component of animal diet for feeding livestock during fodder scarcity periods and ensures efficient digestion. The millet varieties showed significant differences in dry matter yield. Highest dry matter yield was observed in Dual type Sel. Badshah (13 t ha⁻¹) followed by NARC Sel- 8 (12 t ha⁻¹). Lowest dry matter yield was recorded in millet line NARC Sel 3 (6 t/ha). Zaman, Q et al (2004) reported that the dry matter yield as varietal character and the new cultivars possessed high genetic potential for higher dry matter production.

Conclusion
Dual type Sel. Badshah and NARC Sel- 8 performed better towards plant height, number of leaves tiller⁻¹, leaf area, green fodder and dry matter yield. Hence, these two new lines are recommended for planting in high and medium rainfall areas for maximum green and dry matter production under Pothowar regions.

**Table-1**: Green fodder yield and yield components of nine different millet varieties under Pothowar region

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Plant Height (cm)</th>
<th>Leaves tiller⁻¹</th>
<th>Leaf Area (cm²)</th>
<th>Green Fodder Yield (t ha⁻¹)</th>
<th>Dry Matter Yield (t ha⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NARC Sel-10</td>
<td>165 c</td>
<td>10 abcd</td>
<td>163 d</td>
<td>54 ab</td>
<td>11 c</td>
</tr>
<tr>
<td>NARC Sel-12</td>
<td>187 abc</td>
<td>9 abcd</td>
<td>298 a</td>
<td>49abc</td>
<td>10 cd</td>
</tr>
<tr>
<td>HBS</td>
<td>178 abc</td>
<td>10ab</td>
<td>273 ab</td>
<td>45 abc</td>
<td>9 de</td>
</tr>
<tr>
<td>Dual type Sel. (Badshah)</td>
<td>201 a</td>
<td>11 a</td>
<td>301 a</td>
<td>59a</td>
<td>13 a</td>
</tr>
<tr>
<td>NARC Sel-15</td>
<td>183 abc</td>
<td>8 d</td>
<td>255 abc</td>
<td>39bc</td>
<td>8 ef</td>
</tr>
<tr>
<td>NARC Sel-3</td>
<td>135 d</td>
<td>9 cd</td>
<td>192 cd</td>
<td>31 c</td>
<td>6 h</td>
</tr>
<tr>
<td>NARC Sel- 8</td>
<td>192 ab</td>
<td>11a</td>
<td>319 a</td>
<td>57 a</td>
<td>12 ab</td>
</tr>
<tr>
<td>18 BY(Check)</td>
<td>171 bc</td>
<td>8 cd</td>
<td>213 bcd</td>
<td>39bc</td>
<td>8 ef</td>
</tr>
<tr>
<td>Sargodha bajra (Check)</td>
<td>178 abc</td>
<td>10 abc</td>
<td>210 bcd</td>
<td>42 bc</td>
<td>9 de</td>
</tr>
<tr>
<td>C.V</td>
<td>8.26</td>
<td>7.65</td>
<td>18.93</td>
<td>21.31</td>
<td>1.81</td>
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<tr>
<td>LSD</td>
<td>26</td>
<td>1</td>
<td>81</td>
<td>19</td>
<td>0.33</td>
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</tbody>
</table>
REFERENCES


