

Short communication

## Evaluation of different sorghum (*Sorghum bicolor* L. moench) varieties for grain yield and related characteristics

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### Abstract

Eight sorghum genotypes were evaluated for grain and other associated traits at Maize and Millets Research Institute, Yousafwala, Sahiwal, Punjab, Pakistan in 2011. The results revealed that sorghum varieties differed significantly for grain yield, fodder yield, plant height and days to 50% flowering. Among the varieties, YSS-9, YSS-10 (Cream) and YSS-17 produced higher grain yield (3433, 3167 and 3100 kg ha<sup>-1</sup>, respectively) than other genotypes. Varieties YSS-9 and YSS-10 (Cream) produced higher fodder yield of 15833 and 12000 kg ha<sup>-1</sup>, respectively. Sorghum variety YSS-10 (cream) took maximum days (86) to 50% flowering, while variety YSS-98 (control) took minimum 79 days to 50% flowering. Among the tested genotypes, YSS-9 produced higher grain yield as well as fodder yield (stay greener at maturity) than all other genotypes. It has a bold grain size of creamy color which has no tannin contents (anti nutritional factor) and strong root anchor system. So it is concluded that YSS-9 proved as a dual-purpose variety with reasonable grain and fodder yields.

**Key words:** Fodder yield, grain yield, sorghum, varieties, yield traits.

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### Introduction

Sorghum (*Sorghum bicolor* L. moench) is a major kharif cereal and fodder crop in arid and semi-arid areas of the world including Pakistan. It is one of the fifth major food grains of the world. Besides being a major source of staple food for humans, it serves as an important source of feed and fodder for animals. It comparatively grows quickly and gives not only good yield of grain but also very large quantities of fodder. Its grains contain about 10-13% crude protein, 2-3% crude fat and 70-80% carbohydrates. Therefore, it can replace other grains in the feeding program for dairy cattle and poultry [1]. Its grain has high level of iron (>70 ppm) and zinc (>50 ppm), which can reduce micronutrient malnutrition globally. Among various factors responsible for low yield, lack of quality seed of sorghum is of prime importance [2]. Sorghum is also a good substrate for ethanol production, which can be added to fuel for saving precious foreign exchange [3].

Sorghum is also an important crop in arid regions. It requires less irrigation and it can grow even in shortage of water and in hot summer. Drought and heat tolerance make the plant superior to that of maize, which has almost similar seasonal requirements [2]. The hybrids performed better or at par with cultivars and produced 36% more grain yield than cultivars. It was reported that there was no significant difference between hybrids and cultivars for days to bloom, physiological maturity, plant height and seed weight [4]. In another study,

38 hybrids and 22 millet composites were tested for days to 50% flowering, plant height and grain yield and results showed that pearl millet hybrids did not offer sufficient advantage over composite in arid regions [5]. Nine sorghum hybrids and 17 varieties were evaluated at 47 locations and hybrids showed higher yields than varieties [6]. Zahid and Bhatti [7] also reported that sorghum hybrids, having more numbers of leaves/plant and higher leaf area, produced maximum green and dry fodder yields.

Sorghum is an important summer annual grass and ranks fifth among cereal crops in the world. Sorghum plant is unique in stature and can grow in adverse environments. It has a very large and extensive tap root system that enables it to obtain water and nutrients from soil depth of over five feet. *Sorghum bicolor* is usually cultivated for its high stem juice, vegetative biomass (forage yield) and grain yield that reveals its diverse utility. Demand of green fodder and grain yield for rapidly growing livestock and poultry industry in Pakistan, is increasing day by day. Sorghum can be grown successfully throughout Pakistan both under irrigated and rain fed conditions. It is cultivated for forage and grain purpose in an estimated area of 0.41million hectares with 6.31 metric tons green fodder production. Moreover, it fulfills more than 50% requirement of the rain fed region of the country. In rain fed areas, it is also stored in the fields or sheds to feed livestock even in winter fodder scarcity period. In Pakistan, there are two

lean periods for fodder scarcity, first in May-June during summer and second in October-November during winter. Due to stay green trait, sorghum improvement for yield and quality characters can greatly reduce the risk of inadequate forage production during summer. Keeping this in view, the present study was conducted to evaluate genotypes potential among different sorghum genotypes for their grain and fodder yields and other associated characteristics.

## Materials and Methods

The main purpose of this study was to access eight sorghum genotypes, including one control for grain and fodder yield at Maize and Millets Research Institute, Yousafwala, Sahiwal, Punjab, Pakistan during the year 2011. The trial was laid out in a randomized complete block design with four replications and plot size of 5m × 3m. Plant to plant distance was 15 cm and row to row distance was 75 cm. Fertilizer dose was kept at 170-84-62 NPK (kg/ha). All other agronomic practices were kept uniform for all the treatments.

Five plants were selected randomly from central 2-rows of each plot for recording data for days to 50% flowering, days to maturity, plant height, fodder and grain yield. Data on 50% flowering was recorded when 50% plants completed heading. After the maturity of the crop, heads of the plants were removed and thrashed them by hand and Grain yield was adjusted to 15% grain moisture using the formula as prescribed [8]. Plant height was measured 3 weeks after flowering from the base (ground) to the point where the flag-leaf blade extends from the stalk as recommended earlier [9]. Grain and stalk yields were recorded and then converted to kg per hectare. The data were analyzed statistically and means were compared using least significant difference test through MSTATC computer software [10, 11].

## Results and Discussion

### Grain yield

The grain yield is the most important trait and ultimate product of grain varieties. The data revealed that sorghum varieties differed significantly for grain yield (Table 1). The highest grain yield was obtained from sorghum variety YSS-9 (3433 kg/ha), while the lowest grain yield (2667 kg/ha) was recorded in variety YSS-32. Similar results were reported by Osmanzai [4] and Alagarsamy [6].

### Fodder yield

Varieties also differed significantly in fodder yield (Table 1). The highest fodder yield was obtained from varieties YSS-9 (15833 kg/ha). The lowest fodder yield was recorded in variety YSS-32 (6333 kg/ha). The data further showed that YSS-9 proved to be a dual-purpose variety with reasonable grain and fodder yields.

**Table 1** Grain and Fodder yields, plant height, days to 50% flowering and days to maturity as affected by various sorghum varieties and hybrids.

| Varieties  | Grain yield (kg/ha) | Fodder yield (kg/ha) | Plant height (cm) | Days to 50% flowering |
|------------|---------------------|----------------------|-------------------|-----------------------|
| YSS-9      | 3433a               | 15833a               | 233a              | 80a                   |
| YSS-10     | 3167ab              | 12000ab              | 221ab             | 86a                   |
| YSS-17     | 3100ab              | 9833bc               | 231a              | 85b                   |
| YSS-10     | 3067ab              | 8676c                | 217ab             | 84b                   |
| YSS-98     | 2933bc              | 9667bc               | 186abc            | 79d                   |
| YSS-18     | 2800c               | 6583c                | 149c              | 82c                   |
| YSS-19     | 2700c               | 6667c                | 132d              | 85b                   |
| YSS-32     | 2667d               | 6333d                | 172bc             | 80bc                  |
| LSD (0.05) | 551                 | 2833                 | 13.44             | 1.53                  |

Means followed by different letter(s) in a column are significant at 5% level of probability.

### Plant height at maturity

A perusal of the data (Table 1) indicated that maximum plant height (233cm) was recorded in YSS-9. Short statured plants of 132cm were recorded in variety YSS-19. Difference in plant height could be due to variation in genetic make-up or the hormonal balance and cell division rate that results in changes in the plant height of the different varieties Ullah et al. [1] and Olakajo and Iken [12] also reported significant variations in plant height among various maize varieties.

### Days to 50% flowering

Varieties differed significantly in days to 50% flowering (Table 1). Sorghum variety YSS-10 (Cream) took maximum days (86) to 50% flowering than varieties YSS-98 (control) and YSS-9 taking 79 and 80 days to 50% flowering, respectively. Similar results were reported by Osmanzai [4] and Alagarsamy [6].

## Conclusions

Development of superior crop cultivars is the ultimate goal of the plant breeders to obtain a higher grain yield as well as fodder yield to replace the existing low yielding sorghum varieties, which will play a vital role in the development of the dairy industry by ensuring the fodder supply during lean period and ultimately increasing the milk and meat production of the country.

From the results obtained, it is concluded that sorghum varieties differed in their capability of producing higher grain yield and fodder yield. Among the tested genotypes, YSS-9 produced higher grain yield as well as fodder yield (stay greener at maturity) than all other genotypes. So YSS-9 proved as dual-purpose variety with reasonable grain and fodder yields. YSS-9 (new proposed name YS-15) can be helpful in the development of new sorghum cultivar if used in a sorghum breeding program.

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