Science Letters
2016 | Volume 4 | Issue 3 | Pages 190-192

SHORT COMMUNICATION OPEN ACCESS

Investigation of Different Sorghum (*Sorghum bicolor* L. Moench) Hybrids for Yield and Other Associated Traits under Climatic Conditions of Dera Ghazi Khan

Muhammad Ihsan Ullah*[1], Zaib-Un-Nisa[1], Barkat Ali[1], Muhammad Atif Muneer[2,3], Muhammad Zeeshan Munir[2,4], Muhammad Imran[2,3], Saima Adil[5]

[1]Sorghum Research Sub-Station, Dera Ghazi Khan, Punjab, Pakistan
[2]Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad, Pakistan
[3]Center for Plant Biology, School of Life Sciences, Tsinghua University, 100084, Beijing, China
[4]School of Biological Sciences and Technology, Beijing Forestry University, Beijing, China
[5]Department of Life Sciences, Islamia University, Bahawalpur, Pakistan

Abstract
Eight sorghum hybrids with one check variety were evaluated for grain yield and other associated traits at sorghum research sub-station, Dera Ghazi Khan, Punjab, Pakistan in 2013. The results revealed that sorghum hybrids differed significantly for grain yield, stalk yield, plant height, days to 50% flowering and maturity. Among hybrids, YSH-95, YSH-111, and YSH-28 produced higher grain yield (i.e. 4.667, 4.267 and 4.244 tons/ha, respectively) than other hybrids tested. Hybrids YSH-95 and YSH-33 produced higher stalk yield of 43.2 and 37 tons/ha, respectively. Sorghum hybrids YSH-75 and YSH-114 took maximum 73 days to 50% flowering, while the hybrids YSH-113 took minimum 64 days to 50% flowering. The hybrids YSH-111 and YSH-28 showed earliness in maturity as 108 days and 110 days were taken to get maturity, respectively. Maximum plant height of 253 cm was prominent for YSH-95, while minimum plant height of 158 cm was noticed for YSH-36. It is concluded that YSH-95 is potentially superior in producing higher grain and stalk yield. The implication of these results in the context of adaptation to prevailing weather could be an interesting/resourceful option for farmers.
Keywords Grain yield, hybrids, screening, sorghum, stalk yield.

Received June 21, 2016 **Accepted** August 19, 2016 **Published** December 15, 2016
***Corresponding author** Muhammad Ihsan Ullah **E-mail** ihsan7447@yahoo.com

To cite this manuscript: Ullah MI, Zaib-un-Nisa, Ali B, Muneer MA, Munir MZ, Imran M, Adil S. Investigation of different sorghum (*Sorghum bicolor* L. Moench) hybrids for yield and other associated traits under climatic conditions of Dera Ghazi Khan. Sci Lett 2016; 4(3):190-192.

Introduction

Pakistan is a very important country in all over the world for its agricultural production. Crop plants growing in Pakistan are genetically diverse and this diversity can be utilized effectively for future breeding programs, especially to overcome food security challenge, marginal land and energy demand [1]. *Sorghum bicolor* L. Moench is ranked 5th in world's most important cereal crops. Sorghum is a drought tolerant Kharif cereal of rain-fed and arid zones of the world. It is a common source of fodder for cattle and the grains are used in poultry feed to substitute maize. Moreover, it is used as a staple food in Africa, India and also in Pakistan, particularly in rain-fed areas. Sorghum is a fast growing crop which gives considerable grain and stalk yield and contains 70% carbohydrates, 10-12% protein and about 0.3% fat contents. So, it can be effectively utilized in feeding programs for poultry and dairy cattle [2]. Its importance is increasing day by day due to ethanol production, which can be added to the fuel for saving valuable foreign exchange [3]. Sorghum being well adapted to hot dry climate is a suitable option for cultivation in rain-fed, hilly and sub-hilly, as well as irrigated areas of this region. In this contribution, we studied the performance of different sorghum hybrids and investigated the effects of hybrids on grain yield and other associated traits under production restrictions of Dera Ghazi Khan. The studied area is situated in the south-western region of Punjab at latitude 28 ^{o} to 31^{o} south, longitude of 69^{o} to 70^{o} east and the elevation is 121 meters from the sea level. The climate is typically arid sub-mountainous. Cold winters and harsh hot summer are a peculiarity of this area. Average rainfall ranges from 75 to 162mm. The mean winter temperature occasionally drops to zero, while average a maximum temperature in June and July reaches up to 42^{o}C [4].

Sorghum is an important warm season tropical cereal crop and well adapted to perform under drought and high temperature. Local farmers usually trust on stressed resistant and stable yield providing cultivar [5]. Osmanzai [6] noticed the superior performance of hybrids over cultivars and he argued non-significant differences between the cultivars and hybrids for plant height, days to bloom, seed weight, and physiological maturity. Hussain et al. [7] reported that higher yield can be obtained from the hybrids than from varieties.

The inference was supported by the result of 17 sorghum varieties and 9 hybrids grown at different locations. Another study proved that sorghum hybrids have the ability to produce maximum grain and stalk yield [8].

Keeping this in view, the present study was conducted to evaluate genotypic potential among different sorghum genotypes for their grain yield and other associated characteristics under agro climatic conditions of D. G. Khan.

Materials and methods

A field experiment was performed at Sorghum Research Sub-station D. G. Khan, Punjab, Pakistan during the year Kharif-2013. The soil type at the site is sandy loam. Seasonal rainfall and temperature minimum and maximum during the growing season are shown in Fig. 1. The trial was conducted in a randomized complete block design with three replications having a plot size of 5 m × 3 m. Each plot was planted with the four rows. Seeding was done at the rate of 20kg/ha on July 31, 2013. Plant to plant and row to row distances were maintained about 15 cm and 75 cm, respectively. The fertilizer dose for NPK was kept at 170-84-62 Kg ha^{-1}, respectively. Half dose of nitrogen and full doses of P and K were applied at the sowing time while remaining N was applied with the second irrigation. Furthermore, the plant protection and standard agronomic practices were taken for all treatments of the experiment. The trial was harvested on December 3, 2013.

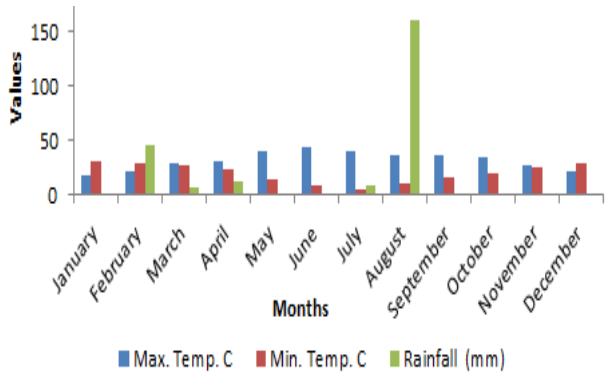

Fig. 1 Climatic conditions of Dera Ghazi Khan in 2013.

Five plants were chosen from two central rows to collect data. For each plot, grain yield, stalk yield, plant height, 50% flowering and days to maturity was noted down. The data of 50% flowering was recorded when 50% plants completed the heading. Plant height was recorded three weeks after flowering from the base (ground) to the point where the flag leaf blade extends from the stalk as recommended earlier by Abel and Pollak [4]. After maturity of the crop, heads of the plants were harvested and threshed by hand. Grain and stalk yields per plant were recorded and then converted into tons per hectare [9]. Mean values were computed using MSTAT-C computer software (MSTATC package, version 1. Michigan State University, USA) and also mean values were compared using least significant difference test.

Results and discussion

Grain yield

Grain yield has always been a main focus for the breeders to produce better varieties. In the present study, hybrids YSH-95 yield was the highest (4.667 t/ha) which was statistically at par with YSH-111 having grain yield of 4.267 t/ha (Table 1). While minimum grain yield of 2.711 t/ha was recorded for hybrid YSH-114. Significant differences were observed in grain yield due to varietal differences in sorghum. Yusuf et al. [10] also reported highly significant differences in yield among various pearl millet varieties.

Stalk yield

Besides grain yield, breeders have an interest in stalk yield, which is an indispensable source of fodder in many countries of the world. Environmental and genomic factors influence stalk yield. YSH-95 out-yielded other hybrids in stalk yield producing 43.2 t/ha. While minimum stalk yield of 19.0 t/ha was recorded for YSH-113. YSH-95 proved as a dual purpose hybrid with appreciable grain and fodder yield, shown in Table 1. Similar results have also been found by the researchers while evaluating the nine genotypes of pearl millet [11]. Muhammad and his colleagues also found significant differences in stalk yield in pearl millet varieties [12].

Plant height at maturity

It has also been observed that plant height is also very important attribute because of its direct correlation with the stalk yield. Maximum plant height of 253 cm and 252 cm was observed in the hybrids YSH-95 and YSH-33, respectively. Short statured plants of 158 cm were recorded in hybrid YSH-36 given in Table 1. The difference in plant height could be due to variation in genetic makeup or the hormonal balance and cell division that results in changes in the plant height of different varieties [2]. Olakojo and Iken [13] also reported significant variations in plant height among various maize varieties. These variations in plant

Table 1 Mean values for grain yield, stalk yield, plant height, days to 50% flowering and days to maturity in sorghum hybrids.

Varieties	Grain yield (ton/ha)	Stalk yield (ton/ha)	Plant height (cm)	Days to 50% anthesis	Days taken to maturity
YSH-95	4.667[a]	43.22[a]	253[a]	72[a]	121[a]
YSH-111	4.267[ab]	28.56[e]	195[e]	68[c]	108[e]
YSH-28	4.244[b]	32.22[cd]	224[c]	67[c]	110[d]
YSH-113	4.000[bc]	19.00[f]	182[f]	64[d]	112[c]
YSH-75	3.778[cd]	29.44[de]	244[b]	73[a]	121[a]
YSH-33	3.511[de]	37.00[b]	252[a]	70[b]	121[a]
YSH-36	3.333[e]	28.45[e]	158[g]	70[b]	112[c]
YSS-98	3.289[e]	21.11[f]	205[d]	72[a]	114[b]
YSH-114	2.711[f]	34.33[bc]	239[b]	73[a]	122[a]

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

height have also been observed in pearl millet [14, 15].

Days to 50% flowering

Hybrids differed significantly in days to 50% flowering (Table 1). Sorghum hybrids YSH-75 and YSH-114 took maximum days 73 days to 50% flowering as compared to YSH-113, YSH-28, and YSH-111 taking 64, 67 and 68 days, respectively, to 50% flowering and proved as early maturing ones. Similar results were reported by Hussain and his colleagues in sorghum varieties [7].

Days taken to maturity

Days taken to maturity are also an important attribute towards the yield improvement and days to maturity usually follows the flowering pattern. Days to maturity were significantly affected by sorghum hybrids (Table 1). Hybrids YSH-111 and YSH-28 showed earliness in maturity by taking 108 and 110 days to maturity. Hybrid YSH-114 was found to be late matured in 122 days. The additive gene action controls it and can improve the yield by selection of good varieties [14, 16].

Conclusions

It has always been a dream of plant breeders to develop high yielding varieties so that farmers can get maximum benefits and ensure the food supply during shortage seasons. From the results obtained, it is concluded that sorghum hybrids differed in their capability of producing higher stalk and grain yield in D. G. Khan region. Among the tested hybrids, YSH-95 produced higher grain and stalk yield as compared to the rest of the hybrids, which showed its supremacy over other hybrids of the trial, under the climatic conditions of D. G. Khan. So, it is suggested a good sorghum hybrid for D. G. Khan region.

Conflict of interest

The authors declare that they have no conflict of interest.

References

[1] Bibi A, Sadaqat H, Tahir M, Akram H. Screening of sorghum (*Sorghum bicolor* var Moench) for drought tolerance at seedling stage in polyethylene glycol. J Anim Plant Sci 2012; 22:671-678.

[2] Khan A, Nawab K, Khan A, Islam B. Growth characters and fodder production potential of sorghum varieties under irrigated conditions. Sarhad J Agric 2007; 23:265-268.

[3] Reddy BV, Ramesh S, Reddy PS, Ramaiah B, Salimath M, Kachapur R. Sweet sorghum-a potential alternate raw material for bio-ethanol and bio-energy. Intl Sorghum Millet Newslett2005; 46:79-86.

[4] Abel B, Pollak L. Rank comparisons of unadapted maize populations by testers and per se evaluation. Crop Sci 1991; 31: 650-656.

[5] Haussmann B, Obilana A, Ayiecho P, Blum A, Schipprack W, Geiger H. Yield and yield stability of four population types of grain sorghum in a semi-arid area of Kenya. Crop Sci 2000; 40: 319-329.

[6] Osmanzai M. In Relative performance of sorghum hybrids and open pollinated cultivars under two soil mositure regimes, Sorghum Improvement Conference of North America, USA; University of Georgia, USA; International Crops Research Institute for the Semi-Arid Tropics, Patacheru 502 324, Andhra Pradesh, India: 1994.

[7] Hussain N, Baloch MS, Yousaf M, Naeem M, Khakwani AA, Begum I. Performance of sorghum varieties in potohar region. Gomal Uni J Res 2011; 27:27-30.

[8] Zahid M, Bhatti M. Comparative study on fodder yield potential of different sorghum hybrids under rain fed conditions. Sarhad J Agric 1994; 10:345-350.

[9] Khan S, Awan IU, Baloch MS, Khan EA, Khakwani AA, Hussain N. Performance of maize varieties/hybrids under irrigated conditions of Dear Ismail Khan. Sarhad J Agric 2013; 29:26-31.

[10] Yusuf MJ, Nabi G, Basit A, Husnain SK, Akhtar LH. Development of High Yielding Millet Variety "Sargodha Bajra-2011" Released for General Cultivation in Punjab Province of Pakistan. Pak J Agri Sci 2012; 49:299-305.

[11] Zaman Q, Malik NH, Hayat K. Performance of millet varieties for green fodder production under DI Khan conditions [Pakistan]. Sarhad J Agric 2004; 20:47-49.

[12] Muhammad D, Hussain A, Khan S, Bhatti M. Forage yield and quality potential of pearl millet cultivars under rainfed conditions. J Agric Res 1994; 32:383-388.

[13] Olakojo S, Iken J. Yield performance and stability of some improved maize (*Zea mays* L.) varieties. Moor J Agric Res 2001; 2:21-24.

[14] Thomson I. JT Amodu, IA Adeyinka, MS Kallah and JP Alawa. J Biol Sci 2007; 7:379-383.

[15] Ayub M, Khalid M, Tariq M, Elahi M, Nadeem M. Comparison of sorghum genotypes for forage production and quality. J Anim Plant Sci 2012; 22:733-737.

[16] Mohyeldin AIA. Genetic studies of pearl millet (*Pennisteum Glaucum* L.) under water stress at different growth stages. PhD dissertation, University of Khartoum; 2015.