

# PERFORMANCE OF MAIZE VARIETIES UNDER IRRIGATED CONDITIONS OF DERA ISMAIL KHAN

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## ABSTRACT

An experiment was conducted to evaluate the performance of seven maize varieties with a local standard check at the Agronomic Research Area, Faculty of Agriculture, Gomal University, Dera Ismail Khan, Khyber Pakhtunkhwa (KPK), Pakistan, during spring 2011. Maize varieties tested were Islamabad Gold, Kisan, Sadaf, Sarhad White, Sahiwal-2002, Islamabad White, Agaiti-2002 and local check Azam. The results revealed that local check Azam was earlier in days to 50% pollen shedding and silking (60.33 and 62.66 days) than other varieties including Sadaf and Islamabad White. Highest plant height was measured in Sahiwal-2002 (198.3cm) and lowest in Islamabad White (163.33cm) whereas highest ear height was found in Sadaf (101cm) and lowest (75cm) in Agaiti-2002. Non-significant differences were noted for number of ears per hectare. Islamabad White had maximum (31.23%) moisture contents in grain at harvest as compare to Islamabad Gold (26.16%). Maximum grain yield (5943 kg ha<sup>-1</sup>) was recorded in Sahiwal-2002 while Sarhad White produced maximum biological yield (23380 kg ha<sup>-1</sup>). Variety Sahiwal-2002 showed the highest percentage of harvest index (32.37%).

**Keywords:** Maize, Verities, Irrigated Conditions, Pakistan

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## INTRODUCTION

Maize (*Zea mays* L.) is considered third most important cereal crop after wheat and rice in the world (Gerpacio and Pingali, 2007). It is a short duration, quick growing crop and has the potential to produce high quantity grains per unit area (Akbar *et al.*, 2008). It is grown for dual-purpose, grain as well as fodder in tropical, sub-tropical and temperate regions of the world. Maize is used for multiple purposes like bread making, corn flakes, corn syrup, corn starch, textile, paper making and in food industries. Corn oil is suitable for human consumption due to the presence of unsaturated fatty acids.

Maize is the leading cereal crop, which covers 4.8% area and 3.5% of the value of agricultural output (MINFAL, 2008). Punjab and Khyber Pakhtunkhwa are the main maize growing provinces of Pakistan. Peshawar, Malakand, Hazara and Dera Ismail Khan are the major maize growing

districts in KPK. Maize is annually grown on an area of 1139.40 thousand hectares with total production of 4997.10 thousand tonnes and average yield of 4268 kg ha<sup>-1</sup> in Pakistan (Anonymous, 2012).

In Pakistan, average yield of maize is very low due to inadequate use of fertilizers, inadequate water, sub-optimal plant density, weeds infestation, insect pest attack and poor selection of suitable varieties for a given ecology (Tahir *et al.*, 2008).

A serious problem always remained between varieties and environment for successful crop stand while recommending a variety for particular location (Hussain *et al.*, 2010). For commercial crop production, environment cannot be changed but a genetic constitution of a variety can be changed by using biotechnology techniques and hybridization to suite the existing soil and environmental conditions. Due to this reason, breeders

collect and create variation in genetic constitution of crops for development of genotype which is best suited to varying climatic zones.

Genetic variability and environmental interaction play an important role in successful maize production (Olakajo and Iken, 2001). Different yield is obtained in different maize varieties due to variability in genetic potential (Aziz *et al.*, 1992). Therefore, it is important to have the knowledge about the yield testing locations for successful stand of crop in different production environments (Trethowan *et al.*, 2001). Keeping all this in view, an experiment was conducted to see the performance of different maize varieties under the irrigated conditions of Dera Ismail Khan.

## MATERIALS AND METHODS

A research trial to test the performance of maize varieties, including Islamabad Gold, Islamabad White, Kisan, Sadaf, Sahiwal-2002, Agaiti-2002, and Sarhad White along with a local check Azam, was conducted at the Agronomic Research Area of Faculty of Agriculture, Gomal University, Dera Ismail Khan, KPK, Pakistan, during spring 2011. The experiment was laid out in a randomized complete block design (RCBD) with three replications. The experiment was planted in a well prepared soil. Each plot was comprised of four rows, 5m long and 75cm apart. The net plot size was 3m x 5m. Nitrogen, phosphorus and potash were applied @ 110:90:75 kg NPK ha<sup>-1</sup>. All phosphorus, potash and half of nitrogen was applied at the time of seed bed preparation while the remaining half N was applied at knee height stage of crop.

The data were recorded on days to 50% pollen shedding, days to 50% silking, plant height at maturity (cm), ear height, number of ears (ha<sup>-1</sup>), moisture contents (%) in grain at harvest, grain yield, biological

yield and harvest index. Data were subjected to analysis of variance techniques (Steel *et al.*, 1997) using MSTATC computer software to assess statistical difference among the treatment means.

## RESULTS AND DISCUSSION

### Days to 50% pollen shedding

The data showed that maize varieties differed significantly for days to 50% pollen shedding. Varieties Sadaf, Islamabad White and Islamabad Gold took maximum number of days (79.00, 78.66 and 76.00) to 50% pollen shedding (Table-1). These varieties were followed by Sahiwal-2002, Sarhad White and Agaiti-2002 with 72.00, 71.66 and 71.33 days to pollen shedding. Minimum numbers of days (60.33) to pollen shedding was recorded for local check Azam. Days to pollen shedding is directly affected by genetic makeup of maize varieties. Such an expression in genetic variability is also significantly affected under different experimental conditions (Ahmad *et al.*, 2011; Younas *et al.*, 2002).

### Days to 50% silking

The data given in Table-1 indicated that maize varieties Sadaf and Islamabad White took maximum number of days (81.33 and 80.66) to 50% silking. These were, however, followed by Islamabad Gold and Sarhad White with 78.00, 75.00 days to mid silking. Variety Azam (check) was found earlier in number of days to 50% silking. The difference in days to mid silking might be due to different genetic constitution of tested varieties. Previous research findings show a variable behavior of maize varieties at different locations due to change in environmental conditions (Ahmad *et al.*, 2000; Hussain *et al.*, 2003; Aziz and Khan, 2005).

### Plant height at maturity (cm)

Among tested maize varieties, Sahiwal-

2002 produced tallest plants of 198.3cm and was statistically similar to Islamabad Gold, Sadaf and Sarhad White with plant height of 186.66, 185 and 183.3cm, respectively (Table-1). Variety Islamabad White and Kisan produced short statured plants of 163.33 and 161.7cm, respectively. All maize varieties used in this study had diverse genetic background; therefore, these varieties produced varying plant height ranging from 161.7 to 198.3cm. Plant height is negatively correlated with flowering date, because flower initiation stops the formation of internode, which means that early maturing varieties produce shorter plants as found in case of Kisan variety in the present research (Troyer and Larkins, 1985; Ahmad *et al.*, 2011; Hussain *et al.*, 2004; Noor *et al.*, 2010; Beyene *et al.*, 2011; Hussain *et al.*, 2011).

#### **Ear height (cm)**

The data given in Table-1 showed that maize variety Sadaf had maximum ear height of 101.0cm. It was followed by Islamabad Gold and Sahiwal-2002 with ear height of 91.66 and 90.0cm, respectively. Among other maize varieties, Sarhad White (86.66cm), Kisan (85cm), Azam (85cm) and Islamabad White (81.66cm) showed statistically similar ear height. The difference in ear height might be attributed to genetic diversity of tested maize varieties (Ajmal *et al.*, 2000; Olakajo and Olaoye, 2005; Salami *et al.*, 2007; Noor *et al.*, 2010).

#### **Number of ears (ha<sup>-1</sup>)**

The data given in Table-1 indicated non-significant difference among maize varieties for number of ears. However, variety Azam (check) produced maximum number of ears (67111 ha<sup>-1</sup>) whereas minimum number of ears (62666) was recorded in variety Islamabad White. Non-significant difference among tested varieties was because of the reason that uniform plant stand was maintained and all

plants produced approximately equal number of ears per plant.

#### **Moisture contents (%) at harvest**

Moisture contents in the grain at harvest indicated significant differences among maize varieties (Table-2). Among varieties, Islamabad White had higher moisture contents (31.23%) in the grain, followed by Sarhad White and Sadaf having 28.96% moisture contents each. Lower moisture contents (21.16%) were noted in Agaiti-2002. It was also noted that early maturing varieties had lower moisture contents in the grain and *vice-versa* (Rehman *et al.*, 2009).

#### **Grain yield (kg ha<sup>-1</sup>)**

The data given in Table-2 revealed significant variations in grain yield. Varieties Sahiwal-2002, Kisan and Sarhad White produced significantly higher grain yield (5943, 5902 and 5794 ha<sup>-1</sup>) than other varieties. Variety Agaiti-2002 produced lowest grain yield of 4677 kg ha<sup>-1</sup>. Grain yield variation might be due to the diverse genetic background of these varieties and their response to agro-ecology of the experimental area. Earlier it has been reported that genotypic variations effect grain yield of maize considerably (Ali *et al.*, 2006; Qamar *et al.*, 2007; Ahmad *et al.*, 2011).

#### **Biological yield (kg ha<sup>-1</sup>)**

The data given in Table-2 showed that maize varieties differed significantly for biological yield. Highest biological yield (23380 kg ha<sup>-1</sup>) was produced by variety Sarhad White, followed by Agaiti-2002 (20800 kg ha<sup>-1</sup>) and Kisan (19470 kg ha<sup>-1</sup>). Local check Azam produced lower biological yield of 18160 kg ha<sup>-1</sup>. Islamabad White and Sahiwal-2002 produced statistically at par biological yield of 18810 and 18370 kg ha<sup>-1</sup>. In the present study, maximum biological yield was recorded in maize variety Sarhad White because it produced taller plants and more stem diameter as compare to rest of the

varieties. Taller plants produce more number of leaves, larger leaf area and more light interception, which result in more photosynthesis and higher biological yield (Masood *et al.*, 2003).

#### Harvest index (%)

Significant variation was observed in maize varieties for harvest index (Table-2). Leading maize genotype with highest percentage of harvest index was Sahiwal-2002 (32.37%). Other varieties with statistically similar harvest index were Islamabad Gold (30.67%) and Kisan (30.30%). The lowest harvest index (22.13%) was recorded in Agaiti-2002. Difference in harvest index was probably due to the change in genetic makeup of the tested varieties (Ajmal *et al.*, 2000; Ali *et al.*, 2006; White *et al.*, 2006; Armen *et al.*, 2007).

#### CONCLUSION

From the given research work, it is concluded that maize varieties Sahiwal-2002, Kisan and Sarhad White were superior in grain yield production. Therefore, on the basis of their good performance, these varieties are recommended for general cultivation in Dera Ismail Khan and other similar agro-ecological zones. Adaption of these genotypes in D. I. Khan's ecology and similar environmental conditions prevailing in other parts of the country can play a pivotal role in increasing maize productivity.

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**Table-1. Effect of different maize varieties on days to 50% pollen shedding, days to 50% silking, plant height (cm), ear height (cm) and number of ear ha<sup>-1</sup>.**

Varieties	Days to 50% pollen shedding	Days to 50% silking	Plant height (cm)	Ear height (cm)	Number of ears (ha <sup>-1</sup> )
Islamabad Gold	76 ab	78 abc	186.66 ab	91.66 ab	64444 <sup>NS</sup>
Agaiti-2002	71.33 bc	74.33 c	176.7 bc	75.0 c	63999
Kisan	69.66 c	72.33 c	161.7 c	85.0 bc	65333
Sarhad White	71.66 bc	75 bc	183.3 ab	86.66 bc	66222
Islamabad White	78.66 a	80.66 ab	163.33 c	81.66 bc	62666
Sadaf	79 a	81.33 a	185.0 ab	101.0 a	64444
Sahiwal-2002	72 bc	74.33 c	198.3 a	90.0 ab	66221
Azam (check)	60.33 d	62.66 d	170.0 bc	85.0 bc	67111
LSD <sub>0.05</sub>	60.33 d	6.273	19.01	13.88	

NS = Non-significant

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

**Table-2. Effect of different maize varieties on moisture contents (%), grain yield (kg ha<sup>-1</sup>), biological yield (kg ha<sup>-1</sup>) and harvest index (%).**

Varieties	Moisture contents at harvest (%)	Grain yield (kg ha <sup>-1</sup> )	Biological yield (kg ha <sup>-1</sup> )	Harvest index (%)
Islamabad Gold	29.8 ab	5408 ab	17630 d	30.67 ab
Agaiti-2002	26.16 d	4677 c	20800 b	22.13 e
Kisan	28.3 bcd	5902 a	19470 c	30.30 ab
Sarhad White	28.96 abc	5794 a	23380 a	24.80 de
Islamabad White	31.23 a	4859 bc	18810 cd	25.83cd
Sadaf	28.96 abc	5236 b	18120 d	28.93 bc
Sahiwal-2002	26.5 cd	5943 a	18370 cd	32.37 a
Azam (check)	28.46 abcd	5081 bc	18160 d	28.03 bcd
LSD <sub>0.05</sub>	2.785	557.9	1254	3.351

NS = Non-significant

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