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Influence of Sowing Dates on Varying Maize (*Zea mays* L.) Varieties Grown under Agro-Climatic Condition of Peshawar, Pakistan

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Abstract

The rapid climate changes are imperative to evaluate and find ways that suite to maize-specific varieties either hybrids or varieties with appropriate sowing dates to avoid the critical growth stages from the stresses due to climate condition. Sowing at proper time and selection of good variety are the most important factor cropping system. A field experiment was conducted at the University of Agriculture Research Farm during summer 2016 to evaluate the influence of sowing dates on varying maize varieties grown under the agro-climatic condition of Peshawar. The experiment was laid out in RCBD (randomized complete block design) were replicated three times with split plot arrangement. Sowing dates (10 June, 21 June, 1 July, 11 July, 22 July) were allotted to main plot and varieties (Iqbal, Azam, Jalal, Babar, SB-989, SB-909, SB-292, CS-200, CS-220, and W-888) were placed in the subplot. The subplot size was 5 m × 3 m. Experimental result showed that maximum days to tasseling (60), days to silking (65), tasseling and silking interval (6), plant height (185 cm), biological yield (21745 kg ha⁻¹), 1000 grain weight (413 g) grain yield (5162 kg ha⁻¹) were observed in different sowing intervals. Among the different varieties the maximum days to tasseling (57), days to silking (62), tasseling and silking interval (7). Plant height, (176 cm), biological yield (17279 kg ha⁻¹), 1000 grain weight (410 g), grain yield (5113 kg ha⁻¹). It is concluded from the result that early sowing and tested variety W-888 give higher grain yield and yield traits of maize.

Keywords: *Zea mays* L varieties; Sowing dates; Grain yield; Agronomic character

Introduction

Maize (*Zea mays* L.) is one of the world's leading cereal crops. It is the third most important cereal crop after wheat and rice in Pakistan. Maize is cultivated both in spring and Kharif seasons in

Pakistan due to the availability of temperate as well as tropical genetic material both in hybrids and open-pollinated maize varieties. It is a short duration crop and is grown twice a year both for grain and fodder purpose. It is grown throughout Khyber Pakhtunkhwa [1]. About two-thirds of the total world production of maize is used for livestock feed or for commercial starch and oil production [2]. In 2013-2014 it was cultivated on an area of 1117 thousand hectares with a total production of 4527 thousand tons and yield was 4053 kg ha⁻¹ [3]. In KPK (Khyber Pakhtunkhwa), it was grown on about (471) thousand hectares with a production of (915) thousand tons annually. The average yield of maize in KPK (Khyber Pakhtunkhwa) was (1943) kg/ha [4]. In rainfed areas, the timing of rainfall is important for production. Changes in climate (variation in temperature and rainfall pattern and distribution) have made sowing timing of maize and other summer crops uncertain. Crop production fluctuates with climate change in the different regions of the world differently [5]. Early to late sowing affects crop growth and yield adversely due to changes in the climate of the area. However, these changes in the climate affect growth and subsequently the yield differently, depending upon the magnitude of change and developmental stage of the crop. The optimum sowing date of the crops and/or its validation is essential to sustain productivity under the climate change; particularly the high summer temperature effect on anthesis in circumstances in the area like Pakistan [3]. A significant effect on growth and yield of maize has been already observed by changing the climate of crop growth [6]. Drought is a worldwide problem and dangerous for arable field crops growth and subsequently for food security [7]. In Pakistan maize is planted in June-July (depending on location). As compare to wheat, maize is highly sensitive to moisture [8]. Yield can be increased to a greater extent through high yielding varieties, appropriate time of planting and with good agronomic practices. Planting dates and varieties selection are the major factors affecting maize production in addition to soil fertility, temperature regimes and irrigation [9]. For optimization of yield, planting at an appropriate time is very critical [10]. Many factors are

responsible for the low yield of maize in Pakistan. One of the most important factors contributing to yield gap is a sowing of maize on appropriate sowing dates. Maize like many other crops that are cultivated in tropics is influenced by the environmental changes (temperature, rainfall etc.) associated with different sowing dates and the wider the deviation from the optimum sowing date the greater will be yield loss. Considerable yield decline as a result of sowing too early or too late has been reported in maize [11].

Methods

A field experiment was conducted at the University of Agriculture Research Farm during summer 2016 to evaluate the influence of sowing dates on varying maize varieties grown under the agro-climatic condition of Peshawar. The experiment was carried in RCBD (randomized complete block design) with a split arrangement having three replication. The experiment was two factors sowings dates were assigned to the main plot and varieties to subplot. Before starting the experiment a composite soil sample was collected and analyzed for different Physico-chemical Properties. The pH of the soil was (7.78) which is slightly alkaline, EC was (0.17 dSm⁻¹) which is nonsaline, the organic matter content (0.82%) and AB-DTPA extractable K was (68 mg/kg).

The detail of factors and treatments is given below:

Factors (sowing dates):

- SD1=June 10, 2016
- SD2=June 21, 2016
- SD3=July 1, 2016
- SD4=July 11, 2016
- SD5=July 22, 2016

Treatments (varieties):

- V1=Iqbal
- V2=Azam
- V3=Jalal
- V4=Babar
- V5=SB-989
- V6=SB-909
- V7=SB-292
- V8=CS-200
- V9=CS-220
- V10=W-888

Data were recorded on days to tasseling, days to silking, tasseling and silking interval, plant height (cm), 1000 grain weight (g), biological yield (kg/ha), grain yield (kg/ha) during this experiment.

Days to silking

Data on days to silking were counted days from planting date to 75% silks appeared in each plot.

Days to tasseling

Data on days to tasseling were counted days from planting date to 75% tassel appeared in each plot.

Silking and tasseling intervals

The days between silking and tasseling were counted.

Plant height (cm)

Plant height data selected five randomly plant form each plot with the help of meter rod form ground to flag leaf then average were calculated.

1000 grain weight

1000 grain weight data were counted 1000 grain form each treatment and then weight with help of electric balance.

Biological yield (kg/ha)

After harvesting three central rows in each subplot, fresh plants along with ears were weighted and biological yield in kg ha⁻¹ by using the below formula.

$$\text{Biological yield (kg ha}^{-1}\text{)} = \frac{\text{Biological yield per three rows}}{\text{No. of rows} \times \text{row length} \times \text{R-R distance}} \times 10000$$

Grain Yield (kg/ha)

Three central rows of each treatment was harvested, dried, threshed and weighted and then was converted into grain yield (kg ha⁻¹).

$$\text{Grain yield} = \frac{\text{Grain yield per three rows}}{\text{No. of rows} \times \text{row length} \times \text{R-R distance}} \times 10000$$

Results

Planting date is one of the key points in crop management to optimizing productivity. Crops response differently to different planting dates. The results showed that planting maize too early and too late significantly had a negative effect on grain yield. The results showed that all the parameters were significantly affected.

The maximum days to silking, days to tasseling, tasseling and silking interval, biological yield, 1000 grain weight, plant height, and grain yield were observed in sowing dates 2 (21 June 2016) while the minimum were recorded in sowing date 5 (22 July 2016).

While in case of varieties the maximum days to silking, days to tasseling, biological yield, plant height, 1000 grain weight, grain yield were observed from the plot having variety W-888 while the minimum were observed in varieties Azam and Iqbal. In varieties combination all the parameters were significantly

affected while tasseling and silking interval was not significant (Tables 1 and 2).

Table 1: Average Temperature, rainfall and humidity in maize crop season of 2016 at Peshawar.

| Environmental Parameters | June | July | Aug | Sep | Oct |
|--------------------------|------|-------|-------|-------|-------|
| Temperature°C | 32.6 | 33.46 | 30.34 | 28.57 | 24.32 |
| Rainfall (mm) | 9.8 | 42.4 | 65.7 | 17.9 | 9.2 |
| Humidity (%) | 38 | 43 | 34 | 23 | 16 |

Table 2: Effect of sowing dates and different varieties on maize yield and yield parameter.

| Treatments | Days to silking | Days to tasseling | Tasseling and silking interval | Biological yield (Kg/ha) | Plant height (cm) | 1000 grain weight (g) | Grain yield (kg/ha) |
|---------------|-----------------|-------------------|--------------------------------|--------------------------|-------------------|-----------------------|---------------------|
| Sowing Dates | | | | | | | |
| Sowing Date 1 | 62 b | 56 b | 6:00 AM | 15579 b | 172ab | 315 b | 4676 b |
| Sowing Date 2 | 65 a | 60 a | 6:00 AM | 21745 a | 185 a | 413 a | 5162 a |
| Sowing Date 3 | 59 c | 54 c | 6:00 AM | 13779 b | 163 b | 274 c | 4767 b |
| Sowing Date 4 | 59 c | 54 c | 5 b | 15179 b | 132 c | 252 d | 4176 c |
| Sowing Date 5 | 51 d | 47 d | 5 b | 9612 c | 171 b | 294 c | 3876 d |
| Sig | *** | *** | ** | *** | ** | *** | *** |
| Varieties | | | | | | | |
| V1= Iqbal | 58 c | 53 bc | 5 b | 12056 d | 161 bc | 274 c | 4767 bc |
| V2= Azam | 57 d | 54 bc | 5 b | 14862 abc | 162 bc | 298 c | 4743 abc |
| V3= Jalal | 59 b | 55 ab | 5 b | 14029 bcd | 152 cd | 371 bc | 4646 bc |
| V4= Babar | 58 c | 56 ab | 6:00 AM | 15529 abc | 165 ab | 294 c | 4975 ab |
| V5= SB-989 | 59 b | 48 c | 5 b | 13945 cd | 148 c | 315 b | 4504 c |
| V6= SB-909 | 60 ab | 51 bc | 5 b | 16806 a | 161 bc | 256 d | 4688 abc |
| V7= SB-292 | 60 ab | 50 c | 5 b | 15362 abc | 160 bcd | 252 d | 4675 bc |
| V8= CS-200 | 60 ab | 54 ab | 5 b | 16806 a | 166 ab | 365 c | 4975 ab |
| V9= CS-220 | 61 a | 55 ab | 6:00 AM | 16473 ab | 168 ab | 374 c | 4646 bc |
| V10= W-888 | 62 a | 57 a | 6:00 AM | 17279 a | 176 a | 410 a | 5113 a |
| Sig | *** | * | ns | ** | *** | ** | *** |

Discussion

Selection of good varieties and proper planting time are the most important factor. The rapid climate changes it is imperative to evaluate and find ways that suite to maize-specific varieties either hybrids or varieties with appropriate sowing dates to avoid the critical growth stages from the stresses due to climate condition. The study was used to assess the influence of sowing dates and varying maize varieties grown under the agro-climatic condition of Peshawar. The sowing dates 2 (21 June 2016) gives higher because the maize yield usually depends on photoperiod. The plant height is a genetically controlled factor so the height of different varieties does not remain equal. These results are in accordance with the results that reported a difference of plant height in different maize varieties [1]. These results contradict

the previous investigation whereby early sowing dates generally resulted in shorter plant height that has lower individual leaf area. Biological yield may be due to lowering of temperature and more availability of water which enhance vegetative growth [12]. Reported that delay in sowing decrease biological yield through May, while further delay showed an increase of biological yield in maize. Variation in yield revealed a diverse genetic background of varieties tested in this study. These results are in line with those of who reported significant differences among maize cultivars for grain yield. The availability of solar radiation, duration, and intensity, the mean thermal temperature response on the crop growth phases and responses of the day to night photo fluctuations. Mid-early sowing gives higher grain yield as compare to early or late sowing. These results are in line with [13] who reported that Average yield was

lower and smaller when maize had been sown both earlier and later [14-16].

Conclusion

The following conclusion was made on the basis of results:

- The most suitable planting date i.e SD2 (21 June 2016) in term of increase grain yield as compared to too early and late planting
- The variety W-888 performed better in grain yield as compared to other varieties
- Late planting varieties SB-909 may be done for fodder use as late planting produced higher biological yields

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