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Adaptability Test of Wheat Cultivation in District Panjgur, Balochistan (Southwestern Province of Pakistan)

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Abstract: A field experiment was conducted in agriculture research center Tasp at district Panjgur, the southwestern province of Pakistan. In this research, Local (unknown), Koto, Zardana, and Umaid wheat cultivars were sown by drilling method to investigate different crop characteristics for an adaptability test under agro-climacteric condition of district Panjgur. From the result, seed germination percentage revealed no significant change among the treatments as 65%, 80%, 85%, and 80% for Local, Koto, Zardana, and Umaid, cultivars respectively. However, the Zardana cultivar seed germination percentage was higher as compared to other cultivars. Moreover, Zardana was found to be high yielding wheat crop cultivar cultivated in agro-climacteric condition of district Panjgur with maximum yield of 3.5 kilogram per plot. In addition, sixty plants of each cultivar were selected for further wheat crop characteristic investigation and were measures as respect to plant height (cm), spike length (cm), and number of grains per spike (counting). The results showed, no significant change as well in all treatments for plant height as 65.88 cm, 78.38 cm, 69.63 cm, and 67.88 cm, in terms of spike length as 6.50 cm, 9.38 cm, 7.75 cm, and 8.88 cm, also in number of grains per spike counted as 18.50, 28.50, 31.50, and 29.25 for Local, Koto, Zardana, and Umaid, respectively. The overall performance of Zardana wheat crop characteristics were suggested to be adopted for cultivation and introduced among farmers as the best yielding wheat cultivar for agro-climacteric conditions of district Panjgur in Pakistan. Furthermore, this study would be useful for cereal production industry and future investigation of different cereal crops characteristics in Pakistan.

Keywords— Adaptability test; "Koto"; "Umaid"; Wheat; "Zardana**"**

1. INTRODUCTION

Wheat (*Triticum aestivum* L.) belongs to the family of *Poaceae* which is one of the major cereal crop consumed globally as a staple food [1]. Over 30% of total cultivated area in the world is covered by wheat crops that feeds more than 35% of worldwide population. Mostly, the growers use to adopt conventional method of cultivating traditional wheat varieties in rain fed regions which are more sensitive to disease and pests with low yielding [2]. Wheat is the main and an important grain crop cultivated as regard to food security in Pakistan which contain sufficient carbohydrate, proteins, fibers, minerals, vitamins and antioxidants composition [3]. It is cultivated on a total area of 9.04 million hectares with an average of 2639 kg per hectare yield in Pakistan [4]. Low yielding wheat crop is the main cause in Pakistan that occurs due to inappropriate crop cultivar selection, cultivating method, cultivate timing and seed rate application [5]. Pakistan produced about 26 million metric tons of wheat in 2016 [6].

Although, Balochistan being largest Province in Pakistan, comprises 44% of total country area sharing 13% of total cultivated land in which over 46% of cropped land area is covered by wheat as main source of staple food cultivated in irrigated and rain fed conditions. However, crops cultivated under different agro-climatic conditions thrive differently. Climate, soil type and nutrients are some of the conditions that affect the growth, development and consequently the crop yield. Crops respond to changes or deviations from the required conditions for its optimum yield. These responses can either be positive or negative [7]; [8]. In addition, lack of nutrients can cause stunted growth, leave coloration and low yield output. Therefore, the crops' ability to respond positively to these changes is termed adaptability [9]. Globally, over 50% of wheat crop diseases are caused as a result of drought condition and is considered as a serious threat to the plant development and yield [10]; [11].

Mostly, over 90% of wheat is cultivated on irrigated areas in whole country [12]. Wheat could be grown on a variety of soils such as well-drained loam, sandy loam, clay loams as well as black soils with neutral pH, however, climatic condition with respect to temperature and rainfall are found to be crucial to its proper growth and development. The average annual temperature and rainfall of Panjgur being a desert area, are 24.3^{o}C and 111mm, respectively. The temperature and rainfall requirement at minimum and maximum level for wheat seed germination ranges from 3.5^{o}C-5.5^{o}C and 35^{o}C and a range of 30-100cm, respectively. Wheat seed germination decreases slowly when temperature is above or below wheat's optimum temperature of 20^{o}C-25^{o}C thus leading to forced maturity as well as yield loss when the temperature is over 30^{o}C [13]. Seed rate and

its germination percentage are the two main factors for wheat crop yielding measurements [14]; [15].

The above reviews provide the background knowledge about climatic variations for wheat cultivation that could help farmers effectively. However, there is no research conducted before on possible increasing concern among farmers over which type of wheat varieties could be best adapted for cultivation with respect to climatic condition in Panjgur. Therefore, the aim of this research was to investigate different characteristics of Local, Koto, Zardana, and Umaid wheat varieties for an adaptability test to select among the best yielding crop in agro-climacteric condition of Panjgur District, Pakistan.

2 Materials and Methods

Local, Koto, Zardana, and Umaid wheat cultivars were used in this research study in the year 2017-2018. The selected four wheat cultivars were sown on 21st November, 2017 in agriculture research sub-station farm Tasp in Panjgur district, Balochistan (28.4907º N, 65.0958º E) the Southwestern Province of Pakistan. The seeds of three cultivars except Local were provided by Directorate of Cereal Crops Headquarter, Director General of Agriculture Research Institute (ARI) Sariab, Quetta, Balochistan. The crops were harvested on 28th April, 2018 and whole data were collected on field for each parameter at the same time of all cultivars.

2.1 Bed Preparation

In this study, bed was ploughed, stones were taken out, kept open for two weeks and sixteen plots size (12ft x 16ft) were prepared by mixing uniform quantity (100kg) of farm yard manure in each plot. Four plots were selected for each cultivar different characteristics study. The seeds were sown by using lining technique (driveller) with (15cm) seed to seed distance by providing equal irrigation until harvested. Different wheat characteristics were observed and recorded from seed germination to harvesting.

2.2 Characteristics Determination

The characteristics recorded in this study were seed germination percentage (%), number of grains per spike, plant height, spike length and crop yield per plot. The seed germination percentage (%) and number of grain per spike characteristics were recorded by traditional counting methods. Sixty plant replications per treatment have been selected for plant height, spike length, and number of grain per spike determination. Whereas, sixteen plant replications per treatment were used for seed germination percentage. However, further seed germination percentage in each plot was calculated by using the formula provided below;

$$\text{Seed Germination } \% = \frac{\text{Total Number of Seed Sown}}{\text{Total Number of Seed Germinated}} \times 100$$

Whereas, plant height and spike length were determined before harvesting on field in a same day for all four cultivars by using Inches tape (Model, 2013) in centimeters (cm).

2.3 Crops yield Determination

In this study, four plots were selected for each cultivar crop yield determination and each plot was considered as a replication. wheat crop yield was determined after harvesting and cleaning in kilograms per plot (kg/plot) separately in the same day for all four cultivars by using digital weight balance (Model, 2013).

2.4 Statistical Analysis

The data was analyzed by applying randomized complete block design (RCBD) with four treatments and different number of replication. Sixty (60) replications of each treatment were analyzed for plant height, spike length, and number of grain per spike. While, sixteen (16) data replications were used for seed germination percentage. Whereas, four (4) replication of wheat crops yield were analyzed. Means of all treatment were compared at test significant level of ($p < 0.01$) by using SPSS (version 20.00; IBM Ltd; Armonk, New York, USA).

3. Results and Discussion

3.1 Different Characteristics of Wheat Crops

In this study, different crop characteristics were observed in Local, Koto, Zardana, and Umaid wheat cultivars. Figure 1 shows the results of seed germination percentage, plant height, spike length, and number of grain per spike characteristics. With respect to seed germination percentage, Zardana cultivar was found to be significantly higher as compared to other cultivars ($P<0.01$) (Figure 1 A). Highest seed germination percentage was recorded in Zardana with 85.94% while Koto and Umaid as well as Local recorded 80.00% and 65.00 % in each case respectively (Figure 1 A). Although, seed germination percentage appeared to be highest in Zardana cultivar with 85.94%, however, other cultivars germination percentage such as Koto and Umaid were observed to be around 80% which thus seemed to be good and hence could be attributed to the early seed sowing factor (Figure 1 A) [16]. Different physical and chemical factors such as drought, water deficit, plant height and weather conditions may be involved in response to crop growth and yielding. Seed germination is the initial and more sensitive stage in wheat crops successive development that can be influenced by extreme conditions [2]. Drilling wheat sown method has been observed as another factor in term of increasing seed germination percentage [5]. As regard the plant height characteristics, Koto was found to be significantly higher with an average of 78.38cm as compared to other cultivars Zardana, Umaid and Local (69.63cm, 67.88cm and65.88cm) respectively ($P<0.01$) (Figure 1B). An increased plant height can be the cause of plant competition

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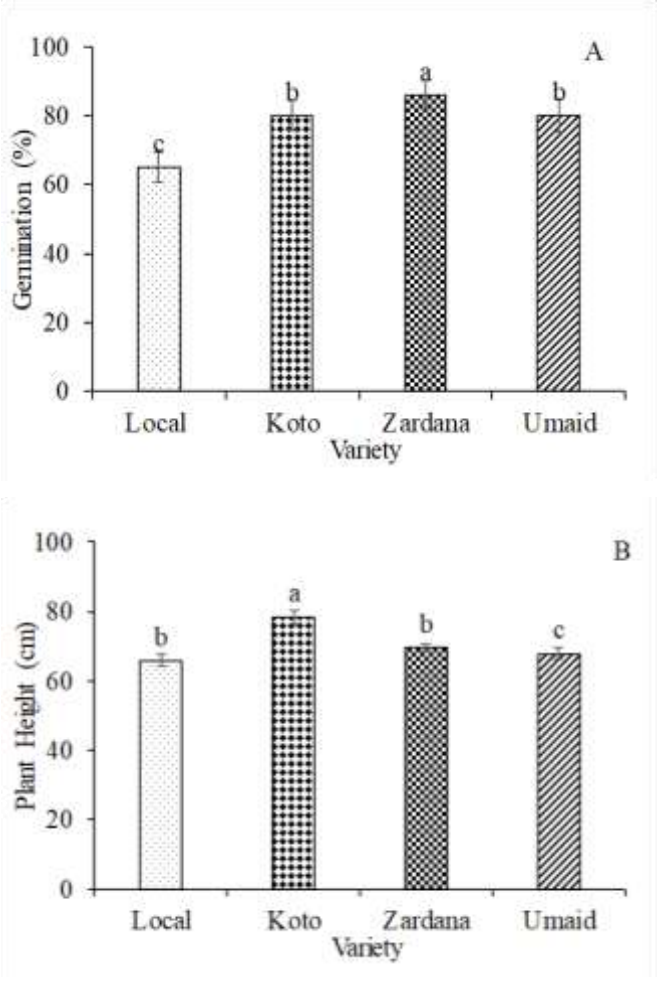
provided uniform spacing in drilling method as compared to broadcasting uneven spaces [5].

In terms of spike length characteristics, Koto cultivar was found to be significantly different among all the treatments (P<0.01) (Figure 1 C). It was further observed that Local treatment recorded the lowest value (6.50cm) among all the treatments with value (9.38cm, 8.88cm and 7.75cm) for Koto, Zardana and Umaid respectively (Figure 1C). Turning to the number of grain per spike counted, Zardana was observed to be significantly different as compared to other treatments (Koto, Umaid and Local) (P<0.01) (Figure 1 D). The results indicated that the highest number of grain was found in Zardana followed by Umaid, Koto, and then Local with average number of grain 31.50kg, 29.25kg, 28.50kg, and 18.50kg, respectively (Figure 1 D). From the results, the characteristics observed were not related to wheat crop yield except number of grain per spike and there was no negative influence of all above discussed characteristics on crop yield. Number of grains per spike and its length depends on correct seed placement [5]. The overall performance of Zardana cultivar can be concluded as the best suited climacteric wheat cultivar to be grown in district Panjgur.



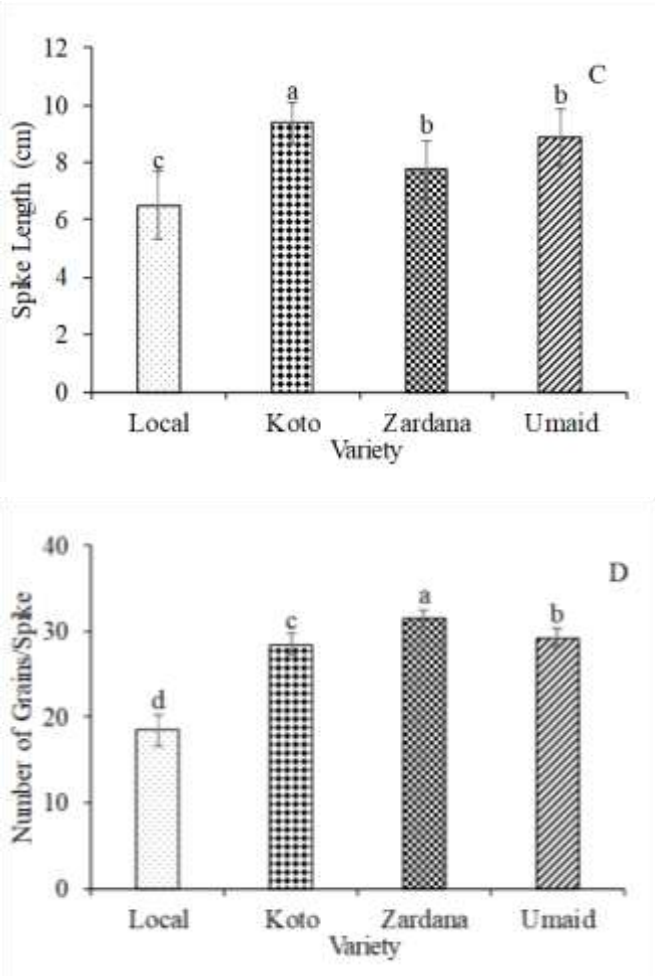


Fig. 1. *Seed germination percentage (A), plant height (B) spike length (C) and number of grains/spike (D). Vertical bars represent S.E. from different number of replicates for each parameter.*

3.2 **Wheat Crop Yield**

Figure 2 shows different wheat crop cultivars yield result conducted for adaptability test in this study by using drilling sown method. The results showed that Zardana was found to be significantly different as compared to other treatments (Koto, Umaid and Local) (P<0.01) (Figure 2). However, the average yield in Local was observed to be lowest (1.9kg) as compared to other treatments (Zardana, Koto and Umaid) (3.5kg, 2.4kg and 2.1) respectively (Figure 2). Therefore, Zardana variety could be said to be best adaptable cultivar among treatments while the Local as least adaptable. From the result, it can be concluded that Zardana wheat cultivar should be promoted in the region as the highest yielding crop cultivar. An increased wheat crop yield was achieved by using drilling sown method as compared to other conventional techniques [5]. From the overall result, Zardana wheat cultivar physical performance was observed as more efficient cultivar to be selected to grow in district Panjgur. Physically, high seed germination percentage,

normal height and highest number of grains per spike were founded to be the most effective crop yielding factors among wheat cultivars.

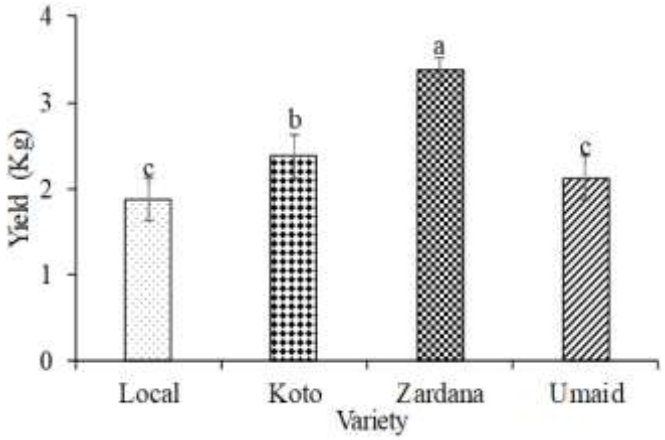


Fig. 2. *Crops yield of four different wheat cultivars. Vertical bars represent S.E. from different number of replicates for each parameter.*

4 Conclusion

An adaptability test on agro-climacteric condition of district Panjgur for wheat crop characteristics has been studied. The overall wheat crop characteristics of Zardana cultivar was found to be significantly higher when compared with other treatments. Drill wheat sowing method was concerned as one of the factor for increased yielding, with uniformly provided spaces for penetration of sun light and proper photosynthesis. The agro-climacteric conditions of district Panjgur, Balochistan Province were well suited and Zardana cultivar would be suggested as the best yielding crop to be grown during rabbi season in Pakistan.

5 Acknowledgment

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