Kurdish Studies
January 2024
Volume: 12, No: 1, pp 5255-5260
ISSN: 2051-4883 (Print) | ISSN 2051-4891 (Online)
www.KurdishStudies.net

DOI: 10.53555/ks.v12i1.3659

The Genetic Variation of Wheat at the Different sites of DG Khan

Muhammad Azmat[1]*, M. Yasin Ashraf[2], Andleeb Shahzadi[3], Tanzeela Kanwal[1], Hafiza Sehrish Saleem[1]., Areesha Nadeem[1]., Aiman Nawaz[1] and Nabila Bibi[1]

[1]Institute of Molecular Biology and Biotechnology (IMMB), the University of Lahore, Lahore, Pakistan.
[2]Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad Pakistan
[3]Department of Medical Pharmacology, Cerrahpasa Medical Faculty, Istanbul University-Cerrahpasa, Istanbul, Turkey

***Corresponding Author:** Muhammad Azmat
*Email: muhammadazmat557@gmail.com

Abstract
Genetically modified crops are making a significant improvement to agriculture regarding crop quality and quantity under rapidly shifting environmental conditions, helping to meet the societal demands of foods. Genetically modified crops are employed to determine their suitability in different localities of the country to increase crop yield. This study aimed to evaluate three genetically modified wheat varieties: Faisalabad-2008, Punjab-2011, and Shafaq-2003 in the local environment of Dera Ghazi Khan, Punjab Pakistan. Each modified variety of wheat was planted in four (04) rows/plot. The plot was 6×23 m with 25 cm row spacing. Yield parameters including no. of tillers, germination count^{-2}, plant-height, no. of spikelets/spike, no. of grains per spike, spike length, 1000-grains weight, and production of grains were determined after the application of fertilizers. Nitrogen (N), potassium (K), and phosphorus (P) sources were usedas fertilizers i.e. urea for N, triple super phosphate for P, and potash sulphate and K. Statistical analysis was performed to evaluate the significant difference in crop phenological parameters including no. of tillers, germination count^{-2}, plant-height, number of spikelets/spike, no. of grains/spike, spike length, 1000-grains weight, and grains production. Faisalabad-2008 showed significantly highest production due to higher yield parameters followed by Punjab-2011 and Shafaq-2003.

Keywords: Wheat, Genetically modified crop, DG khan, Faisalabad-2008, Punjab-2011, Fertilization

Introduction

Wheat is the cereal crop of the genus *Triticum* (family *Poaceae*) and a staple food worldwide (Russell *et al*., 2011). Wheat is a central nutrition crop worldwide, provides food sources for almost 36% of the population all around the world, and contributes around 20% of the entire diet calories (Singh and Chaudhary, 2006). For humans, wheat is the main source of sugars while, its straw is used livestock feedstuff. Wheat grain comprises of 60-80% saccharides, 1.5-2.0% dietary fats, inorganic ions and a chief source of vitamins especially B complex and vitamin E (Schellenberger, 1996). Wheat grows in a temperate environment; it does not require high water content to grow throughout the season. Moreover, total time interval for the complete plant growth is 5 to 6 months (Mfarrej *et al*., 2022). About 80% of the farmers (more than a million) grow wheat, around 40% of the total cultivated region, and 65% of the foodstuff crops region in the country (Khan *et al*., 2022). Wheat is grown on 22 million acres which accounts for 7.8% of agricultural value added and 1.8% of GDP of Pakistan (Pakistan Economic Survey, 2021-2022).

Government have been working hard to achieve self-sufficiency in the production of wheat because a shortage in wheat production could lead to unpleasant situations, political turmoil, a huge reduction of foreign reserves, an increase in the cost of wheat flour, and financial hardships in susceptible areas of the country. (Pakistan Economic Survey, 2021-2022). The wheat crop of Pakistan faces the double risk of biotic and biotic stress which results in lower yield (Khan *et al*., 2012). It has been recommended that data about germplasm variety and genetic similarity between selected breeding materials is a vital component in plant breeding (Babar *et al*., 2020). Genetic variability determines the future breeding program to gain higher productivity; as a result, the goal is to attain a level of independence and sustainability. In that perspective, there is the requirement to grow cultivars with various genetic makeups (Shahid Mukhtar *et al*., 2002). Multiple factors are involved for a stumpy yield of wheat in Pakistan like genetic varieties (Faheem *et al*., 2019), weeds (Memon *et al*., 2013), time of sowing (Aheer *et al*., 2008), inappropriate water and fertilizers inputs (Kibe *et al*., 2006), average rainfall in the area and impact of insects and pests on crops. Among insects and pests, aphids are progressively damage the yield and a dominant group among the regular pests in Pakistan (Aheer *et al*., 2008). All of these agronomic dynamics are significantly prejudiced by humidity, temperature, and rainfall. The vibrant influence for the apposite reaping environment of grain yield is the genetics of the wheat crop (Maqsood *et al*., 2014).

Despite high production potential, the average production of various varieties of Pakistan is far fewer than the other countries (Bhutta *et al*., 2019). To meet the food requirements for increasing population of Pakistan, have maximum production/unit area is needed. Number of elements, covering preparation of land, sowing time, preparation of seed bed, use of multiple and effective fertilizers, management of weeds, and a prior schedule for irrigation are liable for the drastic differences in the quality and quantity of wheat crop. Nevertheless, all parameters are of agronomic importance and largely

affected by humidity, temperature, and rainfall of a particular area. The dynamic element for harvesting situations for grain production is the genetic perspective of the crop (Nadeem, 2001). In this scenario, the use of new genetically modified varieties having the ability of higher production of wheat and high pest or drought resistance are an important factors accountable for enhanced crop production (Zeb *et al*., 2006). Different varieties have diverse crop yield potential and respond contrarily in diverse environmental conditions.

The goal to develop new varieties of crops having desirable characteristics and yield is the only method to overcome the issues of less production and poor quality of the crops. In the case of wheat, accessible genetic variability is available for various yields and their related problems (Bhutta *et al*., 2019). Each genetically modified variety with specific genotypic ability to sustain its performance in a diverse environmental conditionsis the foremost need. Few reports are available on the performance of genetically modified varieties of wheat at DG Khan and evaluation of Faislabad-2008(VI), Punjab-2011(V2), and Shafaq-2003 (V3) are not performed in the said environment. Keeping in view the gap we design research to study the effectiveness and yield parameters of genetically variant wheat species in the environment of DG Khan.

Materials and Methods

Preparation of land for Wheat sowing

The presented research was carried out at Agriculture Adaptive Research Farm, DG Khan, Pakistan (Latitude 31.046639 and Longitude 71.687113). The seedbed was prepared by tilling soil up-to a depth of 6 inches and then seeds were sowed.

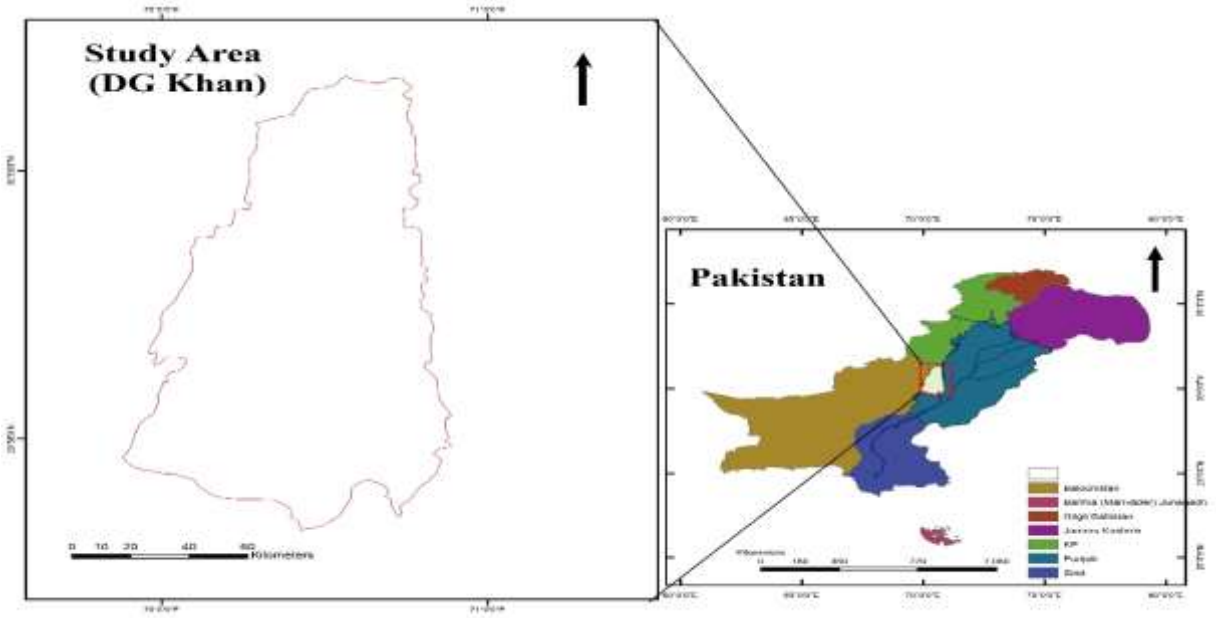

Figure 1. Map showing the study area

Wheat varieties, Sowing and Fertilization

Field trials were conducted in a randomized whole-block design. Samples of soil were analyzed for different biochemical parameters. Each of the tested varieties was planted in four rows per plot. The plot was of the size of (6×23 m) with 25 cm row spacing. Nitrogen (N), potassium (K), and phosphorus (P) were usedas fertilizers in the form of urea for N, potash sulphate, K and triple super phosphate for P, respectively. In this study, three wheat varieties, Faislabad-2008 (VI), Punjab-2011(V2), and Shafaq-2003 (V3) were sown. The seeds were taken from a local agriculture shop at DG Khan Punjab, Pakistan. Fertilizer with nitrogen source was administered in 3 parts; 1/3rd of nitrogen, potassium, and phosphorus was used at time of preparation of soil and mixed by plowing. The other 1/3rd was used at 1st irrigation following 1/3rd at the 3rd time of irrigation. The source of irrigation was tube well water. During the growing season of the crop, standard agricultural practices were adopted for better results.

Yield Parameters

The crop was harvested and sun-dried. The sun-dried crop was threshed and grain yield was noted. The crop germination count (m^{-2}) was noted just before the time of harvesting by calculating no. of germinated plants (m^{-2}), number of productive tillers (m^{-2}), number of spikelets/spike, 1000 grains weight (g), and grains yield (kg ha^{-1}) by random selection of 15 spikes on experimental site. Average data was calculated for all of the counted parameters. 1000 grains were gathered from freshly threshed grains and weighed using sensitive electronic balance. All of the generated data was analyzed by statistical methods using different variance techniques to obtain significant differences. The analysis report was calculated by using different methods of soil treatment from the water testing laboratory DG Khan, Punjab Pakistan by providing soil samples. Each yield parameter was determined according to the method of Bhutta *et al.* (2019).

Physio-chemical characteristics of Soil

The physio-chemical characteristics, (Electrical conductivity of the soil, pH of the soil, organic matter in the soil, availability of potassium (K), and phosphorus (P) saturation, and loam texture) of experimental field soil were calculated and analyzed (**Table** 1). Meteorological data including temperature, humidity, and precipitation of DG Khan Region was also recorded during crop season 2019-2020 listed in the **Table** 2.

Table 1. Physio-chemical characteristics of soil

Characterization	Value
Electric conductivity	3012 m cm^{-1}
pH of Soil	8.1
organic matter	0.34%
Availability of Phosphorus	5 ppm
Availability of Potassium	152 ppm
Saturation	58%
Texture loam	1

Table 2. Meteorological data recorded during crop season 2019-2020

Months	Temperature (°C)		Relative Humidity (%)	Precipitation (mm)
	Maximum	Minimum		
November-2019	25	14	89	12
December-2019	19	8	76	6.8
January-2020	17	6	88	6
February-2020	23	7	77	2.3
March-2020	27	17	85	21.5
April-2020	32	23	75	0.9
May-2020	40	27	66	0

Statistical Analysis

Significance of the data was determined using two-way ANOVA among different varieties by using the software GraphPad Prism version (6.0).

Results and Discussion

Germination count

Wheat variety Faisalabad-2008 exhibited maximum germination count (193 m^{-2}) followed by Punjab-2011 (190.7 m^{-2}) and Shafaq-2003 (187.5 m^{-2}). However, no significant difference was observed (**Figure 2a**). Variance in germination count m^{-2} among different wheat varieties (Faisalabad-2008, Punjab-2011, and Shafaq-2003) showed that each variety has its seed reserves which perform accordingly in different soil conditions, and the suitability of their genetic makeup under each climate. The previous findings (Mushtaq *et al*., 2011; Nadeem, 2001) are similar to our study. They observed that different wheat varieties showed different germination counts under different soil and climatic conditions. Correspondingly, a significant difference was reported in germination count m^{-2} by Nadeem (2001) among different wheat varieties under variant climate conditions.

Productivity tillers

The maximum productivity tillers were found in the variety Faisalabad-2008 (278) followed by Punjab-2011 (273.15) and Shafaq-2003 (268.67). Productivity tillers showed significance ($P<0.0155$) between Faisalabad-2008 and Shafaq-2003 (**Figure 2b**). Crop yield is defined as the function of spikes having productivity tiller per unit area. Among all genotypes, statistical significance was observed which conformity with the results of Mushtaq *et al.* (2011) and Naveed *et al.* (2014). They observed that different wheat varieties showed different productivity tillers under divers environments. Irfan *et al.* (2005) also reported the same finding which they thought was due to different genetic makeup and their response at different agronomical locations.

Plant height

Plant height among Faisalabad-2008 and Shafaq-2003 showed a significant difference ($P \leq 0.0083$) among different genotypes (**Figure 2c**). The relative mean study exhibited that maximum plant height (96.8cm) was recorded for the variety Faisalabad-2008 as compared to Shafaq-2003 which exhibit (86.49cm). The height of a mature plant is the result of the expression of all the genetic makeup of the plant. Similar outcomes were presented by Musaddique *et al.* (2000) and Bhutta *et al.* (2019) in their research. They observed that every genetic variety has its growth properties and variation in plant height was recorded among other genetic and phenotypic characteristics. Our findings endorsed the results of Kaleem *et al.* (2010) evident that height of a plant is greatly influenced by different environmental conditions in which they grow. Environmental temperature and radiation can influence plant growth, but it is concluded that although plant height is a genetic factor but it can largely influenced by environmental factors.

Spike length and spikelets/spike

The data about spike length (cm) by various genotypic varieties showed no significant difference. Faisalabad-2008 showed an increase in spike length (11.85cm) as compared to Punjab-2011 (10.81cm) and Shafaq-2003 (10.16cm) shown in (**Figure 2d**). Faisalabad-2008 showed an increased no. of spikelets/spike (15.89) followed by Punjab-2011 (15.81) and Shafaq-2003 (13.83) presented in (**Figure 2e**). The spikelets/spike statistically showed no significant difference among different genetic variants. Spike length variation is a result of variability among different genetic variants (Naveed *et al.* 2014). Mushtaq *et al.* (2011), produced the same results regarding this trait. They also observed variations in plant spike length and other relative parameters of wheat crops. It is concluded that variation in spike length is because of fluctuation in nutrients in different soils and also other environmental factors combined with the genetic properties of the crop (Mushtaq *et al.*, 2011). Thus, favorable conditions and availability of nutrients could result in increased spike length. The findings of (Bhutta *et al.*, 2019) support our results of spikelets/spike.

Grain/spikes

No. of grain spikes showed no significance among different wheat varieties (**Figure 2f**). In the case of Faisalabad-2008 higher no. of grain per spike (38.65) were recorded in comparison with Punjab-2011 (38.41) and Shafaq-2003 (37.73). Multiple factors are involved in to effect no. of grain spikes such as conventional practices like seeding rates, planting dates and fertility of the soil, genetic varieties, growth condition, temperature, groundwater level, nutritional standing, and weather change (Kiliccedil, 2010). Our findings are similar to the results Bhutta *et al.* (2019). Correspondingly, Imran *et al.* (2015) believe that no. of grains/spike are strongly correlated with the leaf area and biomass among different cultivars.

1000 grains weight

The 1000 grains weight (g) was found non-significantly different among different wheat varieties showed in (**Figure 2g**). The weight of the 1000-grains was almost similar in the case of Faisalabad-2008 (37.6 g) and Punjab-2011 (37.66 g) but lowers in the case of Shafaq-2003 (35.75 g). Arif et al. (2006) and Kiliccedil (2010) also reported similar findings. They stated that different varieties have different weight of 1000 grains. Our results are also linked with Nadeem (2001) and Bhutta *et al.* (2019) who reported the same findings in the case of 1000 grains weight of different genetic varieties. Irfan *et al.* (2005) stated that significant difference occurred among different varieties of wheat with respect to locations is because of the differences in grain tillers and spikes which could be due to different climatic conditions and soil samples.

Grain yields

In the current study, no significant relation between grain yields (kg ha^{-1}) among different wheat varieties was found. Faisalabad-2008 showed maximum yield production (4060.5 kg ha^{-1}) while Punjab-2011 (3905.7 kg ha^{-1}) and Shafaq-2003 (3822.5 kg ha^{-1}) showed less production comparatively (**Figure 2h**). The change in production was due to the genetics of the wheat under given climate conditions. Our results are validation of the results of Bilalis *et al.* (2011) and Bazzaz (2015). Grain yield potential is the function of its genetic components individually and in combination with environmental factors. The increase in soil nutrients allows the plant to uptake more increasing the seed no, no. of tillers, 1000 grain weight, and ultimately yield of grain. A similar study, proposed by Ali (2014), and Malik *et al.* (2009) evident that an increase in no. of tillers, spikelets/spike, and grains/spike are the cause of an increase in the grain yield in promising environmental and soil conditions. The yield difference in different locations is due to changes in soil type and climate conditions.

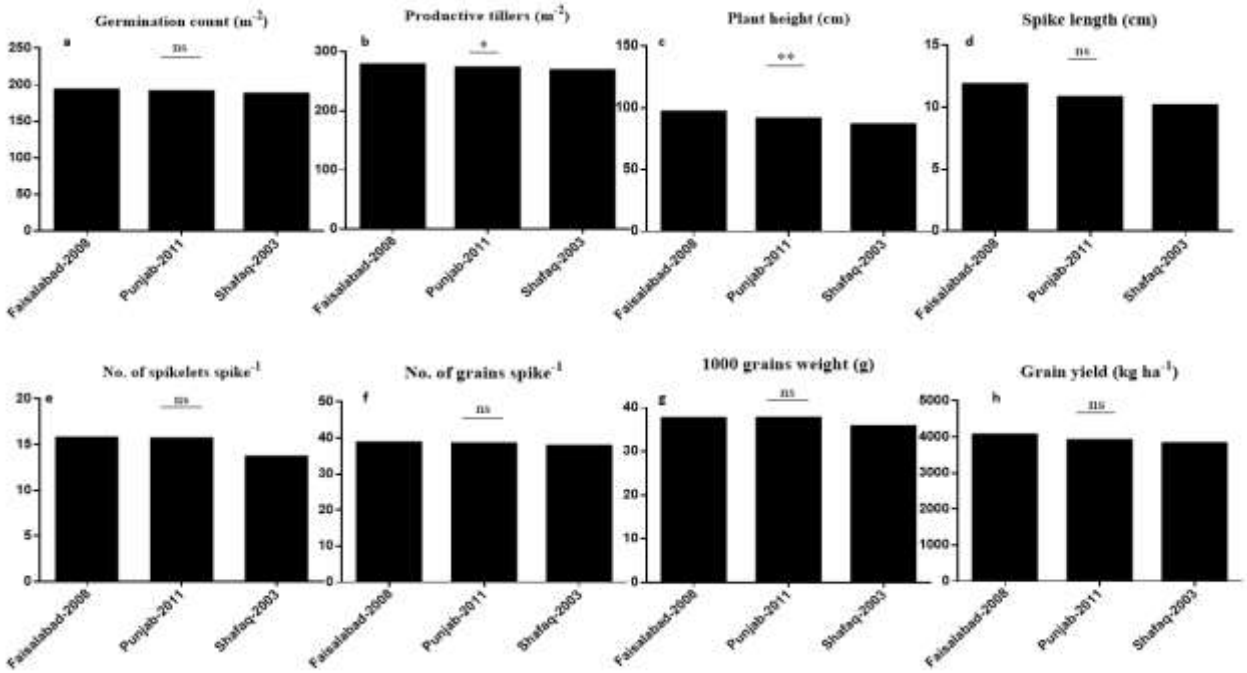

Figure 2. Yield traits of genetically modified varieties Faisalabad-2008, Unjab-2011 and Shafaq-2003.

The statistical analysis of all parameters was analyzed and no significant difference was observed among wheat varieties. On the other hand, productive tillers and plant height in the case of Faisalabad-2008 and Shafaq-2003 were significantly different as shown in (**Table 3**). Table 3 shows a detailed comparison of all the yield parameters.

Table 3. Evaluation of various varieties of wheat and their performance in relation to the environment in DG Khan

Tukey's multiple comparisons test	Mean Diff.	95% CI of diff.	Significant?	Summary	Adjusted P Value
Germination count (m^{-2})					
Faisalabad - 2008 vs. Punjab - 2011	2.245	-5.241 to 9.731	No	ns	0.7101
Faisalabad - 2008 vs. Shafaq - 2003	5.500	-1.986 to 12.99	No	ns	0.1647
Punjab - 2011 vs. Shafaq - 2003	3.255	-4.231 to 10.74	No	ns	0.4978
Productive Tillers (m^{-2})					
Faisalabad - 2008 vs. Punjab - 2011	4.850	-2.636 to 12.34	No	ns	0.2350
Faisalabad - 2008 vs. Shafaq - 2003	9.330	1.844 to 16.82	Yes	*	0.0155
Punjab - 2011 vs. Shafaq - 2003	4.480	-3.006 to 11.97	No	ns	0.2845
Plant Height (cm)					
Faisalabad - 2008 vs. Punjab - 2011	5.650	-1.836 to 13.14	No	ns	0.1513
Faisalabad - 2008 vs. Shafaq - 2003	10.31	2.824 to 17.80	Yes	**	0.0083
Punjab - 2011 vs. Shafaq - 2003	4.660	-2.826 to 12.15	No	ns	0.2595
Spike Length (cm)					
Faisalabad - 2008 vs. Punjab - 2011	1.040	-6.446 to 8.526	No	ns	0.9275
Faisalabad - 2008 vs. Shafaq - 2003	1.690	-5.796 to 9.176	No	ns	0.8216
Punjab - 2011 vs. Shafaq - 2003	0.6500	-6.836 to 8.136	No	ns	0.9709
No. of Spikelets $spike^{-1}$					
Faisalabad - 2008 vs. Punjab - 2011	0.08000	-7.406 to 7.566	No	ns	0.9996
Faisalabad - 2008 vs. Shafaq - 2003	2.060	-5.426 to 9.546	No	ns	0.7485
Punjab - 2011 vs. Shafaq - 2003	1.980	-5.506 to 9.466	No	ns	0.7648
No. of grains $spike^{-1}$					
Faisalabad - 2008 vs. Punjab - 2011	0.2400	-7.246 to 7.726	No	ns	0.9960
Faisalabad - 2008 vs. Shafaq - 2003	0.9200	-6.566 to 8.406	No	ns	0.9427
Punjab - 2011 vs. Shafaq - 2003	0.6800	-6.806 to 8.166	No	ns	0.9682
1000 grains weight (g)					
Faisalabad - 2008 vs. Punjab - 2011	-0.06000	-7.546 to 7.426	No	ns	0.9997
Faisalabad - 2008 vs. Shafaq - 2003	1.850	-5.636 to 9.336	No	ns	0.7908
Punjab - 2011 vs. Shafaq - 2003	1.910	-5.576 to 9.396	No	ns	0.7789

Conclusion

The yield performance of Faisalabad-2008 variety was higher than Punjab-2011 and Shafaq-2003 under local conditions of south Punjab (Dera Ghazi Khan). Although we did not find any significant relationship between different varieties. The rise in all yield parameters counting no. of tillers, germination $count^{-2}$, plant height, no. of spikelets/spike, no. of grain spike, spike length, 1000-grain weight, and grain production yield was higher in the case of Faisalabad-2008. The main factors responsible for this behavior of Faisalabad-2008 were the genetic makeup of this variety and its performance under these favorable local conditions of DG Khan Region. Thus it is suggested that the sowing of Faisalabad-2008 could result in a maximum yield production under the local conditions of DG Khan. The cultivation of Faisalabad should be promoted among local farmers of DG Khan to get maximum production under the climatic conditions of DG Khan. Additionally, more investigation is needed to investigate genetic suitability along with the adaptability of new genetic varieties to get a better qualitative and quantitative performance of wheat varieties. This would ultimately increase the economic conditions of poor formers in DG Khan Region.

References

1. Aheer, G., Ali, A., and Ahmad, M. (2008). Abiotic factors effect on population fluctuation of alate aphids in wheat. *Journal of Agricultural Research (Pakistan)*.
2. Ali, I. N. (2014). Assessment of various humic acid and sulfur levels for higher yields in wheat (Triticum aestivum L.). *Sarhad journal of agriculture*, *30*(1).
3. Arif, M., Khan, M., Akbar, H., and Ali, S. (2006). Prospects of wheat as a dual purpose crop and its impact on weeds. *Pak. J. Weed Sci. Res*, *12*(1-2): 13-17.

4. Babar, U., Nawaz, M. A., Arshad, U., Azhar, M. T., Atif, R. M., Golokhvast, K. S., Tsatsakis, A. M., Shcerbakova, K., Chung, G., and Rana, I. A. (2020). Transgenic crops for the agricultural improvement in Pakistan: a perspective of environmental stresses and the current status of genetically modified crops. *GM crops & food*, *11*(1): 1-29.
5. Bazzaz, M. M. (2015). Canopy temperature and yield based selection of wheat genotypes for water deficit environment. *Open Access Library Journal*, *2*(10): 1.
6. Bhutta, S. K., Bhutta, K. N., Aslam, M. N., Nasir, I. R., and Ali, M. A. (2019). Evaluation of Growth and Yield Attributes of Some Wheat Varieties under Local Conditions of Southern Punjab, Pakistan. *Journal of Plant Breeding and Genetics*, *7*(1): 19-25.
7. Bilalis, D., Karkanis, A., Patsiali, S., Agriogianni, M., Konstantas, A., and Triantafyllidis, V. (2011). Performance of wheat varieties (Triticum aestivum L.) under conservation tillage practices in organic agriculture. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*, *39*(2): 28-33.
8. Faheem, M., Saeed, S., Sajjad, A., Wang, S., and Ali, A. (2019). Spatio-temporal variations in wheat aphid populations and their natural enemies in four agro-ecological zones of Pakistan. *PloS one*, *14*(9): e0222635.
9. GOP. (2022). Economic Survey of Pakistan 2021-2022. *Economic Advisor's Wing. Ministry of Finance, Government of Pakistan, Islamabad*.
10. Imran, A., Ayaz, M., and Noureen, K. (2015). Weather & Wheat Crop Development in Central Punjab (Faisalabad)(2014–2015). *National Agromet Centre Pakistan Meteorological Department, Islamabad*.
11. Irfan, M., Muhammad, T., Amin, M., and Jabbar, A. (2005). Performance of yield and other agronomic characters of four wheat (Triticum aestivum L.) genotypes under natural heat stress. *Int. J. Bot*, *1*(2): 124-127.
12. Kaleem, S., Razzaq, A., Manaf, A., and Saleem, A. (2010). Growth rhythms in sunflower (Helianthus annuus L.) in response to environmental disparity. *African Journal of Biotechnology*, *9*(15): 2242-2251.
13. Khan, A. M., Khan, A. A., Afzal, M., and Iqbal, M. S. (2012). Wheat crop yield losses caused by the aphids infestation. *J Biofertil Biopestici*, *3*(4): 2-7.
14. Khan, M. A., Adnan, M., Basir, A., Fahad, S., Hafeez, A., Saleem, M., Ahmad, M., Gul, F., Durrishahwar, F., and Subhan, F. (2022). Impact of tillage and potassium levels and sources on growth, yield and yield attributes of wheat. *Pak. J. Bot*, *55*(1).
15. Kibe, A., Singh, S., and Kalra, N. (2006). Water–nitrogen relationships for wheat growth and productivity in late sown conditions. *Agricultural Water Management*, *84*(3): 221-228.
16. Kiliccedil, H. (2010). Effect of seeding rate on yield and yield components of durum wheat cultivars in cotton-wheat cropping system. *Scientific Research and Essays*, *5*(15): 2078-2084.
17. Malik, A., Haji, M., Bukhsh, A., Hussain, I., Athar, M., and Ali, M. (2009). Comparative performance of some new wheat cultivars in agro-ecological zone of Dera Ghazi Khan. *The Journal of Animal & Plant Sciences*, *19*(2): 78-81.
18. Maqsood, M., Shehzad, M. A., Ramzan, Y., and Sattar, A. (2014). Effect of nitrogen nutrition on growth, yield and radiation use efficiency of different wheat (Triticum aestivum L.) cultivars. *Pakistan Journal of Agricultural Sciences*, *51*(2).
19. Memon, R. A., Bhatti, G. R., Khalid, S., Mallah, A., and Ahmed, S. (2013). Illustrated weed flora of wheat crop of Khairpur District, Sindh. *Pak. J. Bot*, *45*(1): 39-47.
20. Mfarrej, M., Wang, X., Hamzah Saleem, M., Hussain, I., Rasheed, R., Arslan Ashraf, M., Iqbal, M., Sohaib Chattha, M., and Nasser Alyemeni, M. (2022). Hydrogen sulphide and nitric oxide mitigate the negative impacts of waterlogging stress on wheat (Triticum aestivum L.). *Plant Biology*, *24*(4): 670-683.
21. Musaddique, M., Hussain, A., Wajid, S., and Ahmad, A. (2000). Growth, yield and components of yield of different genotypes of wheat. *Int. J. Agri. Biol*, *2*(3): 242-244.
22. Mushtaq, T., Hussain, S., Bukhsh, M., Iqbal, J., and Khaliq, T. (2011). Evaluation of two wheat genotypes Performance of under drought conditions at different growth stages. *Crop &Environment*, *2*(2): 301-314.
23. Nadeem, M. (2001). Growth, radiation use efficiency and yield of some new wheat cultivars under variable nitrogen rates. *University of agriculture Faisalabad*.
24. Naveed, K., Khan, M. A., Baloch, M. S., Ali, K., Nadim, M. A., Khan, E. A., SHAH, S., and Arif, M. (2014). Effect of different seeding rates on yield attributes of dual-purpose wheat. *Sarhad journal of agriculture*, *30*(1).
25. Russell, W. R., Gratz, S. W., Duncan, S. H., Holtrop, G., Ince, J., Scobbie, L., Duncan, G., Johnstone, A. M., Lobley, G. E., and Wallace, R. J. (2011). High-protein, reduced-carbohydrate weight-loss diets promote metabolite profiles likely to be detrimental to colonic health. *The American journal of clinical nutrition*, *93*(5): 1062-1072.
26. Schellenberger, J. (1996). Wheat in cereal science. the Avi. *Pub. Co. West Port. Connectinet*, 1-38.
27. Shahid Mukhtar, M., Rahmanw, M.-u., and Zafar, Y. (2002). Assessment of genetic diversity among wheat (Triticum aestivum L.) cultivars from a range of localities across Pakistan using random amplified polymorphic DNA (RAPD) analysis. *Euphytica*, *128*: 417-425.
28. Singh, G., and Chaudhary, H. (2006). Selection parameters and yield enhancement of wheat (Triticum aestivum L.) under different moisture stress conditions. *Asian Journal of Plant Sciences*.
29. Zeb, A., Zahir, A., Ahmad, T., and Abdumanon, A. (2006). Physiochemical characteristics of wheat varieties growing in the same and different ecological regions of Pakistan. *Pak. J. Biol. Sci*, *9*(9): 1823-1828.