Pure Appl. Biol.,14(2):259-265,June, 2025
http://dx.doi.org/10.19045/bspab.2025.140024

Research Article

Evaluation of yield potential and agronomic traits of new wheat varieties under agro- ecological conditions of Bannu Division (Khyber Pakhtunkhwa)

Abdul Quddoos[1*], Khalid Mahmood[1], Muhammad Farooq[1], Muhammad Ali[1], Alamgir Khan[2] and Noman Khan[2]

1. Agricultural Research Station Serai Naurang (Bannu) Khyber Pakhtunkhwa Pakistan.
2. Shaheed Benazir Bhutto University, Sheringal, Upper Dir Khyber Pakhtunkhwa Pakistan

**Corresponding author's email: abashaheed47@gmail.com*

Citation

Abdul Quddoos, Khalid Mahmood, Muhammad Farooq, Muhammad Ali, Alamgir Khan and Noman Khan. Evaluation of yield potential and agronomic traits of new wheat varieties under agro- ecological conditions of Bannu Division (Khyber Pakhtunkhwa). Pure and Applied Biology. Vol. 14, Issue 2, pp259-265.
http://dx.doi.org/10.19045/bspab.2025.140024

Received: 19/08/2024 Revised: 09/10/2024 Accepted: 13/10/2024 Online First: 22/10/2024

Abstract

The performance of a total ten new varieties of wheat was tested in two seasons, Rabi 2022-23 and 2023-24 at Agricultural Research Station Serai Naurang (Bannu). Varieties Gulzar-2019, Pirsabak-2019, Zarghoon-2021, Abaseen-2021, Pirsabak-2021, Taskeen-2022, Naurang-2023, Khyber-2023, Thanda-2023 and PS-2023 were studied during this investigation. During Rabi season 2022-23, Gulzar-2019, PS-2019, Zarghoon-2021, Abaseen-2021, PS-2021 and Naurang-2023 were tested while for 2023-24 Zarghoon-2021, Taskeen-2022, Naurang-2023, PS-2023, Khyber-2023 and Thanda-2023 were tested. Varieties Zarghoon-2021 and Naurang-2023 were checked for both seasons; therefore, the average values of these two varieties were taken for different traits. The study was focused on days to heading, days to maturity, plant height (cm), length of spike (cm), grains per spike, 1000 grain weight (gram), grain yield (kg ha^{-1}), biological yield (kg ha^{-1}) and harvest index percentage. Variety PS-2019 acquired maximum yield (7013 kg ha^{-1}) with significant 1000 grain weight (50.00 gram). Naurang-2023 also got significant 1000 grain weight (50.00 gram) and significant grains/spike (72 grains). PS-2019 took maximum days (123) to heading. Similarly, PS-2019 and PS-2021 took maximum days to maturity (170 days). The maximum height (117.00 cm) was achieved by Abaseen-2021. The lengthiest spike (13.42 cm) was noted in Thanda-2023. The highest harvest Index (38.71 %) was recorded for PS-2021. The Variety PS-2023 produced the highest (19667 kilograms/hectare) biological yield. These varieties will help to solve the food security problem, raise the living standard of the farmers' community and help wheat breeders to develop cultivars with higher yield potential and better quality in future through breeding programs

Keywords: Potential; Varieties; Wheat

Introduction

Pakistan is an agricultural based economy with majority of people adopting agriculture as a profession. Agriculture is the largest sector of the national economy and nearly 30-40 % national income is earned by it. Pakistan is facing a low agricultural productivity problem like many developing countries of the world. Pakistan is faced with the same challenges as many developing

countries of the world and this challenge is of growing more food grain while there is little chance to expand cultivated area and the yield per acre of different crops is also very low. Agriculture supplies food to the people of Pakistan. Therefore, it is very necessary to raise production of food items to meet not only food requirements of the state but also earn foreign exchange as well as self-sufficiency.

Wheat (*Triticum aestivum* L.) is a major daily bread crop for food security along with maize (*Zea mays* L.) and rice (*Oryza sativa* L.) grown in the whole world [1]. The wheat crop is also treated as a commercial crop and main source of body nutrients because it adds proteins and calories as 20% to the human diet in Pakistan [2]. It plays a vital role in providing carbohydrates, proteins, micronutrients and daily calories globally [3]. It is ranked first in acreage and production amongst all crops in Pakistan. Wheat crop occupies 70 % area of the Rabi crop and 37 % of the total area cultivated with different crops in Pakistan. Its share as a value-added product in agriculture is 13.8 % and it contributes about 3.2 % to GDP [4].

Livestock uses its grain and straw as a daily ration in Pakistan. Wheat meets about 53 % caloric needs and 59 % proteins requirements of the people [5]. Mostly wheat is grown for home consumption in Pakistan while it is also grown for commercial purposes but only on small scale. It has been observed that 16.26 % monthly expenditure of the household is spent on wheat and its flour. Pakistan consumes the highest wheat per capita per year that is 125 kg in the world. Wheat and its flour consumption per capita in Pakistan per month is 9.27 kg [6].

Government of Pakistan made endeavors to raise cropped area for wheat, total produce and produce per acre in the past. Pakistan has got great achievements and improvement in wheat yield over the last few decades by the substantial research work and unstopped endeavors of the provincial and national agricultural experts. In wheat producing countries of the world Pakistan stands on 9th rank area-wise wheat cultivation, 11th in produce and 8th vide average yield per acre. In Pakistan the average wheat yield is 2787 kg/hectare as compared to the world average of 3086 kgha^{-1}, USA 3018 kg ha^{-1}, China 4762 kg ha^{-1} and India 2801 kg ha^{-1} [7].

The yield of wheat in Indian Punjab is 4400 kgha^{-1} while we got 2667 kg/ha in our Punjab, which is considered the hub of agriculture and wheat production in Pakistan [8]. Nearly 25.50 million tons of wheat was produced during the year 2017-18. Wheat crop contributes 1.7 % GDP and 9.1 % as a value-added product in agriculture [9]. Nowadays, food security is the main objective of every government. Wheat is the main staple food crop and meets food requirements of the country to a greater extent. As wheat crop is the main staple food in Pakistan, therefore, it is cultivated on a large scale in every corner of the state. For 2020-21 Rabi cropping season 9.168 million hectares area was cultivated with wheat crop and total 27.464 tons production was got with average yield as 2974 kg ha^{-}1[10]. Similarly, for the cropping season 2021-22, 8.9768 million hectares area was cultivated with wheat crop and produced 26.208 million tones getting average yield as 2920 kg/ha while in the last cropping season 2022-23, 9.0405 million hectares area was cultivated with wheat crop by getting 28.1755 million tones grain production with average yield as 3117 kg/ha, 7.5 % increase over the previous production [11]. During 2018-19 wheat was cultivated on 0.74 million hectares area in Khyber Pakhtunkhwa getting 1.3328 million tones produce, having average yield as 1795 kg/ha [12]. Wheat is considered main contributor of food security. Although national average yield of sugar cane, maize, rice and wheat is very low than the potential yield of the mentioned crops yet it is

suggested by [13] that great potential is existed to increase productivity in all the irrigated areas of Pakistan by using new inputs and existing inputs more efficiently to utilize the genetic potential of the present cultivars. The demand of wheat in Pakistan is increasing with great speed because of high rate and increase of population growth while on the other hand wheat production is decreasing because of weed problem, late cotton harvesting, poor nutrient management and unavailability of high yielding varieties [14].

Management practices have a key role in the production of crops. Selection of suitable cultivar is one of the most important management practices that plays an important role in grain as well as biological yield [15]. Researchers say that variety is an important factor that affects not only the yield of the farmers but also policy of the government to give high priority to it and the highest priority to transfer this technology immediately. It is very encouraging matter for the breeders that new varieties are not only released with a greater speed but also extended to farmers in a much less time and it is very fruitful and beneficial that is realized by the plant breeders. Dissemination of modern varieties makes it sure that productivity will increase continually and so yield potential of new varieties will also be met. It overcomes the obstacles in the way of investment in research, being profitable and beneficial, it increases returns to the research to maintain genetic resistance to diseases and pests [16].

This study aims to test yield potential and agronomic traits of new cultivars of wheat and identify different varieties cultivated in the irrigated area of Bannu division Khyber Pakhtunkhwa. It is expected that this research will help researches, extension workers and wheat growers in the irrigated area of Khyber Pakhtunkhwa

Materials and Methods

Yield potential and performance of ten new and modern varieties of wheat, Gulzar-2019, PS-2019, Zarghoon-2021, Abaseen-2021, PS-2021, Taskeen-2022, Naurang-2023, Khyber-2023, Thanda-2023 and PS-2023 were tested for two years (Rabi season 2022-23 and 2023-24) at Agricultural Research Station Serai Naurang (Bannu). During Rabi season 2022-23 Gulzar-2019, PS-2019, Zarghoon-2021, Abaseen-2021, PS-2021 and Naurang-2023 were tested while for the Rabi season 2023-24 Zarghoon-2021, Taskeen-2022, Naurang-2023, PS-2023, Khyber - 2023 and Thanda-2023 were tested. Varieties Zarghoon-2021 and Naurang-2023 were checked for both seasons; therefore, the average values of these two varieties were taken for various parameters. Trials were conducted in randomized complete block design with three replications having a plot size of 1.2 x 5.0 m with row to row space 30 cm. Recommended doses of nitrogenous and phosphoric fertilizers 120-90 kg/ha were applied to the trials. Phosphoric fertilizers were applied at the time of seedbed preparation while nitrogenous fertilizers were applied in two to three equal doses in proper interval. Weedicides Axil and Alymax were applied in the months of December and January to control weeds. Necessary observations, inspection and monitoring were regularly performed on major traits. Data was collected for the traits such as days to 50 % heading, plant height (cm), days to maturity, grains per spike, , length of spike (cm),1000 grains weight (gram), grain yield (kg ha^{-1}), biological Yield (kg ha^{-1}) and harvest index percentage and analyzed statistically .

Results and Discussion

Days to 50 % heading

The data recorded in (Table 1) showed that maximum days were taken by PS-2019 (125 days) followed by Zarghoon-2021 with 123 days while minimum days were taken by

Thanda-2023 (111) followed by Naurang-2023 (113 days). It is clear from the result that variety PS-2019 has significant result as compared to varieties Thanda-2023, Naurang-2023 and PS-2023 and at par with other varieties.

Days to maturity

The data presented in (Table 1) indicated that PS-2019 and PS-2021 took maximum days (170) to reach maturity followed by Abaseen-2021 (169 days) and Zarghoon-2021(168 days) while minimum days to maturity were recorded for Thanda-2023 (157). Statistical analysis showed that Varieties PS-2019 and PS-2023 were highly significant with the variety Thanda-2023, non-significant with one another and at par with the other varieties (Gulzar-2019, Zarghoon-2021, Abaseen-2021, Taskeen-2022, Naurang-2023, PS-2023 and Khyber -2023).

A similar study was conducted by [22] and got the same result.

Plant height (cm)

The data for plant height in (Table 1) revealed that maximum plant height was achieved by Abaseen-2021 (117.00 cm) followed by PS-2023 (115.00 cm) while the minimum plant height was noted in Gulzar-2019 (97.33 cm) followed by PS-2019 (99.56 cm). Statistical analysis showed that variety Abaseen-2021 had significantly the highest height of the varieties Gulzar-2019, PS-2019, Zarghoon-2021 and PS-2021 while at par with the other varieties such as Taskeen-2022, Naurang-2023, PS-2023, Khyber-2023 and Thanda-2023. A similar research was performed by [17-19] and obtained the same results. Similarly, research findings of [20-22] were in accordance with the results of our investigation.

Length of spike (cm)

The data in (Table 1) showed that the highest length of spike (13.42 cm) was obtained by the variety Thanda-2023 followed by Khyber-2023 (12.46 cm) while minimum spike length (10.17 cm) was noted in the variety Gulzar-2019 followed by Abaseen-2021 (10.63 cm). Statistically the variety Thanda-2023 got the significant lengthiest spike of all the varieties. Similarly, variety Khyber-2023 had significant spike length as compared to all varieties except Naurang-2023 with which it was at par. Similar research was performed by [17-19] and got the same findings. Similar research findings had been searched by [20-22].

Grains per spike

The data presented in (Table 2) revealed that Naurang-2023 had maximum numbers of grains per spike (72) followed by Taskeen-2022 (70 grains) while minimum numbers of grains (58) per spike were recorded in Abaseen-2021 followed by Khyber-2023 (61 grains). It was noted that

Naurang-2023 had the most significant numbers of grains per spike of all the varieties except Taskeen-2022 with which it was at par. Similarly, Taskeen-2022 had also significant numbers of grains per spike as compared to all other varieties except PS-2019 and PS-2023 with which it was at par. Similar investigation was worked out by [17-19] and acquired the result at par with this. Our research result coincided with the research result of [20-22].

1000 grains weight (grams)

Data in (Table 2) showed that varieties PS-2019, PS-2021 and Naurang-2023 had maximum 1000 grain weight (50.00 gram) followed by Thanda-2023 (49.00 grams) while the Khyber-2023 got minimum weight (39.00 grams) followed by Gulzar-2019 (40.00 grams) weight. It is clear from the data that varieties PS-2019, PS-2021 and Naurang-2023 had significant 1000 grain weight. PS-2023, Taskeen-2022 and Abaseen-2021 are non-significant with each other and at par with Thanda-2023 and Zarghoon-2021 statistically. Similar task was assigned by [17-19] and observed the same conditions. Findings of our research work are similar with the research results of [20-22].

Yield/hectare (Kg)

It is clear from (Table 2) that the highest yield ha^{-1} (7013 kg) has got by the variety PS-2019 followed by Naurang-2023 having 6879 kg ha^{-1} and Thanda-2023 (6720 kg ha^{-1}) while Gulzar-2019 shows the minimum yield (5369 kg/ha) followed by Khyber-2023 (5398 kg /ha). It has observed that all the new varieties got the highest potential and statistically they are at par with each other. The result obtained during this experiment is quite similar to the findings of **[17-19]**. Similar results were also obtained by **[20-22]**.

Biological yield (Kg/ha)

The data in (Table 2) indicated that the highest biological yield per hectare (19667 kg) was recorded in the variety PS-2023 followed by Taskeen-2022 (19267 kg/ha) and Naurang-2023 (19232 kg/ha) while minimum biological yield (15657 kg/ha) was acquired by the varieties Gulzar-2019, Abaseen-2021 and PS- 2021. Statistically, variety PS-2023 was significant with varieties Gulzar-2019, Abaseen-2021, PS-2021 and Khyber -2023 and at par with the varieties Thanda-2023, Naurang-2023 and Taskeen-2022. Similar study was performed by **[17-19]** and obtained the same result. Similarly, **[20-22]** got results from their research work that were similar to our results.

Harvest index %

Data in the (Table 2) indicated that maximum harvest index (38.72 %) was calculated in PS-2021 % followed by PS-2019 (38.57 %). The minimum harvest index (29.71%) was noted in the variety Khyber-2023 followed by Taskeen-2022 (30.12%). Variety PS-2021 had the highly significant percentage of harvest index over other varieties such as Gulzar-2019, Zarghoon-2021, Taskeen-2022, Naurang-2023, PS-2023, Khyber-2023 and Thanda-2023 and at par with PS-2019 and Abaseen-2021. Similar investigation has been performed by **[19]** and got results that are similar to our findings.

Table 1. Agronomic traits of different new varieties of wheat for Rabi season 2022-23 & 2023-24

Variety	Days to 50% heading	Days to Maturity	Plant Height (cm)	Length of Spike (cm)
Gulzar-19	119	168	97.33	10.17
PS-19	123	170	99.56	11.62
Zarghoon-21	121	168	103.90	11.44
Abaseen-21	119	169	117.00	10.63
PS-21	120	170	104.11	11.15
Taskeen- 22	117	162	112.00	11.47
Naurang-23	113	163	110.50	11.85
PS-23	114	162	115.00	11.40
Khyber-23	118	162	112.00	12.46
Tanda-23	111	157	114.00	13.42
LSD Value (5%)	8.09	11.47	7.48	0.82

Table 2. Yield potential and agronomic traits of new varieties of wheat for Rabi season 2022-23 & 2023-24

Variety	Grains /Spike	1000 grains Weight (gm)	Yield /Hectare (Kg)	Bio: Yield (Kg)	Harvest Index (%)
Gulzar-19	64	40.00	5369	15657	34.29
PS-19	67	50.00	7013	18182	38.57
Zarghoon-21	64	47.00	6060	16920	35.82
Abaseen-21	58	46.00	6007	15657	38.37
PS-21	65	50.00	6062	15657	38.72
Taskeen-22	70	43.00	5804	19267	30.12
Naurang-23	72	50.00	6879	19232	35.77
PS-23	66	43.00	5943	19667	30.22
Khyber-23	61	39.00	5398	18167	29.71
Tanda-23	64	49.00	6720	18667	36.00
LSD value (5%)	4.59	3.18	1780.08	1255.12	2.44

Conclusion

Based on overall performance for the stated two years of research it was concluded that varieties PS-2019, Naurang-2023 and Thanda-2023 exhibited better performance in terms of grain yield/ha by obtaining 7013 kg/ha, 6879 kg/ha and 6720 kg/ha respectively. So we can recommend that these varieties are very good and highly productive for the area concerned and farmers of the area can produce it successfully with great potential. Moreover, these varieties are also drought, heat and salinity tolerant which are very suitable for this area having arid and semi-arid climate. These highly productive and stress tolerant varieties will help to solve the food security problems in the area and raise the living standard of the farmers' community. Moreover, it will help wheat breeders by using it in future breeding programs for the development of cultivars with higher yield potential, stress tolerance and better quality. In short this study screened out the best varieties for agro-ecological conditions of the Bannu division.

Authors' contributions

Conceived and framed the trials: A Quddoos & K Mahmood, Conducted trials: A Quddoos, Performed the data analysis: K Mahmood & M Farooq, Searched materials / analysis/ tools: A Quddoos & M Farooq, Wrote the paper: A Quddoos & K Mahmood, Did the overall analysis and proof reading: A Khan & N Khan.

References

1. Reeves TG, Thomas G & Ramsay G (2016). Save and grow in practice: maize, rice, wheat a guide to sustainable cereal production. UN Food and Agriculture Organization, Rome. http://www.fao.org/3/a-i4009e.pdf (Accessed: September 25, 2020).
2. Johanson E, Henriksson T, Prieto-Linde ML, Andersson S, Ashraf R & Rahmatov M (2020). Diverse wheat-alien introgression lines as a basis for durable resistance and quality characteristics in bread wheat. *Front Plant Sci* 11: 1-15.
3. Chattha MU, Hassan MU, Khan I, Chattha MB, Mahmood A, Nawaz M, Subhani MN, Kharal M & Khan S (2017). Biofortification of wheat cultivars to combat zinc deficiency. *Frontier in Plant Sci* 8: 281.
4. Govt. of Pakistan (2004). Economic Survey of Pakistan 2004-05. Ministry of Finance, Econ. Adviser's Wing, Finance Div, Islamabad.
5. Landes R & Mark A (1993). Determinates of Wheat import demand. Staff Report No.

AGES 9312, Agri. And trade analysis division and commodity, Eco. Division Eco. Res. Service, US Deptt. of Agri. Washington DC.

6. Govt. of Pakistan. (2004). Economic Survey of Pakistan 2004-05. Ministry of Finance, Econ. Adviser' s Wing, Finance Div., Islamabad.
7. GOP (2013). Wheat: Economic Survey of Pakistan, 2012-13. Ministry of Food, Agriculture and Livestock, Agriculture and Livestock Division (Economic Wing), Government of Pakistan, Islamabad.
8. Khan A & Sardar R (2004). Wheat production scenario. Dawn. Business Review. 12 Jan.
9. GOP (2017-18). Wheat: Economic Survey of Pakistan, 2017-18. Economics Advisory Wing, Finance Division, Islamabad. Chap 2: 13-32.
10. Pakistan Economic Survey 2020-21. Ministry of Finance, Government of Pakistan.
11. GOP (2023). Wheat Policy Analysis for 2023-24 Crop, Agriculture Policy Institute Ministry of National Food Security and Research GOP Islamabad December.pp. 6.
12. Crop Statistics Khyber Pakhtunkhwa 2018-19.
13. Byerlee D (1987). Maintaining the momentum in post green revolution agriculture: A micro - level perspective from Asia. MSU Inter, l. Dev. Paper No. 10. Uni. of Michigen.
14. Muhsin M, Nawaz M, Khan I, Chattha MB, Khan S, Aslam MT, Iqbal MM, Amin MZ, Ayub MA, Anwar U, Hassan MU & Chattha MU (2021). Efficacy of seed size to improve field performance of wheat cultivars under late sowing conditions. *Pak J of Agri Res* 34(1): 247-253.
15. Iqbal Z, Pasha I, Abrar M, Masih S and Hanif MS (2015). Physico-Chemical, Functional and Rheological Properties of Wheat Varieties. *J of Agric Res* 53(2): 253-266.
16. Heisery PW (1990). Accelerating the transfer to wheat breeding gains to farmers: A study of the dynamics of varietal replacement in Pakistan. *CIMMYT Res Rep No. 1, Mexico D.F. Mexico.*
17. Bhutta Sk, Bhutta KN, Aslam NM, Nasir IR & Ali MA (2019). Evaluation of growth and yield attributes of some wheat varieties under ecological conditions of Southern Punjab. *Pak J Plant Breed. Genet* 07(01): 19-25.
18. U Amin, Ahmad S, Lehari SM, Ramzam M, Ali L, Shahzad F, Ejaz M & Bakhsh L (2023). Comparison of yield and yield components of Faisalabad originated varieties under coastal environment. *Pure Appl Biol* 12(2): 1406-1433.
19. Kaleri SK, Kaleri AA, Baloach AW, Veesar NF,Ning H, Abro TF, Kaleri SH & Khan M (2016). Performance of some wheat varieties on the basis of yield and yield contributing characters. *Inter J Biol Biothech* 13(S): 571-74.
20. Dawood M, Sarwar N, CHattha MU, Khan I, Chattha MB, Hussain F, Iqbal MM, Akram M, Husnain H, Shahid M, Hussain M & Hassam MU (2021). Assesment for Agronomic and Grain Qualitative Attributes of Wheat cultivars under Agro-ecological Condition of Faisalabad. *J of Innov Sci* 7(2): 229-235.
21. Ayaz K (2016). Performance of Different Bread Varieties for Yield and Yield Attributes under diallel Combinations. *Ann of Agrar Sci* 14: 25-34.
22. Sandhu BS & Dhaliwal NS (2017). Comparative performance of wheat cultivars in Muktsar district of Punjab. *Adv Res J Crop Improv* 8(2): 186-190.