



RESEARCH PAPER

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Evaluation of wheat performance under different sowing techniques in agro climatic conditions of KPK, Pakistan

Abdul Latif¹, Muhammad Irfan Ahmad^{*2}, Waleed Asghar³, Jalil Ahmad⁴, Asad Abbas⁵,
Muhammad Zulfiqar Ahmad⁶, Muhammad Umair Mubarak⁷

¹*School of Resources and Environment, Anhui Agricultural University, Hefei, Anhui, China*

²*School of Agronomy, Anhui Agricultural University, Hefei, Anhui, China*

³*Beijing Normal University, School of Environmental Sciences, China*

⁴*Institute of Vegetables and Flowers, Chinese Academy of Agricultural Sciences Beijing, China*

⁵*Department of Horticulture, Anhui Agriculture University, Hefei, China*

⁶*State Key Lab of Tea Plant Biology and Utilization, College of Tea and Food science and Technology, Anhui Agricultural University, Hefei, China*

⁷*Institute of Soil & Environmental Sciences, University of Agriculture, Faisalabad, Pakistan*

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Abstract

The present study aims at investigating the impacts of different planting methods on the growth and yield of wheat. The six different agronomic sowing methods are Broad cast single 1, Broad cast double 2, Rabi Drill, Hand Drill, Bed sowing, Zero Tillage were applied to check the performance of growth and yield of wheat crop variety Faisalabad – 2008 in rabbi season 2015 under the agro climatic conditions of Research Farm, Gomal University D.I. Khan, KPK, Pakistan. Sowing methods show statistically significant difference in Germination m⁻², Number of tillers m⁻², Plant height, spike length, Number of Spikelets/ spike, no of grain per spike, 1000- grain weight (g), Grain Yield kg ha⁻¹ Maximum thousand grain weight (47. 067) was produced in those plots where zero tillage was done and maximum grain yield 2194 kg ha⁻¹ was produced when wheat was sown by method of zero tillage. The poor results were obtained in method of broad cast single 1.

*Corresponding Author: Muhammad Irfan Ahmad ✉ irfan306@outlook.com

Introduction

Wheat (*Triticum aestivum*) is essential staple food crop of the world, used for animal and human purpose which occupied the largest crop area and has greater production than any other crop. In Pakistan, wheat is considering an important cereal crop MINFAL (2011). Wheat was grown on the area of 15896 (000) hectares, with a grain production of 17853 (000) tons and average grain yield of 2775 kg ha⁻¹ during the season of 2006-07 in Punjab. An arid area contributes 14% in area and 13% in production with average grain yield 2456 kg ha⁻¹ during the same year (Anonymous, 2007). Lack of appropriate sowing techniques for wheat crop is one of most important reason for its lower productivity Mikhail *et al.*, 2007. Wheat is grown in Pakistan on more than 8 million ha. The availability of highest grain yield varieties, high nutrients of soil but production is low as compared to other countries; the different agronomic factors are involved to reduce the yield such as not appropriate fertilizer management, soil management, appropriate seed rate and sowing techniques. Therefore research was conduct to evaluate the performance the sowing techniques (Singh and Singh 1992; Galichenko, 1994; Singh *et al.*, 1994a).

Sikander *et al.*, 2003 described that best planting techniques is play very important role to enhance the wheat grain yield. Therefore research was conducted 1998-99 at three different location in the rice-wheat area of Punjab to evaluate the best planting method to effect the yield components (*Triticum aestivum* L.). Planting methods included bed formation + drill sowing (BDS), broad casting + bed formation (BCB), broadcasting (BC) and drill sowing (DS). The higher plant emergence was observed in drill sowing method as compared to other methods. At harvesting, number of heads m⁻²) was higher with BCB and BDS planting system as compared to broadcasting and drill sowing methods. Biological yield was significantly higher in flat planted wheat (broadcasted and drill sown) in comparison with bed planted wheat (BB and DB) Although number of heads m⁻²), spike length and number of grains per spike were significantly higher in raised bed wheat (broadcasted and drilled beds) in

comparison with the flat sown wheat (broadcasting and drill sowing) but grain yield were lower in raised bed wheat than flat sown wheat. In raised bed planted wheat, 1000 grain weight was also significantly lower as compared to flat sown wheat.

Care 2005 conduct an experiment to investigate the different crop sowing techniques of wheat crop i.e. conventional drilling, precision drilling and broadcasting in winter wheat. The best method is used to produce highest yield is Broadcasting method as compared to other. However, there was no consistent relationship between any of the spatial arrangement and subsequent yield performance. Singh *et al.* (2005) scientific study was conducted in Uttar Pradesh, India, that in wheat, strip drilling resulted in highest in growth and grain yield (5.67t ha⁻¹), followed by zero tillage drilling, conventional sowing and bed planting. The sowing techniques of broadcast in wheat crop generally gave lower yield as compared to sowing in rows Krezel and Sobkowicz (1996). However, Ahuja *et al.* (1996) conducted an experimental research results are recorded 5.08 t ha⁻¹ grain yield with broadcasting while 4.75 t ha⁻¹ with sowing in 23 cm apart rows. Parihar and Singh (1995) demonstrated that an experiment was conducted with two different method, the highest grain yield was observed in cross sowing increased grain yield by 4.3 percent compared with the normal method of sowing (line sowing).

Keeping in view of arid environments and number of plants per acre, the study was conducted to determine the role of planting methods on wheat grain yield and yield contributing parameters in arid areas.

Material and methods

Site and soil

The experiment was conducted at Research Farm, Gomal University D.I. Khan, KPK, during the Year 2015-16. The soil was sandy loam and had a good drainage capacity. Before the sowing of crops analyses of soil test showed pH 7.33, N 0.061 (%), Phosphorus 7.43 mg kg⁻¹ and Potash 165.33 mg kg⁻¹.

Experimental design and the treatments

A field experiment was conducted to study the response of different techniques of wheat cultivar Faisalabad – 2008 in season 2015. The experimental design RCBD was employed having 3 replications. The net plot size was 6 m × 7 m having row to row spacing 25 cm. the experiment comprised of following treatments. The Selected soil and its characteristics are given in Table 1.

Table 1. Physico-chemical soil analysis of crop area.

Characteristic	Soil sample depth			
	10 cm	15 cm	20 cm	Mean
Soil pH	7.2	7.5	8.2	6.99
Organic Matter(%)	1.22	1.22	1.04	1.22
Total Nitrogen (%)	0.066	0.066	0.052	0.061
Available P (mg kg ⁻¹)	4.2	7.1	10.	7.2
Available K (mg kg ⁻¹)	180	157	137	162.33
Texture	Sandy loam	Sandy loam	Sandy loam	

Treatments

- T1= Broad cast single 1
- T2= Broad cast double 2
- T3= Rabi Drill
- T4= Hand Drill
- T5= Bed sowing
- T6= Zero Tillage

Planting material

The cultivar Faisalabad – 2008 of wheat was selected according to plant character which influences the growth and yield. This verity was identified from the literature according to agronomic characters such as plant development rates, plant height and leaf area and yield. The seeds of cultivar were obtained from AYUB.

Crop husbandry

The seed bed was prepared before the sowing for 2-3 times with tractor- mounted cultivator each followed

by planking. The wheat was sown with six different techniques in November. The seed rate was used 100 kg/ha maintains row to row distance 25m. The fertilizer arrangement of nitrogen, Phosphorus and potassium were used in the form of urea, DAP and Potassium (k₂So₄), Nitrogen & Phosphorus was applied @ 120 & 100 Kg/ha, respectively.

Half dose of Nitrogen & Full dose of Phosphorus was applied during Sowing time/seed bed preparation while remaining ½ Nitrogen was applied with 1st Irrigation. All other agronomic practices such as land preparation and irrigation etc. were executed in line with normal day to day farming practices.

Statistical analysis

Data collected on growth, biomass, radiation use efficiency and yield was analyzed statistically by employing the Fisher’s analysis of variance technique and significant of treatment means was tested using least significance difference (LSD) test at 5% probability level (Steel *et al.*,1997).

Result and discussion

Germination m⁻²

The planting methods have statistically significant effect on germination of wheat performance. From table 2 result are showed that highest germination was noted in zero tillage method (205) as compared to other methods.

On other hand the poor emergence was recorded in those plots where broad cast single method was applied T1 (151) the treatment T5 (193) are statistically at par with T4 (192). These results are closed with the find of shaalan *et al.*, 1977.

Table 2. Effect of sowing methods on wheat performance.

	GM /m ²	No.Tillers/m ²	Ph (cm)	SL(cm)	No.SP/S	No.G/S	1000. GW(g)	GY Kg/ha.	BY Kg/ha	S.Y Kg/ha	H.I (%)
T1= Broad Cast Single 1	151.33 ^e	317 ^f	101.86 ^a	17.0 ^a	17.33 ^b	49.66 ^d	45.23 ^c	3040.7 ^c	9178 ^e	3099.6 ^f	33.13 ^e
T2= Broad Cast Double 2	180.67 ^d	350.33 ^e	99.25 ^c	18.0 ^a	18.66 ^{ab}	53.66 ^c	47.90 ^b	3540.3 ^b	9200 ^d	3650.7 ^e	38.48 ^d
T3=Rabi Drill	185.33 ^{cd}	403 ^d	99.22 ^c	17.66 ^a	18.66 ^{ab}	58.0 ^b	49.23 ^a	3826.3 ^b	9500 ^b	3972.3 ^b	40.27 ^b
T4=Hand Drill	192.0 ^{cd}	374.67 ^c	100.37 ^{abc}	18.33 ^a	18.66 ^{ab}	56.66 ^b	48.21 ^{ab}	3770.3 ^b	9490 ^b	3886 ^c	39.72 ^{bc}
T5=Bed Sowing	193 ^b	391.67 ^b	101.46 ^{ab}	18.0 ^a	19.0 ^a	58.33 ^b	46.76 ^{ab}	3670.3 ^b	9300 ^c	3792.3 ^d	39.46 ^{cd}
T6=Zero Tillag	205.0 ^a	433 ^a	99.67 ^{bc}	18.33 ^a	19.0 ^a	63.3 ^a	52.12 ^a	4388 ^a	10078 ^a	4471.3 ^a	43.54 ^a

Number of tillers m⁻²

The different sowing methods have influence in tillering in the wheat crop. The results are shown in table 2 depicted that all the planting method show a statistically significant results. The highest tiller was counted in T6 (433) as compared to other remaining sowing methods. T3 (403) T5 (391) T4 (374) T2 (350) T1 (317). The lowest number of tillers was observed in that plats where the sowing method was applied T1 (317). These results are line with Bilalis1 *et al.*, 2011. Who described that number of tiller was counted more in zero tillage planting method as compare to other congenital tillage.

Plant height (cm)

The height of wheat plant is an important yield contributing parameter. The height was measure at physiologically maturity. The data presented in in Table 2 Showed that increase in height of plants results in boost the growth rate and ultimately higher yield of crop. The different sowing methods of wheat crop showed significant results for plant height. The highest plant height was noted in T1 treatment (101.86) as compared to other treatments T5 (101.46) T4 (100.37) T6 (99.87) T3 (99.25) T2 (99.22). The lowest height was produced in that plats where T2 (99.22) was applied. Results are statistically at par with T3 (99.25). The similar finding was observed in Abbas *et al.*, 2009, who also concluded that planting methods have effect on plant height. The good results are found in zero tillage methods.

Spike length

It is revealed from data shown in table 2 described that spike length was statistically significant. All the sowing methods show results are statistically at par with each other, but the highest length was noted in zero tillage plantation.

Number of Spikelets/ spike

The evidence are provided in table 2. The maximum spikelets spike⁻¹ (19) are noted in zero tillage method are statistically at par with bed sowing treatment. The lower number of spikelets spike⁻¹ (17.33) are observed in T1 (broad cast single 1). It is statistically similar spikelets spike⁻¹ and closely followed by these methods broad cast double 2, rabbi drill, hand drill.

No of grains/ Spike

The data presented in table 2 demonstrated that the statistically significant results were observed. The highest number of grains per spike (63.30) was produced in zero tillage method. The T3, T4 and T5 produced no of grain per spike are 58, 56.66, 58.33 respectively are statistically at par with each other. The lower number of grain (49.66) was produced in those plots where broad cast single 1 method was applied. There was positive and strong liner relationship between no of grain / spike and grain yield with value of (R² = 0.83).

1000- grain weight (g)

The results are verified from data presented in table 2 showed that sowing methods have statistically significant results of 1000- grain weight. Maximum thousand grain weight (52.12) was noted in zero tillage planting method are statistically at par with rabbi drill method (49.23). The lower grain weight (45.23) was obtained by broad cast single. There was positive and strong liner relationship between no of grain / spike and grain yield with value of (R² = 0.90) as shown in Fig. 1.

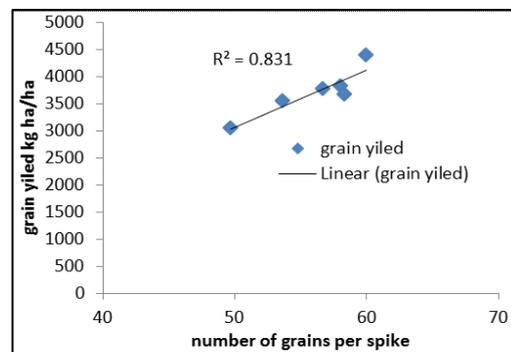


Fig. 1. Relationship between No. of grains and Grains Yield.

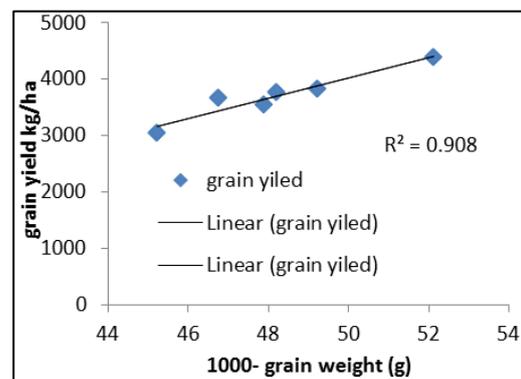


Fig. 2. 1000-Grain Weight (g).

Grain Yield kg ha⁻¹

The data presented in (Table 2) showed that grain yield statistically significant in all planting treatments. The maximum grain yield 4388 kg ha⁻¹ was produced when wheat was sown by method of zero tillage. In case of treatment T3 (rabbi drill), T4 (hand drill), T5 (bed sowing) and T2 (Broad cast double 2) are statistically at par with each other. The lower wheat yield was obtained in broad cast single 1 method as compared with other sowing methods. The results are described that highest grain yield was produced by zero tillage Kahloon *et al.*, 2012, Tripathi*, 2013, Sharma *et. al.*, (2008), Abbas *et. al.*, (2009), Rehman *et. al.*, (2010). Better root development was resulted in better uptake of nutrient that ultimately resulted in increase in crop productivity and yield (Izumi *et. al.*, 2004 and Merrill *et. al.*, 1996). Tripathi *et al.*, 2013.

Straw yield kg ha⁻¹

The planting methods have statistically significant effect on wheat yield performance. Data present in table 2 showed that highest straw yield 4471 kg ha⁻¹ was observed in zero tillage treatment because this is good method as compared to remaining methods. The lowest straw yield 3099.6 kg/ha was noted in broad cast single method. These results are close finding with Narese *et al.*, 2014, who stated that straw yield was more in zero tillage as compared to other planting method. Narese *et al.*, 2014.

Biological yield kg ha⁻¹

The biological yield is good contributing factor for increase the grain yield. In this experiment clear significant difference was observed in all treatments. The highest biological yield 10078 kg/ha was observed from the T6 (zero tillage) treatment as compared other treatments. The lowest value of 9178 kg/ ha was achieved in T1 (Broad cast single 1).

H.I %

In our study statistically significant difference was observed. Data present in table 1 showed that highest harvest index (43.54 %) was obtained in zero tillage with comparison of other sowing techniques. The treatment T5 (Bed Sowing) was produced H.I 39.46 % follow the treatment T4 (Hand Drill) 39.72 %.

The less amount of Harvest index (33.13 %) was obtained in broad cast single 1 method. The positive finding with these results

References

- Abbas G, Ali MA, Abbas G, Azam M, Hussain I.** 2009. Impact of planting methods on wheat grain yield and yield contributing parameters. The Journal of Animal & Plant Sciences **19(1)**, 30-33.
- Abbas G, Ali MA, Abbas G, Azam M, Hussain I.** 2009. Impact of planting methods on wheat grain yield and yield contributing parameters. The J. Anim. Plant Sci **19(1)**, 30-33.
- Ahuja KN, Lal RB, Kumar A.** 1996. Effect of seed rate, date and method of sowing on growth and yield of wheat. Annals of Agricultural Res **17(2)**, 190-192.
- Anonymous.** 2007. Area, Production and yield of wheat in Punjab Agricultural Statistics of Pakistan.
- Carver MFF.** 2005. The influence of different establishment methods on performance of early drilled winter wheat. HGCA- Project Report **375**, 24.
- Dimitrios B, Anestis K, Sotiria P, Maria A, Aristeidis K, Vassilios T.** 2011. Performance of Wheat Varieties (*Triticum aestivum* L.) under Conservation Tillage Practices in Organic Agriculture. Not Bot Horti Agrobo **39(2)**, 28-33.
- Galichenko II.** 1994. Which sowing method is best for winter crops. Zemledelie **1**, 23-23.
- Izumi Y, Uchida K, Iijima M.** 2004. Crop production in successive wheat-soyabean rotation with no-tillage practice in relation to root system development. Plant Prod. Sci **7**, 329-336.
- Kahloon MH, Iqbal MF, Farooq M, Liaqat Ali, Fiaz M, Ahmad I.** 2012. A comparison of conservation technologies and traditional techniques for sowing of wheat. The Journal of Animal & Plant Sciences **22(3)**, 827-830.

- Krezel R, Sobkowicz P.** 1996. The effect of sowing rates and methods on winter triticale grown on light soil. *Roczniki Nauk Rolniczych. Seria A Produkcja Roslinna* **111(3/4)**, 69-78.
- Merrill SD, Black AL, Bauer A.** 1996. Conservation tillage affects root growth of dryland spring wheat under drought. *Soil Sci. Soc. Am. J* **60**, 575-583.
- Mikhail AS, Jamieson PD.** 2007. Deconvoluting Nitrogen Use Efficiency in Wheat: A Simulation Study. *European Journal of Agronomy* **26**, 283-294.
- Minfal.** 2011. Agriculture Statistics of Pakistan. Govt. of Pakistan, Ministry of Food, Agriculture and Livestock. Economic Wing, Islamabad.
- Naresh RK, Tomar SS, Purushottam SP Singh, Dipender Kumar, Bhanu Pratap, Vineet Kumar, Nanher AH.** 2014. Testing and evaluation of planting methods on wheat grain yield and yield contributing parameters in irrigated agro-ecosystem of western Uttar Pradesh, India. *African Journal of Agriculture Research* **9(1)**, 176-182, DOI: 10.5897/AJAR2012.0027
- Parihar GN, Singh R.** 1995. Response of wheat (*Triticum aestivum*) genotypes to seed rate and sowing method under Western Rajasthan conditions. *Indian J. of Agron* **40(1)**, 97-98.
- Rehman MA, Hossain SJ, Hossain MB, Amin MR, Sarkar KK.** 2010. Effect of variety and culture method on yield and yield attributes of wheat. *Int. J. Sust. Crop. Prod* **5(3)**, 17-21.
- Shalan MI, Chaudhary MS, Sarour FA.** 1977. The effects of tillage and planting methods of growth, weed population and yield of semi- dwarf of wheat (*Triticum aestivum* L.) *Libyan J. Agric* **6**, 55-67.
- Sharma RK, Chhokar RS, Singh RK, Gill SC.** 2008. Zero tillage wheat and unpuddled rice: the energy, labour and cost efficient alternatives to conventional rice-wheat system. Proceedings of the "14th Australian Agronomy Conference" (MJ Unkovich), Adelaide, South Australia pp 147-158.
- Sikander K, Tanveer, Imtiaz Hussain, Sohail M, Kissana NS, Abbas SG.** 2003. Effects of Different Planting Methods on Yield and Yield Components of Wheat. *Asian Journal of Plant Sciences* **2**, 811-813.
- Singh G, Singh OP, Yadav RA, Singh RS, Singh BB.** 1994. Effect of seeding methods, seed rates and fertility levels on yield and economics of late sown wheat after rice in flood prone area. *Ann. Agric. Res* **15**, 448-451.
- Singh KK, Jat AS, Sharma SK.** 2005. Improving productivity and profitability of rice (*Oryza sativa*) wheat (*Triticum aestivum*) cropping system through tillage and planting management. *Indian J. of Agric. Sci* **75(7)**, 396-399.
- Singh RA, Singh RG.** 1992. Response of various methods of sowing on yield of wheat variety HUW 234. *Agric. Sci. Dig. Karnal* **12**, 217-218.
- Steel RGD, Torrie JH, Dickey DA.** 1997. Principles and Procedures of Statistics. A Biometrical Approach. 3rd ED. Mc Graw Hill Book. Int. Co. New York pp 400-408.
- Tripathi RS, Raju R, Thimmappa K.** 2013. Impact of Zero Tillage on Economics of Wheat Production in Haryana, *Agricultural Economics Research Review* **26(1)**, 101-108.