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IMPACT OF PLANTING METHODS ON WHEAT GRAIN YIELD AND YIELD CONTRIBUTING PARAMETERS

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ABSTRACT

A field experiment was carried out during two consecutive years 2006-07 and 2007-08 at two locations in arid area of the Punjab province. The objective of the study was to compare conventional planting method (broadcasting) of wheat sowing with drill planting method for grain yield and its parameters. The experiment comprised of four (15,22.5 and 30 cm spaced rows ad broad casting) treatments arranged in randomized complete block design with three replications in a net plot size of 12x17 m. The results over the years of the study revealed that the germination were statistically at par in drill sowing at 15 cm apart rows and broadcasting. Better plant height was noted in drill planting with 30 and 22.5 cm rows. However, number of spikelets spike $^{-1}$ and number of grains spike^{-1} were statistically similar in broadcasting and drilling at 22.5 cm apart rows. Similar 1000-grain weight was recorded in drill sowing at 30, 22.5 cm and broadcasting. The maximum grain yield was obtained through broadcast method and it was statistically at par with drill planting method where row spacing was 22.5 cm. Whereas, drill-planting techniques with row spacing 15 cm and 30 cm, were inferior to broadcast method. It may be concluded that broadcast method is suitable for wheat sowing in sandy loam soils of arid area.

Key word: *Triticum aestivum* L; planting methods; NPK fertilizers; Arid; Pakistan.

INTRODUCTION

Wheat is a staple food of the masses and feed for animals all over the world. It was grown on an area of 15896 (000) hectares, with a production of 17853 (000) tons and average grain yield of 2775 kg ha^{-1} during 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). The average grain yield of Mianwali district was 2079 kg ha^{-1} and that of Bhakkar district 2369 kg ha^{-1}, which was even less than the average yield of arid areas. Carver (2005) investigated the impact of different crop establishment methods, i.e. conventional drilling, precision drilling and broadcasting in winter wheat. Broadcasting method produced the most effective spatial arrangements. However, there was no consistent relationship between any of the spatial arrangement and subsequent yield performance. Singh *et al*. (2005) concluded from a field experiment in Uttar Pradesh, India, that in wheat, strip drilling resulted in higher growth and grain yield (5.67 t ha^{-1}), followed by zero tillage drilling, conventional sowing and bed planting. The broadcast sowing generally gave lower yield than sowing in rows Krezel and Sobkowicz (1996). However, Ahuja *et al*. (1996) recorded 5.08 t ha^{-1} grain yield with broadcasting while 4.75 t ha^{-1} with sowing in 23 cm apart rows, where as Raj *et al*. (1992) found that row spacing (15,22.5 or 30 cm) had no effect on grain yield in 1986-87 but the yields were lower in the wider row spacing (30 cm) in 1985-86. Parihar and Singh (1995) revealed that 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.

MATERIALS AND METHODS

The trial was laid out in randomized complete block design with three replications in a net plot size of 12 x 17 m. The test variety was Bhakkar 2002. Sowing was done on November 20, 2006 at Khajabad, Mianwali and November 7, 2007 at Chak No. 6 TDA, Bhakkar. The treatments of the experiment were as following.

T_1 = Broadcasting (Control), T_2 = Planting at 15 cm apart rows. T_3 = Planting at 22.5 cm apart rows., T_4 = Planting at 30 cm apart rows. Recommended dose of NPK was applied according to treatments as urea, triple supper phosphate, and sulphate of potash, respectively. While Nitrogen fertilizer was applied in three splits doses. One-third Nitrogen was applied at the time of seedbed preparation and was thoroughly mixed into soil by ploughing and planking. The 2nd (1/3) of Nitrogen was applied at the time of 1st irrigation & 3rd dose at the time of

3rd irrigation after (Fageria and Baligar, (1997). Canal water was used for irrigation.

Sowing was done manually in broadcast method and with Rabi drill planting method in good moisture conditions. All other agronomic practices were kept uniform for both the experimental sites. The observations on the parameters Germination $(m^2)^{-1}$, Number of tillers $(m^2)^{-1}$, Plant height (cm), Number of spikelets $spike^{-1}$, Number of grains $spike^{-1}$, 1000- grain weight (g) and Grain yield (kg ha^{-1}) were recorded during the course of the experimentation. Wheat crop growing and development stages for recording of parameters after sowing were Germination $(m^2)^{-1}$ 15 days, Number of tillers $(m^2)^{-1}$ 40 days, Plant height (cm) 150 days, Number of spikelets $spike^{-1}$ 150 days, and yield contributing parameters after 150 days

The data thus collected was analyzed statistically through a computer run programme MSTATC. The treatment means were compared through least significant difference test at 5% probability level (Steel *et al*., 1997).

RESULTS AND DISCUSSION

Germination (m^2): It is evident from table 1 that during first year of the experiment, planting at 15 and 22.5 cm and broadcast method produced similar and higher germination m2. However, statistically low germination was produced when crop was sown in 30 cm spaced rows. During 2007-08, none of the planting methods or spacing influenced germination significantly. The mean of two years results showed that statistically similar germination was recorded in 15 cm apart planting and broadcasting method, however, broadcasting was also at par with planting in 22.5 cm rows. Wheat planting at 30 cm apart rows produced minimum germination per unit area. Hence it can be concluded from the results that in Thal area, germination was similar for both the planting methods. It might be attributed to the sandy loam soil and optimum soil moisture conditions, which played major role in germination of wheat crop.

Table 1 Response of planting methods on germination in wheat.

Planting methods	Germination per m^2		
	2006-07	2007-08	Mean
Broadcasting (control)	258.3^{ab}	231.3	244.8^{ab}
Planting at 15 cm apart rows	310.7^{a}	242.7	276.7^{a}
Planting at 22.50 cm apart rows	264.0^{a}	208.3	236.2^{b}
Planting at 30 cm apart rows	188.7^{b}	201.7	195.2^{c}
LSD at 0.05%	64.41	NS	33.71

Means sharing same letters in columns do not differ ($p < 0.05$)

Tillers (m^2): Planting methods i.e. broadcast nor drill planting nor row spacing of (15, 22.5 and 30) cm influenced tillering in wheat during both the years. Moreover, the tillers during both the years individually or average of the years showed poor tillering in all the treatments under study. Less tillering can be attributed to the low fertility status and less water holding capacity of sandy loan soils of Thal area.

Table 2 Response of planting methods on number of tillers in wheat.

Planting methods	Number of Tillers per m^2		
	2006-07	2007-08	Mean
Broadcasting (control)	373.3	428.7	401.0
Planting at 15 cm apart rows	366.3	380.0	373.2
Planting at 22.50 cm apart rows	379.7	379.3	379.5
Planting at 30 cm apart rows	362.3	396.0	379.2
LSD at 0.05%	NS	NS	NS

Plant height (cm): The data presented in table 3 depicted that during the year 2006-07, the maximum plant height of 104.7 cm was produced when wheat was sown in 30 cm spaced rows, however, broadcast (103.8 cm) and 22.5 cm spaced rows (103.9 cm) were also statistically at par. The minimum plant height of 100 cm was produced at 15 cm row spacing. During next year i.e. 2007-08, row spacing of 30 and 22.50 cm produced significantly similar but taller plants (103.7 and 102.8 cm), while row spacing of 22.5 cm was also statistically at par with broadcasting method (101.9 cm). The average of two years data expressed the similar trend as in the year (2007-08). The less difference of plant height in both the planting methods can be described to the appropriate plant population and inherent varietal character of wheat variety Bhakkar- 2002.

Table 3 Response of planting methods on plant height in wheat.

Planting methods	Plant height in m2		
	2006-07	2007-08	Mean
Broadcasting (control)	103.8 a	101.9^{b}	102.9^{b}
Planting at 15 cm apart rows	100.0 b	99.8^{c}	99.9^{c}
Planting at 22.50 cm apart rows	103.9 a	102.8^{ab}	103.4^{ab}
Planting at 30 cm apart rows	104.7 a	103.7^{a}	104.2 a
LSD at 0.05%	1.844	1.777	1.14

Means sharing same letters in columns do not differ ($P<0.05$).

Number of spikelet spike^{-1} : It is evident from table 4 that maximum number of spikelets spike^{-1} were recorded in broadcast method of seed placement during the year 2007-08 (13.7) as well as average over both the years (14.05). In 2006-07, planting at 22.5 cm apart rows produced the maximum number of spikelets per spike (14.47), although it was statistically at par and closely followed by the broadcast method (14.40). More number of spikelets per spike in broadcast and row planting at 22.5 cm can be referred to the ideal plant population in the both treatments, which resulted in less crop plant competition.

Table 4 Response of planting methods on number of spikelets spike^{-1} in wheat.

Planting methods	No. of spikelets spike^{-1}		
	2006-07	2007-08	Mean
Broadcasting (control)	14.40 [a]	13.7[a]	14.05[a]
Planting at 15 cm apart rows	12.20[c]	11.2[c]	11.70[c]
Planting at 22.50 cm apart rows	14.47 [a]	12.8[a]	13.64[a]
Planting at 30 cm apart rows	13.20 [b]	11.2 c	12.20[b]
LSD at 0.05%	0.3996	0.9869	0.474

Means sharing same letters in columns do not differ (P<0.05).

Number of grains spike^{-1}: It is clear from the data shown in table 5, that the number of grains spike^{-1} were produced in broadcast method during 2006-07, 2007-08 and pooled of the years (43.0, 42.27 and 42.64 respectively). However, drill planting at 22.5 cm produced statistically similar number of grains spike^{-1} during individual years (41 and 41.8) and average over the years (41.40). The lowest numbers (37.13, 36.07 and 36.60, respectively) were produced when planting was done in 15 cm spaced rows during both the individual year and average of the years as well (P<0.05).

Table 5 Response of planting methods on number of grains spike^{-1} in wheat.

Planting methods	No. of grains spike^{-1}		
	2006-07	2007-08	Mean
Broadcasting (control)	43.0[a]	42.27[a]	42.64[a]
Planting at 15 cm apart rows	37.13[c]	36.07[c]	36.60[c]
Planting at 22.50 cm apart rows	41.09[a]	41.80[a]	41.40[a]
Planting at 30 cm apart rows	41.53[ab]	35.13[b]	38.33[b]
LSD at 0.05%	2.742	0.9199	1.288

Means sharing same letters in columns do not differ (P<0.05).

1000-grain weight (grams): It is clear from the data presented in table 6, that during the year 2006-07, 1000-grain weight did not differ significantly among the planting methods. However, during 2007-08, the maximum 1000-grain weight of 35 grams was produced by broadcast method and planting at wider row spacing of 30 cm. The row spacing of 22.5 cm also remained statistically at par with the above-mentioned treatments with 1000-grain weight of 33.3 grams. Planting at a distance of 15 cm produced the lowest weight of 30 grams. The average of two years results showed similar trend as in 2007-08.

Table 6. Response of planting methods to 1000-grain weight in wheat.

Planting methods	1000-Grain weight in (g)		
	2006-07	2007-08	Mean
Broad casting (control)	33.3	35.0[a]	34.17[a]
Planting at 15 cm apart rows	31.7	30.0[b]	30.83[b]
Planting at 22.50 cm apart rows	36.7	33.3[a]	35.00[a]
Planting at 30 cm apart rows	36.7	35.0[a]	35.83[a]
LSD at 0.05%	NS	2.883	2.568

Means sharing same letters in columns do not differ (P<0.05).

Grain yield (kg ha^{-1}): The data presented in table 7 for grain yield revealed that during 2006-07, the maximum grain yield of 4633 kg ha^{-1} was produced when wheat was sown at 22.5 cm apart rows. The maximum grain yield producing treatment, however, was at par with broadcast method of sowing with a grain yield of 4533 kg ha^{-1}. Planting at 15 or 30 cm apart rows produced grain yield of 4083 and 3967 kg ha^{-1}, which were statistically lower than the above-mentioned treatments, although at par with one another. During next year i.e. 2007-08 broadcast method produced the maximum grain yield of 4200 kg ha^{-1} than all the row spaces, which produced 3933, 3500, and 3483 kg ha^{-1} of grain yield, respectively. The trend of average data for two years was similar to that produced during the year

Table 7. Response of planting methods on grain yield in wheat.

Planting methods	Grain yield (kg ha^{-1})		
	2006-07	2007-08	Mean
Broadcasting (control)	4533[a]	4200[a]	4367[a]
Planting at 15 cm apart rows	4083[b]	3500[c]	3792[b]
Planting at 22.50 cm apart rows	4633[a]	3933[b]	4283[a]
Planting at 30 cm apart rows	396710	3483[c]	3725[b]
LSD at 0.05%	141.3	167.4	175.3

Means sharing same letters in columns do not differ (P0.05).

2007-08 with broadcast method at the top (4367 Kg ha^{-1}).The maximum grain yield in broadcast method of sowing can be described to higher number of spikelets $spike^{-1}$, number of grains $spike^{-1}$ and 1000-grain weight, which was favored because of better growing condition in broadcast method. Similar findings were also reported by carver (2005), Ahuja *et al*. (1996), Raj *et al*. (1992) and Serma and Medhy (1995). The findings reported by Thal and Singh (2004), Singh *et al*. (2005), Singh and Uttam (1992), Krezel and Sobkowicz (1996), Raj *et al*. (1992) and Parihar and Singh (1995) are in contradictory to the present findings. It might be due to varying environmental and soil conditions.

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