

Interaction Effect of Sowing Time, Planting Method and Seed Rate on Performance of Wheat Variety PBW 550

BALKARAN SINGH* AND R. S. UPPAL

*Department of Agronomy, Punjab Agricultural University
 Ludhiana 141004, India*

E-mail : balkaransandhu@gmail.com

**Correspondence*

Abstract

A field experiment was conducted during *rabi* of 2008-09 to study the effect of seed rate, sowing time and planting method on growth and yield of PBW-550 variety of bread wheat (*Triticum aestivum* L.). Three sowing dates (25 October, 5 November and 15 November) and two planting methods (bed planting and flat sowing) in the main plots and four seed rates viz., 87.5, 100, 112.5 and 125 kg/ha in the sub-plots were selected. The experiment was conducted using split plot design with three replications. The available soil nitrogen was low while P and K were medium. The results reveal that the sowing date of 15 November was at par with 5 November sowing producing significantly higher grain yield, ear length and grains per ear as compared to 25 October sown crop. Bed planting or flat sowing methods did not affect significantly the growth and yield attributes of wheat. Among different seed rates the maximum grain yield, number of grains per ear and ear length of wheat were recorded with 125 kg/ha, which was statistically at par with 112.5 kg seed/ha and was significantly higher than 87.5 and 100 kg seed rate. Interaction effect of planting method and seed rate was significant. Interaction between planting method and seed rate showed that bed planting method with 100 and 112.5 kg seed/ha and flat sowing method with 112.5 and 125 kg seed/ha gave the statistical similar yield, ear length and grains per ear.

Key words : Wheat, Seed rate, Sowing time, Planting methods.

In India, wheat is the second most important food crop after rice and has played a vital role in increasing and stabilizing the food production of the country. India ranks second in the world in respect of wheat production only next to china. Wheat is the most important winter cereal crop of the country and cultivated on an area of 27.2 mha with an annual production of 74.9 mt and average yield of 2.8 t/ha. It has been projected that to feed 1.3 billion population and diversified uses, India will have to produce at least 109 million tones of wheat by 2020 AD, which might be possible through elevating the productivity up to 40 q/ha (1). The yield and yield attributes are influenced by seed rate, time of planting and appropriate planting methods along with nutrient management and irrigation. Optimum seed rate is essential for maintaining plant population which plays an important role in increasing crop productivity. Low plant population per unit area is one of the major constraints for low yield. Optimum plant stand per unit area of a crop varies with seed size, genotype, sowing time and sea-

son (2). The seed rate requirement also varies with planting method. Bed planting method with 20% less seed rate gives similar yield with flat sowing method with 100% area (3). Sowing time is one of the most important management factors involved in obtaining higher yield. Timely sowing of wheat crop generally gives higher yield as compared to late sown crop. Late-sown wheat crop faces high temperature stress during ripening phase. Late planting reduces the tillering period and hot weather during critical period of grain filling lead to forced maturity thereby reduces the grain yield. The selection of suitable method of sowing plays an important role in the placement of seed at proper depth, which ensures better emergence and subsequent crop growth. Wheat is planted using different sowing methods depending upon the available soil water, time of planting, and amount of residue in the field and availability of planting machine. In India, drill sowing is recommended because of its uniform seed distribution at desired depth, which usually results in higher germination and uniform

Table 1. Effect of sowing time, planting method and seed rate on grain yield

| Treatment | Tillers/m ² area | Ear length (cm) | Number of grains per ear | Grain yield (q/ha) |
|--------------------------|--------------------------------|-----------------------|--------------------------------|--------------------------|
| Sowing Time | | | | |
| 25 Oct | 363.03 | 8.29 | 41.38 | 47.02 |
| 5 Nov | 394.99 | 10.10 | 49.94 | 55.60 |
| 15 Nov | 394.12 | 10.13 | 49.72 | 56.51 |
| CD (<i>P</i> =0.05) | 5.50 | 0.12 | 0.92 | 1.72 |
| Planting Method | | | | |
| Bed Planting | 383.01 | 9.51 | 47.02 | 53.31 |
| Flat sowing | 385.08 | 9.50 | 47.02 | 52.77 |
| CD (<i>P</i> =0.05) | NS | NS | NS | NS |
| Seed Rate (kg/ha) | | | | |
| 87.5 | 372.22 | 9.21 | 45.97 | 51.17 |
| 100 | 382.06 | 9.48 | 46.89 | 52.16 |
| 112.5 | 390.85 | 9.66 | 47.62 | 54.38 |
| 125 | 391.06 | 9.68 | 47.59 | 54.46 |
| CD (<i>P</i> =0.05) | 8.24 | 0.24 | 0.88 | 1.09 |

stand. Furrow irrigated raised bed system (FIRBS) is recently introduced concept in wheat sowing to obtain better crop performance. In this system, there is a bed having a number of rows of crop between two furrows. The irrigation water is applied through furrows and it irrigates the crop by lateral movement. Therefore, keeping these points in view the present investigation was carried out to study the growth behavior of wheat under different seed rate, sowing time and planting method.

Methods

The field experiment was conducted during *rabi* of 2008-09 at Punjab Agricultural University, Ludhiana on sandy loam soil, low in available N (133 kg/ha) and medium in available P (14 kg/ha) and K (227.5 kg/ha) with pH-8.0. The experiment was replicated thrice in split plot design with three sowing time viz. 25 October, 5 November and 15 November and two planting methods viz. bed planting and flat sowing as main plot treatments while sub-plot treatments consisted of four seed rates viz. 87.5, 100, 112.5 and 125 kg/ha. The crop received a uniform dose of nutrients at 125 kg N, 62.5 kg P₂O₅ and 30 kg K₂O through urea, single super phosphate and muriate of potash respectively. Half of the nitrogen and full dose of phosphorus and

Table 2. Effect of interaction between planting method and seed rate on ear length of wheat (cm). CD (*P*=0.05), Seed rate = 0.24, Planting method = NS, Seed rate × Planting method=0.34.

| Planting method | Seed rate (kg/ha) | | | | Mean |
|--------------------|-------------------|------|-------|------|------|
| | 87.5 | 100 | 112.5 | 125 | |
| Bed planting | 9.13 | 9.56 | 9.89 | 9.45 | 9.51 |
| Flat sowing | 9.29 | 9.40 | 9.62 | 9.90 | 9.50 |
| Mean | 9.21 | 9.68 | 9.66 | 9.68 | |

potash were applied as basal at the time of sowing. The remaining nitrogen was applied after first irrigation at crown-root initiation. The crop received six irrigations at different growing stages. To check the weed growth, one hoeing with khurpa was given after first irrigation. Clodinafop 15 WP at 160 g per acre and 2,4-D at 250 g per acre has applied to control the growth of grassy and broad leaf weeds. Rogor 30 EC (dimethoate) was applied to control aphids at grain filling stage. Propanoazole 25 EC was applied at milk stage to check the infestation of head scab. The crop sown on 25 October took 141 days to maturity as compared to 147 and 145 days for the 5 and 15 November respectively. The observations on grain yield, grains/ear and ear length were recorded at maturity.

Results and Discussion

Number of Tillers

The number of tillers are the main yield contributing character. The number of tillers of wheat crop sown on 5 November produced maximum tillers which were statistically at par with the crop sown on 15 November and significantly superior to the crop sown on 25 October (Table 1). It was due to the optimum and favorable conditions for growth of the crop as compared to early sown crop. Singh and Jain (4) also observed the similar results that effective tillers significantly increased at normal sown crop as compared to early crop sown.

Both planting methods did not show any significant effect on the number of tillers per square meter. Bhat and Mahal (5) also reported that different planting methods did not influence the number of tillers to significant level in wheat.

However, the numbers of tillers were recorded maximum with 125 kg seed/ha which was statistically

Table 3. Effect of interaction between planting method and seed rate on number of grains per ear of wheat. CD ($P=0.05$), Seed rate = 0.88, Planting method = NS, Seed rate \times Planting method = 1.24.

| Planting method | Seed rate (kg/ha) | | | | Mean |
|-----------------|-------------------|-------|-------|-------|-------|
| | 87.5 | 100 | 112.5 | 125 | |
| Bed planting | 45.71 | 47.26 | 48.22 | 46.87 | 47.02 |
| Flat sowing | 46.22 | 46.51 | 47.02 | 48.31 | 47.02 |
| Mean | 45.97 | 46.89 | 47.62 | 47.59 | |

at par with 112.5 kg seed/ha and significantly superior to 87.5 and 100 kg seed/ha. Sen et al. (6) also observed that the number of tillers increased with increase in seed rate.

Ear Length

The crop sown on 15 November gave maximum ear length, which was statistically at par with ear length of crop sown on 5 November but significantly higher than the crop sown on 25 October. Bed planting and flat sowing methods failed to produce any significant effect on the ear length of the wheat crop. The ear length increased with increase in seed rate from 87.5 to 125 kg seed/ha and maximum ear length was recorded with 125 kg seed/ha, which was statistically at par with 100 and 112.5 kg seed/ha. Basbag et al. (7) recorded the similar results.

Interaction between planting method and seed rate recorded significant results (Table 2). Ear length with flat sowing method increased with increase in seed rate and gave response up to the 125 kg seed/ha. The ear length with 125 kg seed/ha was 9.90 cm which was statistically at par with bed planting method with 112.5 kg seed/ha (9.89 cm) produced the maximum ear length. In bed planting method the ear length significantly decreased with increase in the seed rate of 125 from 112.5 kg/ha. All other interactions were non-significant.

Grains Per Ear

Wheat crop sown on 5 November produced significantly maximum number of grains per ear, which remained statistically at par with number of grains per ear of crop when sown on 15 November and significantly higher than the crop sown on 25 October. Tewari and Singh (8) recorded the similar results. The

Table 4. Effect of interaction between planting method and seed rate on grain yield of wheat (q/ha). CD ($P=0.05$), Seed rate = 1.09, Planting method = NS, Seed rate \times Planting method = 1.54.

| Planting method | Seed rate (kg/ha) | | | | Mean |
|-----------------|-------------------|-------|-------|-------|-------|
| | 87.5 | 100 | 112.5 | 125 | |
| Bed planting | 51.34 | 52.33 | 55.61 | 53.97 | 53.31 |
| Flat sowing | 51.01 | 52.00 | 53.14 | 54.96 | 52.77 |
| Mean | 51.17 | 52.16 | 54.38 | 54.46 | |

planting methods failed to produce any significant effect on the number of grains per ear of the wheat crop. The number of grains per ear increased with increase in seed rate from 87.5 kg seed/ha to 112.5 kg seed/ha and maximum number of grains per ear was recorded with 112.5 kg seed/ha which was statistically at par with 100 kg seed/ha and 125 kg seed/ha. Significantly lower number of grains per ear was recorded with the 87.5 kg seed/ha was due to lesser ear length recorded in 87.5 kg/ha seed rate used as compared to higher seed.

Interaction between planting method and seed rate recorded significant differences in results (Table 3). The number of grains per ear with flat sowing method increased with increase in seed rate and it increased up to the 125 kg seed/ha. The number of grains per ear with 125 kg seed/ha was 48.31, which was statistically at par with bed planting method with 112.5 kg seed/ha. In bed planting method the number of grains per ear significantly decreased with increase in the seed rate at 125 kg seed/ha from 112.5 kg/ha. Bed planting method with 112.5 kg seed/ha and flat sowing method with 125 kg seed/ha were produced the maximum number of grains per ear. Interaction of sowing time and planting method, sowing time and seed date, sowing time, planting method and seed rate was non-significant.

Grain Yield

The crop sown on 15 November gave maximum grain yield, which was statistically at par with 5 November sown crop and produced significantly higher than the crop sown on 25 October. Singh and Ahmad (9) also reported higher grain yield from the wheat sown on 15 November. Sowing methods did not influence the grain yield of the wheat crop significantly. Further, the grain yield increased with increase in seed

rate from 87.5 kg seed/ha to 125 kg seed/ha and maximum grain yield was recorded with 125 kg seed/ha remaining statistically at par with 112.5 kg seed/ha and produced significantly higher grain yield as compared to 87.5 kg seed/ha and 100 kg seed/ha seed rate.

Interaction between planting method and seed rate was significant (Table 4). The data revealed that grain yield in flat sowing method increased with increase in seed rate and gave response up to the 125 kg seed/ha. Under flat sowing method the grain yield was maximum with 125 kg seed/ha which was statistically at par with 112.5 kg seed/ha and significantly higher than 87.5 kg seed/ha and 100 kg seed/ha. In bed planting method higher grain yield was obtained with 112.5 kg seed/ha, which was significantly higher than 87.5, 100, and 125 kg seed/ha. Bed planting method sown with 112.5 kg seed/ha and flat sowing method shown with 125 kg seed/ha produced the maximum grain yield. Kumar et al. (10) also recorded the similar results. Interaction between sowing time and planting method, sowing time and seed rate and sowing time, planting method and seed rate was non-significant.

References

1. Kulhari S. C., S. L. Sharma and S. R. Kantwa. 2003. Effect of varieties, sowing dates and nitrogen levels on yield, nutrient uptake and quality of *durum* wheat. *Ann. Agric. Res.* 24 : 332—336.
2. Pandey A. K. and V. Prakash. 2003. Response of wheat varieties to seed rates under rainfed condition. *Ann. Agric. Res.* 24 : 567—569.
3. Anonymous. 2009. *Package and practices for rabi crops of Punjab*. Punjab Agric. Univ., Ludhiana, India.
4. Singh A. K. and G. L. Jain. 2000. Effect of sowing time, irrigation and nitrogen on grain yield and quality of *durum* wheat. *Ind. J. Agric. Sci.* 70 : 532—533.
5. Bhat M. A. and S. S. Mahal. 2006. Performance of wheat (*Triticum aestivum* L.) genotypes under different planting and weed control methods. *Crop Res.* 32 : 153—156.
6. Sen A., M. D. Pandey, S. N. Sharma, R. K. Singh, A. Kumar, P. Shukla and V. K. Srivastava. 2003. Surface seeding of wheat (*Triticum aestivum*) as affected by seed rate and nitrogen level. *Ind. J. Agric. Sci.* 73 : 509—511.
7. Basbag M., A. Alp and B. Samanci. 2003. Response of triticale (*Triticosecale*) to nitrogen and seeding rate under Turkey conditions. *Ind. J. Agron.* 48 : 287—289.
8. Tewari S. K. and M. Singh. 1993. Yielding ability of wheat (*Triticum aestivum*) at different dates of sowing—a temperature dependent performance. *Ind. J. Agron.* 38 : 204—209.
9. Singh N. B. and Z. Ahmad. 1997. Response of wheat (*Triticum aestivum*) varieties to differ dates of sowing. *Ind. J. Agric. Sci.* 67 : 208—211.
10. Kumar R., S. K. Aggarwal and R. K. Nanwal. 2007. Effect of planting systems, seed rates and nitrogen levels on bread wheat (*Triticum aestivum*). *Ind. J. Agric. Sci.* 77 : 669—671.