EFFECT OF SEED RATE AND ROW SPACING ON YIELD AND YIELD COMPONENTS OF WHEAT (*TRITICUM AESTIVUM* L.)

N. Iqbal, N. Akbar, M. Ali, M. Sattar and L. Ali*

ABSTRACT

A field experiment was conducted at Adaptive Research Farm, Vehari, Pakistan during 2006-07 to evaluate the effect of different seed rates and row spacings on the growth and yield of wheat (*Triticum aestivum* L.). Four levels of seed rates (125, 150, 175 and 200 kg/ha) and three row spacings (11.25, 15.0 and 22.5 cm) were tried (cv. Uqab 2002), The results showed that seed rate of 150 kg gave higher grain yield (4.10 t/ha). Among row spacings 22.5 cm performed better (3.96 t/ha) as compared to other spacings (3.82-3.87 t/ha). Interaction effect of seed rates and row spacings was non-significant.

KEYWORDS: ***Triticum aestivum;*** **seeding rates; spacing; agronomic characters; Pakistan.**

INTRODUCTION

Among the factors responsible for low wheat yield, delay in sowing, traditional sowing methods, low seed rate and improper row spacing are very important. Under the present practice of sowing wheat after rice and cotton, wheat sowing often gets delayed, reducing the yield to a considerable extent. Late seeding dates normally result in higher seeding rates because a delay in sowing normally reduces individual plant growth and tiller production (7, 12). Nazir *et al.* (10) concluded that seed rate of 150 kg gave significantly higher grain yield (3101 kg/ha) than 100 kg seed rate. According to Singh and Uttam (14) the highest yield was obtained by using a seed rate of 125 kg whereas, seed rate of 160 kg for getting maximum yield was suggested by Ram *et al.* (11). Dwyer *et al.* (5) observed that narrow row spacing causes higher leaf photosynethesis and suppresses weeds growth compared with wider row spacing. Narrow row spacing also produces high leaf area index (LAI), which results in more interception of photosynthetically active radiation (PAR) and dry matter accumulation (DMA) (16).

***Adaptive Research Farm, Vehari, Pakistan.**

Present study was planned to determine the appropriate seed rate and row spacing for getting maximum wheat grain yield under agro-ecological conditions of Vehari.

MATERIALS AND METHODS

This study was conducted at Adaptive Research Farm, Vehari, Pakistan during 2006-07. Four seed rates (125, 150, 175 and 200 kg) and three row spacings (11.25,15.0 and 22.5 cm) were tried on wheat variety Uqab-2000. The experiment was laid out in a split plot design with three replications. Seed rates were placed in main plot and row spaicngs in sub-plot. Net plot size was 4.50 x 11.10 m. Crop was planted with hand drill on November 28, 2006. NPK was applied @ 128:114:62 kg per hectare in the form of urea, SOP and SSP, respectively. Half nitrogen and whole phosphorus and potash were applied at sowing while remaining half nitrogen was applied at first irrigation. All other agronomic practices were kept normal and uniform.

Germination count was recorded three times after ten days of sowing from each sub-plot with the help of 1 m^2 quadrate and their means were calculated. At harvesting number of fertile tillers and total tillers were recorded three times from each sub-plot and their means were also calculated. Ten spikes were taken from each sub-plot, threshed manually, their total number of grains was counted and averaged as number of grains per spike. Five samples of thousand grains were taken at random from a total lot of each sub-plot and weighed on an electric balance and average 1000-grains weight was recorded. Wheat bundles of each sub-plot were threshed with thresher and average grain yield was recorded as kg per plot and converted into tons per hectare.

The data collected were analyzed by using standard procedure of Fisher's analysis of variance technique. Individual comparison of treatment means was made by using least significance difference test (LSD) at 5 percent probability level (15).

RESULTS AND DISCUSSION

Seed rates

The data (Table 1) revealed that there was an increase in germination count with increase in seed rate from 125 to 200 kg. Among seed rates, 200 kg gave significantly higher germination count (168.33/m^2) followed by 175 seed

Table 1. Effect of different seed rates on yield and yield components of wheat.

Seed rates (kg/ha)	Germination count/m^2	No. of fertile tillers/m^2	Total No. of tillers/m^2	No. of grains/ spike	1000-grains weight (g)	Av. grain yield (t/ha)
125	132.27d	237.73d	246.03d	40.30a	40.74a	3.669d
150	144.63c	253.00c	265.70c	39.46a	39.64b	4.120a
175	159.17b	263.97b	280.77b	37.50b	38.81c	3.904b
200	168.33a	278.73a	294.33a	36.61b	37.83d	3.785c
LSD	3.457	1.881	2.337	1.783	0.3283	0.1032

Any two means not sharing a letter in common differ significantly at 5% probability level (LSD).

rate (159.17/m^2) whereas, 125 kg seed rate gave significantly minimum germination count (132.27/m^2). These findings are in accordance with the work of Geleta *et al.* (6) who reported that increasing seed rates resulted in increased plants emerged. The data further depicted that there was linear increase in number of fertile tillers and total tillers with increased seed rate. Among seed rates, 200 kg produced significantly higher number of fertile tillers (278.75) and total tillers (294.33/m^2) followed by 175 kg seed rate (263.97 fertile tillers and 280.33 total tillers/m^2). Seed rate of 125 kg produced significantly the lowest number of fertile tillers and total tillers (237.73 and 246.03). These findings are in consonance with those of Kraft and Spiss (8) who reported that increasing seed rate increased the fertile tillers and total tillers significantly. Wheat planted at 125 kg seed rate produced significantly more number of grains per spike (40.30) which was, however, at par with 150 kg seed rate (39.46). Minimum number of grains (36.61) was recorded at 200 kg which was also at par with 175 kg seed rate (37.50). These findings confirm the results of Kraft and Spiss (8). Data further depicted that lower seed rates (125 kg/ha) produced significantly heavier grains (40.74 g) than higher seed rates (200 kg) (37.83 g). Bellatore *et al.* (3) and Silva and Gomes (13) reported that increasing seed rate reduced 1000-grain weight significantly. The results (Table 1) further revealed that grain yield was affected significantly by different seed rates. Seed rate of 150 kg produced significantly higher grain yield (4.120 t/ha) followed by 175 and 200 seed rate (3.904 and 3.785 t/ha). However, seed rate of 125 kg produced significantly lower grain yield (3.669 t). Nazir *et al.* (10) also found that 150 kg seed rate produced significantly the highest grain yield.

Row spacings

The data (Table 2) revealed that different row spacings also differed significantly and 11.25 cm row spacing gave significantly higher germination count (153.70/m^2), which was at par with 15 cm spacing (151.28/m^2). Row

Table 2. Effect of different row spacings on yield and yield components of wheat

Row	Germination	No. of fertile	Total No. of	No. of	1000-grains	Grain yield

spacings (cm)	count /m^2	tillers/m^2	tillers/m^2	grains/ spike	weight (g)	(t/ha)
11.25	153.70a	263.37a	275.60a	38.15a	38.81b	3.819b
15.00	151.28ab	258.85b	272.40c	38.45a	38.80b	3.866ab
22.50	148.33b	252.85c	267.13c	38.77a	40.16a	3.922a
LSD	3.148	1.850	2.490	NS	0.1448	0.07241

Any two means not sharing a letter in common differ significantly at 5 percent probability level (LSD).

spacing of 22.50 cm produced significantly lower germination count (148.33/m^2). Amjad and Anderson (2) reported that narrow row spacing produced significantly greater germination count. The results further revealed that different row spacings affected significantly the number of fertile tillers and total tillers per square meter. Row spacing of 11.25 cm produced significantly more number of fertile tillers (263.37/m^2) and total tillers (275.60/m^2) as compared to 22.50 cm (252.85 and 267.13/m^2) (Table 2). Al-Fakhry and Ali (1) have also reported that narrow row spacing increased number of fertile tillers and total tillers significantly over wider row spacing. Number of grains per spike was not affected significantly by different row spacings. Average grains per spike ranged from 38.15 to 38.77 (Table 2). These results are in conformity with those of Malik *et al.* (9) where number of grains per spike was not affected significantly by various row spacings. The data further showed that 1000-grain weight was affected significantly by different row spacings. Wider row spacing (22.50 cm) produced more 1000-grain weight (40.16 g) as compared to narrow row spacing of 11.25 cm (38.81 g). These results did not agree to those of Malik *et al.* (9), who reported that 1000-grain weight was not affected significantly by various row spacings. Grain yield was also affected significantly by row spacings and spacing of 22.50 cm produced significantly more grian yield (3.922 t/ha) which was at par with 15.00 cm row spacing (3.866 t/ha) (Table 2). These results contradict the findings of Bhullar and Wali (4) who reported that grain yield was higher at narrow row spacing.

Interaction of seed rates and row spacings

Interaction of seed rates and row spacings did not affect significantly the germination count, number of fertile tillers, total number of tillers, number of grains per spike, 1000-grains weight and grain yield.

CONCLUSION

The study concludes that seed rate of 150 kg per hectare performed better for late sowing of wheat upto 28th November. Among row spacings, 22.5 cm row spacing produced higher grain yield as compared to 11.25 and 15.00 cm row spacings.

REFERENCES

1. Al-Fakhry, A. K. and Y. A. Ali. 1989. Effect of plant densities and fertilization on yield of two wheat cultivars (*Triticum aestivum* L.) under rainfed conditions in Northern Iraq. Mesopotamia J. Agric. 21(1):221-236 [Field Crops Absts. 42(8):5792:1989].
2. Amjad, M. and W. K. Anderson. 2006. Managing yield reduction from wide row spacing in wheat. Aust. J. Exp. Agric. 46(10):1313-1321.
3. Bellatore, G. P., C. Di Prima and R. Sarmo. 1985. Effect of sowing density on biological performance and yield of various durum wheat cultivars. Rivista di Agronomic. 3(2-3):159-169 [Field Crops Absts. 30(4):2004; 1987].
4. Bhullar, M. S. and U. S. Wali. 2004. Effect of seed rate and row spacing on the efficiency of clodinafop for combating isoproturan resistant *Phalaris minor* in wheat. Plant-Protection-Quarterly. 19(4):143-146.
5. Dwyer, L. M., M. Tollenaar and D. W. Stewart. 1991. Changes in plant density dependence of leaf photosynthesis of maize (*Zea mays* L.) hybrids, 1959 to 1988. Can. J. Plant Sci. 71:1-11.
6. Geleta, B., M. Atak, P. S. Baenziger, L. A. Nelson, D. D. Baltenesperger, K. M. Eskridge, M. J. Shipman and D. R. Shelton. 2002. Seeding rate and genotype effect on agronomic performance and end-use quality of winter wheat. Crop Sci. 42(3):827-832.
7. Gooding, M. J. and W. P. Davies. 1997. Wheat Production and Utilization. CAB Int., Wallingford, UK.
8. Kraft, I. and L. Spiss. 1988. Relationship between stand density and yield components in wheat. Zbornik Biotechniske Fakultete Universe Advent Kardel No. 5:27-33 [Field Crops Absts. 43(7):4592; 1990].
9. Malik, M. A., M. H. Rasheed and A. Razzaq. 1996. Row spacing study on two wheat varieties under rainfed conditions. Sarhad J. Agric. 12(1):31-36.
10. Nazir, M. S., A. Jabbar, Z. Waheed, A. Ghaffar and M. Aslam. 2000. Response of late sown wheat to seeding density and nitrogen management. PNC. J. Biol. Sci. 3(6):998-1001.
11. Ram, K., T. Sing, H. Singh and A. S. Faroda. 1988. Effect of seed rate and spacing on grain yield of late sown wheat variety WH-291. Haryana Agri. Uni. J. Res. 18(1):26-28 [Field Crops Absts. 42(6):3874; 1989].

12. Satorre, E. H. 1999. Plant density and distribution as modifiers of growth and yield. p. 141-159. *In*: Wheat Ecology and Physiology of Yield Determination. Satorre, E. H. and G. A. Slafer (eds.). Food Products Press, New York.
13. Silva, D. B. and A. C. Gomes. 1990. Spacing and sowing density in irrigated wheat in the cerrado region. Pesquisa Agropecuaria Brasileira. 25(3):305-315 [Wheat, Barley and Triticale Absts. 9(4):3929; 1995].
14. Singh, V. P. N. and S. K. Uttam. 1994. Effect of seed rate and sowing depth on yield of wheat under saline-alkaline soil. Bhartiya Krishi Anusandhan Patrika. 9(1):73-76 [Field Crops Absts. 48(6):3929; 1995].
15. Steel, R. G. D., J. H. Torrie and D. A. Dickey. 1997. Principles and Procedures of Statistics. 3rd Ed. McGraw Hill Book Co., USA.
16. Tollenaar, M. and A. Auguilera. 1992. Ear and kernel formation in maize hybrids representing three decades of yield improvement. Crop Sci. 32:432-438.