Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.6719

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (3):** 403-409 (2018)

International Journal of Pure & Applied Bioscience

Research Article

OPEN ACCESS

Effect of Early and Mid Sowing on Growth and Yield of Wheat (*Triticum aestivum* L.) Varieties

Nawaz Ali*, Abhinav Dayal, Gabriyal M. Lal, Neha Thomas and Tarsem Singh

Department of Genetics and Plant Breeding, Naini Agricultural Institute (NAI)

Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad- 211007 UP (India)

*Corresponding Author E-mail: nawazali1994@gmail.com

Received: 25.05.2018 | Revised: 22.06.2018 | Accepted: 27.06.2018

ABSTRACT

The experiment was conducted at, Field Experimentation Center, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad during rabi of 2017-18. For this study different wheat varieties were sown on different time in Randomized block design (RBD). First sowing was done as early sowing on 15 November and second sowing on 01 December as mid sowing for evaluating whether different sowing time affect growth and yield parameters such as plant height (cm), Grain filling duration (days), Spike length (cm), Spike weight (g), Number of spike per plant, physiological maturity (days), Grain yield per plant (g), Grain yield per spike, Harvest index, Test weight (g) were considered for evaluating growth and yield. Study showed that varieties sown early performed better than mid sown wheat varieties in terms of plant height (cm), spike length (cm), spike weight (g), number of spike per plant, grain yield per plant (g), grain yield per spike (g), harvest index, test weight (g). On the basis of 12 early sown wheat varieties, HD-2967 showed maximum number of spike per plant (8.33), spike length (13.98 cm), spike weight (130.00 g), grain yield per spike (17.94 g) and grain yield per plant (18.30 g), test weight (48.80 g) whereas PBW-550 showed minimum plant height (74.33 cm) and grain filling duration (32.00 days). In mid shown wheat varieties Super-252 showed high Number of spike per plant (8.33), spike length (12.36 cm), spike weight (113.33 g), grain yield per spike (15.40 g), grain yield per plant (18.21 g), harvest index (84.25), test weight (43.5 g).

Key word: *Wheat varieties, Sowing time, Growth and Yield parameters.*

INTRODUCTION

Wheat is a cereal grass of the Graminae (Poaceae) family and of the genus Triticum, is the world's largest cereal crop. It has been described as the "King of Cereals" because of the acreage it occupies, high productivity and the prominent position it holds in the international food grain trade. According to the earliest historic records, wheat was an important cultivated cereal in South-western Asia, Syria, Northern Israel, Iraq and Eastern Turkey.

Cite this article: Ali, N., Dayal, A., Lal, G.M., Thomas, N. and Singh, T., Effect Of Early and Mid Sowing on Growth and Yield of Wheat (*Triticum aestivum* L.) Varieties, *Int. J. Pure App. Biosci.* **6(3):** 403-409 (2018). doi: http://dx.doi.org/10.18782/2320-7051.6719

Wheat was cultivated in ancient Greece and Egypt in pre-historic times. The central Asia, Near East, Mediterranean and Ethiopian regions are the world's most important centers of diversity of wheat and its related species[10,15].

Wheat (*Triticum aestivum* L.) is an important cereal grown as food grain in the world. Wheat has good nutrition profile with 12.1 percent protein, 1.8 percent lipids, 1.8 percent ash, 2.0 percent reducing sugars, 6.7 percent pentose's, 59.2 percent starch, 70 percent total carbohydrates and provides 314 Cal/100 g of food. It is also a good source of minerals and vitamins viz., calcium (37 mg/100g), iron (4.1mg/100g), thiamine (0.45mg/100g), riboflavin (0.13mg/100g), and nicotinic acid (5.4mg/100g)[20].

Wheat is grown in world on an area of about 222 million hectares with a production of 730 million tones and productivity of 32.9 quintal/hectare. Wheat is grown in India on an area of about 302.27 lakh hectares with a production of 93.50 million tones and productivity of 30.93 quintal/hectare, In Uttar Pradesh wheat is grown on an area of about 9.65 million hectares with production of 26.87 million tones and productivity of 27.86 quintal/hectare (Directorate of Economics and Statics, Department of Agriculture, Cooperation & Farmers Welfare, 2015-16).

Sowing time is very important in wheat crop as it may affect rice-wheat, maize-wheat cropping system if there in early or delay in wheat sowing. Early sowing always produces higher yield than late sowing and normal sowing gave higher grain yield than late sowing[16]. In India main cause of low yield is late sowing of wheat. Sowing date affects the growth and yield of wheat by affecting its environment. Early sowing always gives high yield than late sowing mainly due to longer duration of growth. Each day delay in sowing from 20th November onward decreases grain yield @ 39 kg ha-1[18].

Wheat (*Triticum aestivum* L.) is very sensitive to high temperature and trends in increasing growing season temperatures have already been reported for the major wheat-producing regions[2,9]. Though, heat stress affects the metabolic pathways at every stage of life of wheat finally leading to yield reduction, the effect of high temperature is particularly severe during grain filling; these losses may be up to 40% under severe stress[21,8]. Other effects of high temperatures are decreased grain weight, early senescence, shrivelled grains, reduced starch accumulation, and altered starch-lipid composition in grains, lower seed germination and loss of vigour[5]. Grain filling duration has been used as a parameter to identify heat tolerant wheat genotypes[22,12].

MATERIAL AND METHODS

The field experiment for the present investigation entitled "Effect of early and mid sowing on growth and yield of wheat (*Triticum aestivum* L.) varieties" was conducted during Ravi-2017-18 at field experimentation centre of Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India. The field experimental setup was laid out in randomized block design (RBD) with 3 replications during the 2017-18 growing season. Standard agronomic practices and plant protection measures were adopted as per schedule. Observations were recorded on five randomly selected plants per replications for plant height, number of spike per plant, spike length, grain filling duration, physical maturity were recorded on plot basis and 4 quality character spike weight, grain yield per spike, grain yield per plant, harvest index, test weight. The field data were analyzed statistically as per randomize block design (RBD) as suggested by[14].

OBSERVATIONS

Plant height (cm):

The height of main shoot was recorded from the base of plant to the tip of spike at the time of maturity including awns. Plant height was measured with the help of scale and expressed as the plant height in centimeters.

Grain filling duration (days):

The grain filling duration was observed for difference between days of flowering and days to maturity.

Spike length (cm):

Spike length of all wheat variety tagged plants were measured in centimeter and average recorded.

Spike weight (g):

The total spike weights from randomly selected tagged plants were balanced manually from each replication of variety. Average will be recorded as spike weight in gram.

Number of spike per plant:

The total number of spike from randomly selected tagged plants were count the spike and recorded number of spike per plant.

Days to physiological maturity (days):

Number of days taken from the date of sowing to the time when more than 75 percent of spikes on the plots turned golden yellow was workout and recorded in days.

Grain yield per plant (g):

The total yield from randomly selected tagged plants were weighted from each variety average was worked out and recorded yield (gram) as per plant.

Grain yield per spike (g):

The total yields of grain from randomly selected tagged plants were balanced manually from each replication of variety. Average was worked out and recorded as yield (g) of grain per spike.

Harvest index:

The total biological yield the entire plants above the ground level were harvested, sundried and weight at maturity. The value of harvest index was calculated from the following formula.

$$\text{Harvest index} = \frac{\text{Total biological yield}}{\text{Biological yield}} \times 100$$

Test weight (g):

The 1000 grains was counted randomly from the seed yield of each treatment in four replication and weight by adopting the procedure given by. The average weight was recorded in g.

RESULTS AND DISCUSSION

Plant height in early sown 12 wheat varieties ranged from 74.33 to 92.66 cm with mean value of 82.49 cm. Variety PBW-550 exhibited minimum plant height (74.33 cm), whereas variety HD-2967 exhibited high plant height (92.66 cm). Plant height in mid sown wheat varieties ranged from 72.40 to 96.00 cm with mean value 81.69 cm. Variety PBW-550 exhibited minimum plant height (72.40 cm), whereas variety Super-252 exhibited high plant height (96.00 cm).

Number of spikes per plant in early sown 12 wheat varieties ranged from 6.93 to 8.33 with mean value of 7.78. Maximum number of spikes per plant (8.33) was recorded in the variety HD-2967, whereas variety Lokman exhibited minimum number of spikes per plant (6.93). Number of spikes per plant in mid sown wheat varieties ranged from 6.26 to 8.33 with mean value 7.30. Maximum number of spikes per plant (8.33) was recorded in the variety Super-252, whereas variety Super-303 exhibited minimum number of spikes per plant (6.26).

Spike length in early sown 12 wheat varieties ranged from 9.66 to 13.98 cm with mean value of 11.45 cm. Variety HD-2967 exhibited maximum spike length (13.98 cm), whereas variety Lokman exhibited minimum spike length (9.66 cm). Spike length in mid sown wheat varieties ranged from 9.37 to 12.36 cm with mean value 10.86 cm. Variety Super-252 exhibited maximum spike length (12.36 cm), whereas variety Lokman exhibited minimum spike length (9.37 cm).

Grain filling duration in early sown 12 wheat varieties ranged from 32.00 to 36.00 days with mean value of 34.08 days. Variety HD-2967 exhibited long grain filling duration (36.00 days), whereas variety PBW-550 exhibited short grain filling duration (32.00 days). Grain filling duration in mid sown wheat varieties ranged from 28.33 to 32.66 days with mean value 30.44 days. Variety

PBW-502 exhibited long grain filling duration (32.66 days), whereas variety Super-252 exhibited short grain filling duration (28.33 days).

Physiological maturity in early sown 12 wheat varieties ranged from 81.00 to 120.66 days with mean value of 112.13 days. Variety Super-252 exhibited early physiological maturity (81.00 days), whereas variety M.D.Vijeta exhibited mid physiological maturity (120.66 days). Physiological maturity in mid sown wheat varieties ranged from 103.66 to 113.66 days with mean value 109.55 days. Variety PBW-550 exhibited early physiological maturity (103.66 days), whereas variety Kuber exhibited mid physiological maturity (113.66 days).

Grain yield per plant in early sown 12 wheat varieties ranged from 14.77 to 18.30 g with mean value 16.98 g. Variety HD-2967 exhibited maximum grain yield per plant (18.30 g), whereas variety PBW-154 exhibited minimum grain yield per plant (14.77 g). Grain yield per plant in mid sown varieties ranged from 13.86 to 18.21 g with mean value 16.05 g. Variety Super-252 exhibited maximum grain yield per plant (18.21 g), whereas variety PBW-154 exhibited minimum grain yield per plant (13.86 g).

Harvest index in early sown 12 wheat varieties ranged from 49.33 to 69.40 with mean value 63.72. Variety HD-2967 exhibited maximum harvest index (69.4), whereas variety Kuber exhibited minimum harvest index (49.33). Harvest index in mid sown varieties ranged from 58.43 to 84.25 with mean value 68.61. Variety HD-2967 exhibited maximum harvest index (84.25), whereas variety M.D.Vijeta exhibited minimum harvest index (58.43).

Test weight in early sown varieties was ranged from 35.60 to 48.80 g with mean value of 42.07 g. The variety HD-3086 exhibited highest test weight (48.80 g), whereas variety HD-2967 exhibited low test weight (35.60 g). Test weight in mid sown varieties was ranged from 32.60 to 43.50 g with mean value of 38.40 g. The variety Lokman exhibited highest test weight (43.50 g), whereas variety PBW-343 exhibited low test weight (32.60 g).

Table 1: Mean performance of early sown wheat varieties for pre and post-harvest observations

Varieties		Plant height (cm)	Number of spike per plant	Spike length (cm)	Grain filling duration (days)	Physiological maturity (days)	Spike weight (g)	Grain yield per spike (g)	Grain yield per plant (g)	Harvest index	Test weight (g)
PBW-154		81.53	7.66	10.95	33.33	112.33	123.33	10.59	14.77	62.61	45.6
PBW-343		83.93	8.23	10.92	33.33	118.00	116.66	9.94	15.57	60.64	38.4
PBW-502		79.06	7.06	11.94	35.66	114.00	125.00	10.74	16.63	62.24	40.4
PBW-550		74.33	8.10	10.18	32.00	109.66	110.00	11.78	15.67	65.87	41.8
HUW-234		89.26	7.36	11.48	33.00	117.00	121.66	13.02	17.91	69.36	36.1
HD-2967		92.66	8.33	13.98	36.00	115.00	130.00	17.94	18.30	69.4	35.6
Super-252		88.33	7.86	12.89	35.33	81.00	115.00	16.53	17.77	61.95	47
Super-303		82.30	8.13	12.40	32.66	118.66	125.00	15.31	17.60	61.55	42.4
HD-3086		77.46	8.20	10.80	35.33	110.66	125.00	10.89	16.50	60.36	48.2
Kuber		75.06	7.50	10.26	35.33	110.33	113.33	13.34	18.13	49.33	43.2
M.D.Vijeta		86.80	8.00	11.92	33.33	120.66	120.00	11.40	18.25	64.4	37.4
Lokman		79.13	6.93	9.66	33.66	118.33	83.33	17.09	16.76	64.95	48.8
Grand Mean		**82.49**	**7.78**	**11.45**	**34.08**	**112.13**	**117.36**	**13.21**	**16.98**	**62.72**	**42.07**
CD 5%		9.53	2.46	1.19	2.53	3.21	5.78	1.38	1.41	3.91	0.72
S E		3.22	0.83	0.40	0.86	10.39	14.39	0.46	0.69	82.49	0.09
CV		6.78	18.57	6.12	4.37	16.05	21.24	6.12	4.91	8.33	0.75
RANGE	**Max**	92.66	8.33	13.98	36	120.66	130	17.94	18.30	69.4	48.8
	Min	74.33	6.93	9.66	32	81	83.33	9.94	14.77	49.33	35.6

Table 2: Mean performance of mid sown wheat varieties for pre and post-harvest observations

Varieties		Plant height (cm)	Number of spike per plant	Spike length (cm)	Grain filling duration (days)	Physiological maturity (days)	Spike weight (g)	Grain yield per spike (g)	Grain yield per plant (g)	Harvest index	Test weight (g)
PBW-154		86.20	7.40	10.28	29.66	110.66	93.33	10.17	13.86	63.56	43
PBW-343		74.60	7.86	10.04	32.33	111.00	80.00	9.33	14.60	69.93	32.6
PBW-502		76.66	6.76	11.48	32.66	109.33	71.66	9.94	16.43	73.12	36.6
PBW-550		72.40	7.90	10.66	29.00	103.66	60.00	10.33	14.08	68.52	35.8
HUW-234		81.53	7.16	10.73	31.33	112.33	86.66	14.43	17.42	65.44	40.3
HD-2967		89.86	7.53	11.18	31.00	112.00	105.00	13.47	17.92	72.85	35.3
Super-252		96.00	8.33	12.36	28.33	109.00	113.33	15.40	18.21	84.25	39.8
Super-303		77.13	6.26	12.19	29.33	108.66	81.66	13.44	16.14	71.08	39.7
HD-3086		81.20	6.66	10.83	32.33	106.33	90.00	9.73	17.34	73.5	39.6
Kuber		85.00	7.40	9.95	30.33	105.33	81.66	14.95	15.13	62.23	41.3
M.D.Vijeta		82.66	7.73	11.28	29.66	113.66	93.33	10.64	16.10	58.43	33.4
Lokman		77.06	6.66	9.37	29.33	112.66	108.33	14.65	15.47	60.48	43.5
Grand Mean		**81.69**	**7.30**	**10.86**	**30.44**	**109.55**	**88.75**	**12.20**	**16.05**	**68.61**	**38.40**
CD 5%		9.53	2.13	1.48	1.74	2.37	24.56	1.11	1.15	2.73	0.75
S E		3.23	0.78	0.50	0.59	1.79	8.32	0.37	0.46	78.36	0.10
CV		6.84	18.64	8.01	3.36	2.83	16.24	5.36	4.26	11.24	0.85
Range	**Max**	96	8.33	12.36	32.66	113.66	113.33	15.40	18.21	84.25	43.5
	Min	72.4	6.26	9.37	28.33	103.66	60	9.33	13.86	58.43	32.6

Decrease in plant height in late sowing was due to shorter growing period. Early sown crop may have enjoyed the better environmental conditions especially the temperature and solar radiation which resulted to tallest plants. These results are in line with those reported by Shahzad *et al.*,[17]. Differences in plant height among varieties might be attributed to their genetic diversity. These results are similar to those of Ahmad[1]. Less number of grains per spike in mid sowing was due to less production of photosynthates due to shorter growing period. These results are in line with those of Shahzad *et al.*,[17]. Differences in number of grains per spike among varieties might be attributed to their genetic variability. These results are in line with those reported by Haider[7]. The early sowing resulted in better development of the grains due to longer growing period. These results are in line with those of Shahzad *et al.*,[17]. Lower grain yield in mid sowing was mainly due to less number of tillers, less number of grains per spike weight. These results are in accordance with those of Spink *et al.*,[19] and Aslam *et al.*,[4]. These results are similar to Shahzad *et al.*,[17]. Early sowing was mainly more number of tillers and more plant height. These results are in line with those of Donaldson *et al.*,[6]. They reported that early sowing resulted in higher biological yield more number of tillers. These results are in line with those of[11].

CONCLUSION

From the above study it was found that varieties sown early showed better results in terms of plant height, number of spike per plant, spike length, Spike weight, grain yield per plant, grain yield per spike, harvest index, test weight in comparison with mid sown wheat varieties.

Acknowledgement

Author is thankful to Advisor Dr. Abhinav Dayal, Co-Advisor Dr. G. M. Lal for continuous support, guidance, co - operation. Author feels immense pleasure to thank all the advisory committee members for their constructive criticism and special thanks to Head, Prof Dr. Suresh B. G. Department of Genetics and Plant Breeding for his encouragement and support throughout this study.

REFERENCES

1. Ahmad, I. Z., Effect of irrigation and cultivars on the growth and yield of wheat. M.Sc. (Hons.) Agri. Thesis, *University of Agriculture*, Faisalabad-Pakistan (1991).
2. Alexander, L.V., Zhang, X., Peterson, T. C., Caesar, J., Gleason, B., Tank, A.,

Haylock, M., Collins, D., Trewin, B. Rahimzadeh, F. Tagipour, A. Kumar, K.R. Revadekar, J. Griffiths, G. Vincent, L. Stephenson, D. B., Burn, J., Aguilar, E., Brunet, M., Taylor, M., New, M., Zhai, P., Rusticucci, M., Vazquez and Aguirre, J. L., Global observed changes in daily climate extremes of temperature and precipitation. *Journal of geophysical research Atmospheres*, **111:** 1-22 (2006).

3. Anonymous Annual report of Directorate of Economics & Statistics, *Department of Agriculture*, Cooperation & Farmers Welfare (2017).
4. Aslam, M., Hussain, M., Akhtar, M., Cheema, M. S. and Ali, L., Response of wheat varieties to sowing dates. *Pakistan Journal of Agronomy*, **2(4):** 190-194 (2003).
5. Balla, K., Karsai, I., Bencze, S. and Veisz, O., Germination ability and seedling vigour in the progeny of heat-stressed wheat plants. *Journal of Acta Agronomica Hungarica*, **60(4):** 299-308 (2012).
6. Donaldson, E., Schillinger, W. F. and Dofing, S. M., Straw production and grain yield relationship in winter wheat. *Crop Science*, **41:** 100-106 (2001).
7. Haider, R. S., Growth and yield response of three wheat varieties to N alone and in combination with P and P+K under late sown conditions. M.Sc. (Hons.) *Agri. Thesis*, *University of Agricuture*, Faisalabad-Pakistan (2004).
8. Hays, D., Mason, E., Hwa, D. J., Menz, M. and Reynolds, M., Expression quantitative trait loci mapping heat tolerance during reproductive development in wheat (*Triticum aestivum*). *Wheat production in stressed environments*, *Springer, Amsterdam*, 373-382 (2007).
9. Hennessy, K., Fawcett, R., Kirono, D., Mpelasoka, F., Jones, D., Bathols, J., Whetton, P., Stafford Smith, M., Howden, M., Mitchell, C. and Plummer, N., An assessment of the impact of climate change on the nature and frequency of exceptional climatic events. *Commonwealth Scientific and Industrial Research Organisation and Bureau of Meteorology* (2008).
10. Kundu, S. and Nagarajan, S., Distinguishing characters of Indian wheat varieties, Research Bulletin No. 4, *Directorate of Wheat Research, Karnal, India* (1996).
11. Matuz, J. and Aziz, J. S., The effect of sowing season on Iraqi and Hungarian wheat varieties. *Cereal Research Communication*, **18(1-2):** 41-43 (1990).
12. Mohammadi, V., Zali, A. A. and Bihamta, M. R., Mapping QTLs for heat tolerance in wheat. *Journal of Agriculture Science and Technology*, **10:** 261-267 (2008b).
13. Panse and Sukhtme, Statistical method for agriculture workers. *Indian Council of Agricultural Research*, New Delhi, 381 (1967).
14. Panse, V.G. and Sukhatme, P. V., Statistical methods for agricultural workers (2nd Ed.) *ICAR Publication, New Delhi*. 259 (1967).
15. Perrino, P. and Porcedu, E., Wheat genetic resources in Ethiopia and the Mediterranean region. In: Wheat Genetic Resources, Meeting Diversity Needs, *International Center for Agricultural Research in the Dry Areas*, 161-178 (1990).
16. Rajput, R. L. and Verma, O. P., Effect of sowing dates on the yield of different varieties of wheat in Chambal Command Area of Madhaya Pradesh Bharyiya Krishi Anusandhan Patrika. *Indian Journal of Agronomy*, **9:** 165-169 (1994).
17. Shahzad, K., Bakht, J., Shah, W. A., Shafi, M. and Jabeen, N., Yield and yield components of various wheat cultivars as affected by different sowing dates. *Asian Journal of PIant Science*, **1(5):** 522-525 (2002).
18. Singh, V. P. N. and Uttam, S. K., Influence of sowing dates on yield of wheat cultivar under saline sodic conditions in Central Uttar Pradesh. *Indian Agriculture*, **38(1):** 61-64 (1994).
19. Spink, J. H., Semere, T., Sparkes, D. L., Whaley, J. M., Foulkers, M. J., Clare, R.

W. and Scott, R. K., Effect of sowing date on plant density of winter wheat. *Ann. App. Biol*., **137:** 179-188 (2000).

20. Vaughan, D. A., Morishima, H. and Kadowaki, K., Diversity in the Triticum genus. *Current Openion in Plant Biology*, **6:** 139-146 (2003).
21. Wollenweber, B., Porter, J. R. and Schellberg, J., Lack of interaction between extreme high-temperature events at vegetative and reproductive growth stages in wheat. *Journal of Agronomy Crop Science*, **189:** 142-150 (2003).
22. Yang, J., Sears, R. G., Gill, B. S. and Paulsen, G. M., Quantitative and molecular characterization of heat tolerance in hexaploid wheat. *Euphytica*, **126:** 275-282 (2002b).