Vol.10 No. 2, Page No. 23–30 (2021)
Received: July, 2021; Accepted: September, 2021

Performance of Diverse Wheat Varieties at different Dates of Sowing under Changing Climate

Sant Bahadur Singh[1], Vishnu Shankar and Jitendra Kumar
[1]Associate Professor, Department of Agronomy, R.B.S. College, Bichpuri, Agra (U.P.) India
*Corresponding author's Email: jkyadav.ag@gmail.com

Abstract

Investigation was carried out during Rabi Season of 2018-19 under the Department of Agronomy at R.B.S. College, Agricultural Research Farm Bichpuri, Agra. Treatment combinations were compared in a split plot design having dates of sowing in main plots and varieties in sub plots with three replications. The soil of experimental field was sandy loam in texture. Number of grains and grains weight spike^{-1} were significantly higher with 05th Nov. (D_1) date of sowing as 25th Nov. (D_1), 15th Dec. (D_3) and 05th Jan. (D_4) dates of sowing. The 1000 grains weight reduced significantly from 05th Nov. (D_1) date of sowing to 25th Nov. (D_1), 15th Dec. (D_3) and 05th Jan. (D_4) date of sowing. Biological, grain and straw yields were obtained significantly higher with 05th Nov. (D_1) date of sowing over 25th Nov. (D_1), 15th Dec. (D_3) and 05th Jan. (D_4) dates of sowing. The highest harvest index was recorded with 05th Nov. (D_1) date of sowing and it was significantly higher over rest dates of sowing. Wheat crop sown at 05th Nov. (D_1) time gave higher net returns and B:C ratio over 25th Nov. (D_1), 15th Dec. (D_3) and 05th Jan. (D_4) sown crop. Variety HD-2967 (V_1) had significantly higher grain weight spike^{-1} over all other varieties. Variety HD-3086 (V_2) also had significantly higher grain weight spike^{-1} over rest of the varieties except HD-2967 (V_1). Significantly higher 1000 grain weight was obtained with variety HD-2967 (V_1) as compared to all other varieties. Variety HD-2967 (V_1) did not differ significantly with the variety HD-3086 (V_2), but both the varieties gave significantly higher biological yield as compared to all other varieties. Variety HD-2967 (V_1) gave significantly more grain yield over all other varieties. Variety HD-3086 (V_2) also had significantly higher grain yield over rest of the varieties. Variety HD-3086 (V_2) gave significantly higher straw yield as compared to other except HD-2967 (V_1). Variety HD-3086 (V_2) gave significantly higher harvest index as compared to all other varieties except HD-2967 (V_1). Highest net return ha^{-1} and B: C ratio were obtained from the wheat variety HD-2967 followed by variety HD-3086.

Keywords : Wheat varieties, dates of sowing, growth, yield.

Introduction

Wheat (*Triticum aestivum* L.*)* which belongs to the family *Poaceae* is the world's most widely cultivated cereal crop. In India, wheat is the second most important cereal crop next to rice contributing nearly 35 per cent to the national food basket and plays an important role in food and nutritional security. The major Wheat producing countries are China, India, USA, France, Russia, Canada, Australia, Pakistan, Turkey, UK, Argentina, Iran and Italy. These countries contribute more than 71% of the total world Wheat production. During 2015 India stood first in area and second in production next to China 130.18 million tonnes in the world. The India's share in world Wheat area was about 14.16%, whereas it occupied 11.74 % share in the total world Wheat production. India raises almost exclusively winter wheat. The major wheat growing areas in India are located in the northern regions of the country. The major Wheat producing States are Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan, Bihar, Maharashtra, Gujarat, Karnataka, West Bengal, Uttaranchal, Himachal Pradesh and Jammu & Kashmir. These States contribute about 99.5% of total Wheat production in the country. As per present population growth rate, population of India

by 2025 will be around 1.3 billion and assuming 20 percent more per capita requirement of food grain, due to better standard of living and increase in the demand of processing industries, requires wheat production to be around 109 million tonnes by the year 2025 AD. Therefore, in view of the above consideration the present investigation was conducted to find out the effect of sowing time on growth, yield attributes, and yields of wheat. To compare the performance of wheat varieties for growth, yield attributes and yield. To find out the effect of dates of sowing and varieties on economics of wheat production. To work out the economics of the crop.

Material and Methods

The present Field experiment was conducted at Agricultural Research Farm of Raja Balwant Singh College, Bichpuri Agra, during *Rabi* season of 2018-19.

To fulfill the requirement of objectives "Split-Plot Design" with four dates of sowing and four varieties replicated four times was adopted. Other details about treatments are given in Table 1:

Table1 Treatment details with notations

S. No.	Treatments	Notations
A.	**Dates of Sowing (main plots)**	
1.	05th Nov. 2018	D_1
2.	26th Nov. 2018	D_2
3.	15th Dec. 2018	D_3
4.	05th Jan.2019	D_4
B.	**Wheat Varieties (sub plots)**	
1.	HD-2967	V_1
2.	HD-3086	V_2
3.	PBW-343	V_3
4.	RAJ-4037	V_4

Pre-sowing irrigation was done to maintain the moisture for proper germination. At proper tilth two cross ploughings by tractor was done. After each ploughing, planking was done to bring the field in proper condition prior to sowing. Then field was finally laid out into plots leaving irrigation channels and bunds in between treatments. On third of recommended dose of nitrogen (150 kg N ha^{-1}), full doses of phosphorus (60 kg P_2O_5 ha^{-1}) and potash (40 kg K_2O ha^{-1}) were supplied through DAP and MOP, respectively as basal dose at sowing time. Remaining 2/3rd nitrogen was applied through urea top dressing 1/3rd after 1st irrigation and 1/3rd after 2nd irrigation. Seed material obtained from Directorate of Wheat Research (DWR), Karnal, Haryana, under All India Coordinated Wheat Improvement Project was treated with Agrosan GN @ 2 g kg^{-1} seed. The seed material of all the 4 varieties was applied @ 100 kg seed ha^{-1} (adjusted seed rate taking 1000 grain weight 38g) in furrows, 18 cm apart at the depth of 4-5 cm with the help of *kudali* and was covered by light planking. The crop was irrigated at the proper time as judged by the appearance of soil and the crop. Five irrigations were given to crop sown on all three dates of sowing. The source of irrigation water was canal and tube-well.

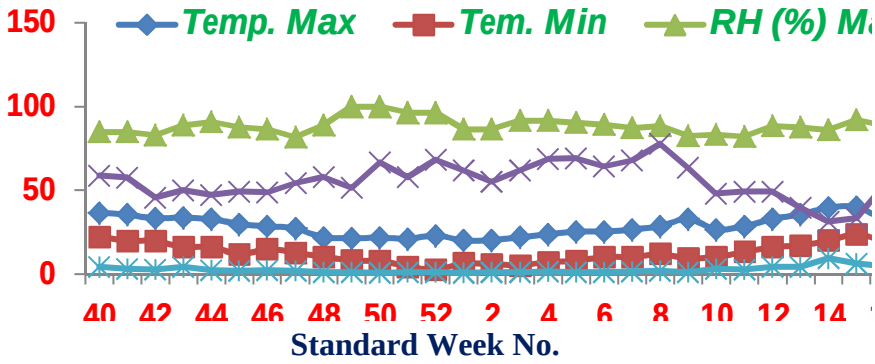

Fig.1 Weekly Meteorological data for Rabi season of 2018-19 recorded at observatory RBS College, Bichpuri, Agra

Result and Discussion

In case of wheat the main yield contributing characters are length of spike, number of spikelet's spike^{-1} number of grains spike^{-1}, grain weight spike^{-1} and 1000 grain weight. The variations in these yield attributes due to treatment effect were measured and results so obtained were subjected to statistical analyses. The data pertaining to the main effects of all yield attributes have been summarized in Table 2. A critical study of the data presented in Table 2 revealed that date of sowing had significant effect on length of spike. The length of spike significantly reduced with every delay in sowing date. Thus, lowest spike length was recorded with 5th Jan. (D_4) date of sowing. The magnitude of reduction in spike length with 25th Nov. (D_2), 15th Dec. (D_3) and 5th Jan. (D_4) dates of sowing were to the tune of 28.74, 4.16 and 3.51 percent, respectively when compared with 5th (D_1) date of sowing varieties under the test significant impact on length of spike. HD-2967 (V_1) produced longest spike and it was significant higher overall the varieties tested in this experiment. The differences in spike length due to HD-3086 (V_2) and PBW-343(V_3) 0were nominal and could not reach the level of significance, but they produced longer spike than that of RAJ-4037 (V_4). It is apparent that 5th Nov. (D_1) date of sowing had significantly higher number of fertile spikelets spike^{-1} over 25th Nov. (D_2) and 15th Dec. (D_3) as well as 5th Jan. (D_4) date of sowing. The variation in number of spikelets spike^{-1} due to 25th Nov. (D_2) and 15th Dec. (D_3) date of sowing was nominal and could not reach the level of significance. further revealed that variety HD-2967 (V_1) had significance more number of spikelets spike^{-1} as compared to all other varieties under test except variety HD-3086 (V_2). Variety HD-3086 (V_2) also gave significantly higher number of spikelets spike^{-1} over rest of the two varieties. Varieties HD-2967 (V_1) and HD-3086 (V_2) produced 4.52, 5.39 and 3.19 percent more spikelets spike^{-1} over PBW-343 (V_3) and RAJ-4037 (V_4) which were at par they with respect to spikelets spike^{-1}.

Table 2 Yield contributing characters of wheat as influenced by date of sowing and varieties

Treatments		Spike Length (cm)	No. of spikelet's spike^{-1}	No. of grains spike^{-1}	Grains weight spike^{-1} (g)	1000 grain weight (g)
Date of sowing						
05th Nov.	D_1	9.90	19.00	57.82	2.04	39.78
25th Nov.	D_2	8.01	18.44	56.51	1.99	39.13
15th Dec.	D_3	9.96	18.42	54.98	1.67	39.00
05th Jan.	D_4	7.69	18.04	54.93	1.43	38.34
SEm ±		0.40	0.19	0.44	0.02	0.18
CD at 5%		1.16	0.56	1.28	0.06	0.54
Varieties						
HD-2967	V_1	9.58	18.98	58.00	1.91	39.75
HD-3086	V_2	4.43	18.74	56.08	1.80	39.20
PBW-343	V_3	8.29	18.16	56.00	1.73	39.05
RAJ-4037	V_3	7.26	18.01	54.18	1.67	38.00
SEm ±		0.40	0.19	0.44	0.02	0.18
CD at 5%		1.16	0.56	1.28	0.06	0.54

The data presented in table 2 indicated that the number of grains spike^{-1} was significantly affected due to different date of sowing. The number of grains spike^{-1} significantly reduced with every delay in date of sowing. The magnitude of reduction in the number of grains spike^{-1} was to the tune of 2.32, 5.17 and 5.26 percent with 25th Nov. (D_2), 15th Dec. (D_3) and 5th Jan. (D_4) date of sowing as compared to 5th Nov. (D_1) date of sowing respectively. 15th Dec. (D_3) date of sowing was at par with 5th Jan. (D_4) and produced significantly a smaller number of grains apike^{-1} than that of 5th Nov. (D_1) and 25th Nov. (D_2) date of sowing. Variety HD-2967 (V1) produced significantly higher number of grains spike-1 over rest of the varieties. The increase in number of grains spike^{-1} due to variety HD-2967 (V_1) was to the tune of 3.42, 3.57 and 7.05 percent over HD-3086 (V_2), PBW-343 (V_3) and RAJ-4037 (V_4), respectively. Table 2 revealed that weight of grains spike^{-1} was significantly affected due to dates of sowing. The maximum weight of grains spike^{-1} was recorded with 5th Nov. (D_1) date of sowing which was significantly superior over all other dates of sowing and the increase was to the tune of 3.54, 22.75 and 43.36 percent, respectively. 25th Nov. date of sowing also registered significantly more weight of grains spike^{-1} than that of 15th Dec. and 5th Jan. date sowing. Variety HD-2967 (V_1) had significantly higher weight of grains spike^{-1} as compared to all other varieties. The variety HD-3086 (V_2) also produced significantly higher grains weight per spike as compared to PBW-343 (V_3) and RAJ-4037 (V_4) varieties. The 1000 grains weight reduced significantly with delay in sowing as compared to 5th Nov. (D_1) date of sowing. However, the difference in 1000 grains due to 25th Nov. and 15th Dec. date of sowing was nominal and could not reach the level of

significance. Variety HD-2967 (V_1) gave significance higher 1000 grains weight as compared to all other varieties under test. The magnitude of increase in 1000 grains weight with verity HD-2967 (V_1) was 1.40, 1.78 and 4.61 percent over varieties HD-3086 (V_2), PBW-343 (V_3) and RAJ-4037 (D_4), respectively.

Table 3 Biological, grain, straw yields and harvest index as influenced by date of sowing and varieties of wheat

Treatments		Biological yield (q ha^{-1})	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Harvest index (%)
Date of sowing					
05th Nov.	D_1	123.34	54.83	68.51	44.45
25th Nov.	D_2	108.85	46.98	61.87	43.16
15th Dec.	D_3	95.75	40.09	55.66	41.86
05th Jan.	D_4	84.24	32.18	52.06	38.20
SEm ±		0.79	1.53	0.88	0.47
CD at 5%		2.32	4.48	2.56	1.38
Varieties					
HD-2967	V_1	110.71	47.92	62.79	43.28
HD-3086	V_2	103.61	43.40	60.21	41.89
PBW-343	V_3	101.10	42.19	58.91	41.56
RAJ-4037	V_3	98.77	40.56	58.21	41.07
SEm ±		0.79	1.53	0.88	0.47
CD at 5%		2.32	4.48	2.56	1.38

The data summarized in table 3 revealed that biological yield was significantly affected due to date of sowing. Maximum biological yield was recorded with 5th Nov. (D_1) date of sowing which was significantly superior over all other dates of sowing. The next best time of sowing was 25th Nov. (D_2) which also produced significantly higher biological yield than 15th Dec. (D_3) and 5th Jan. (D_4) sowing. Sowing of wheat on 5th Nov. produced 13.30, 28.80 and 43.02 percent higher biological yield over 25th Nov. (D_2), 15th Dec. (D_3) and 5th Jan. (D_4) dates of sowing, respectively. Maximum biomass yield was recorded with variety HD-2967 (V_1) and which was significantly superior over all other varieties tested in this experiment. The data set out in table 3 indicated that dates of sowing had significant effect on grain yield. 5th Nov. (D_1) date of sowing resulted in significantly higher grain yield as compared to all the date sowing tested in this experiment. 25th Nov. (D_2) sowing also had significantly higher grain yield

than 15th Dec. (D_3) and 5th Jan. (D_4) sowing dates. The increase in grain yield with 5th Nov. sowing was to the tune of 16.71, 36.77 and 70.39 percent over 25th Nov. (D_2), 15th Dec. (D_3) and 5th Jan. (D_4) sowing dates respectively. Variety HD-2967 (V_1) had significantly higher grain yield up to 18.15 percent as compared to all other varieties. The maximum straw yield was recorded with 5th Nov. (D_1) date of sowing which was significantly higher over all other dates of sowing. 25th Nov. also had significantly higher straw yield than 15th Dec. and 5th Jan. date sowing. Variety HD-2967 (V_1) had significantly higher straw yield as compared to all other varieties. Varieties RAJ-4037 (V_4), PBW-343 (D_3) and HD-3086 (V_2) were found at par among them and could not cross the level of significance. The highest harvest index was recorded with 5th Nov. (D_1) sowing which was found significantly superior over all other dates of sowing. The difference in harvest index due to 25th Nov. (D_2) sowing was also significant than that of 15th Dec. and 5th Jan. date of sowing. Variety HD-2967 (V1) had highest harvest index which was significantly higher as compared to all other varieties. The difference in harvest index due to rest of the verities was nominal and could not reach the level of significance[2,4].

The grain yield with 5th Nov. (D_1), 25th Nov. (D_2), 15th Dec. (D3) and 5th Jan. (D_4) dates of sowing was 54.83, 46.98, 40.09 and 32.18 q ha^{-1}, respectively. The magnitude of increase in grain yield with 5th Nov. (D_1) sowing date was to the tune of 16.71, 36.77 and 70.39 percent, 25th Nov. (D_2), 15th Dec. (D_3) and 5th Jan. (D_4) date of sowing, respectively. Grain yield contributing characters *i.e.* length of spike, number of fertile spikelets $spike^{-1}$, number and weight of grains $spike^{-1}$ and 1000 grains weight due to date of sowing had similar trend to that recorded in grain yield ha^{-1}, which might be held responsible for higher grain yield ha^{-1} with 5th Nov. date of sowing. These results are inclose conformity with the findings of earlier investigators[5]. Like total biological yield and grain yield, straw yield was also considerable affected due to different dates of sowing. The Maximum straw yield was recorded with 5th Nov. (D_1) date of sowing and this decrease was rest dates of sowing. Similar trend were also recorded in case of number of shoots $metre^{-1}$ row length and plant height. Better Plant growth might be held responsible for higher straw yield ha^{-1} with 5th Nov. (D_1) sowing date, 25th Nov. (D_2), 15th Dec. (D_3) and 5th Jan. (D_4) dates of sowing. Gupta *et al.,* (2004) and Malik *et al.,* (2005) have also reported same results. The harvest index speaks the conversion efficiency of non-grains to grain portion by turning up nutrient uptake as well as its utilization. In this investigation the highest harvest index was recorded with 5th Nov. (D_1) date of sowing and it was higher by 25th Nov. (D_2), 15th Dec. (D_3) and 5th Jan. (D_4) dates of sowing. Many investigators[3,6,7,8] have also reported same results.

Variety HD-2967 (V_1) had significantly higher length of spike by rest of the varieties. HD-3086 (V_2) also had significantly higher length of spike by 21.07 to 28.74 percent over rest of varieties. HD-2967 (V_1) also had significantly higher total number of fertile spikelets $spike^{-1}$ over rest of the varieties except HD-3086 (V_2). HD-2967 (V_1) did not differ much with HD-3086 (V_2) but both the varieties produced higher number of grains $spike^{-1}$ by 3.48 and 3.57 to 7.05

percent, respectively over rest of the varieties whereas, variety HD-2967 (V_1) had significantly higher grain weight spike^{-1} by 4.05 to 7.78 percent over rest of the varieties. HD-3086 (V_2) also had higher grain weight spike^{-1} by 10.40 to 14.37 percent over rest of the varieties. HD-2967 (V_1) also produced considerably higher 1000 grains weight by 1.40 to 4.61 percent when compared with rest of varieties. HD-2967 (V_1) did not differ much with HD-3086 (V_2), but both the varieties gave considerably higher biological yield by 6.85 to 12.90 percent respectively over rest of the varieties. Whereas, variety HD-2967 (V_1) gave considerably more grain yield by 16.71 to 36.77 percent over rest of the varieties. HD-3086 (V_2) also had considerably higher grain yield by 20.06 to 33.62 percent when compared with rest of the varieties. The results of straw yield were similar to that recorded in biological yield. Harvest index was considerably higher with HD-2967 (V_1) over rest of the varieties. HD-3086 (V_2) also had higher harvest index over rest of the varieties.

Economics

The highest net profit of Rs. 65876.34 ha^{-1} and B: C ratio of 2.83 was recorded with when variety HD-2967 (V_1) sown at 5th Nov. (D_1) with this sowing date, the net return and B:C ratio with variety HD-3086 (V_2) was Rs. 63716.46 and 2.77, respectively. The additional net profit Rs. 2159.88 to Rs. 15119.16 was obtained by HD-2967 (V_1) while sown at 5th Nov. (D_1) date of sowing as compared to all other treatment combination. These results are in close conformity with the findings of other scientists[1,9].

Conclusion

Based upon the results of present investigation, 05th Nov. (D_1) sowing date has recommended to tested varieties of wheat under irrigated conditions for Agra region. Among the wheat Varieties tested, HD-2967 (V_1) be recommended and alternative variety is by HD-3086 (V_2) in respect of grain and straw yield. Date of sowing 05th Nov. (D_1) and varieties HD-2967 (V_1) interaction effect are good for Agra region. On the basis of maximum net return and B: C ratio wheat variety HD-2967 sown on 05th Nov. is recommended for the farmers of Agra region.

References

1. Bachhao, K.S., Kolekar, P.T., Nawale, S.S. and Kadlag, A.D. (2018). Response of different wheat varieties to different sowing dates, *Journal of Pharmacognosy and Phytochemistry*; **7**(1): 2178-2180
2. Gupta, A.K., Bali, A.S. and Dixit, A. K. (2004). Performance of wheat genotypes under different sowing schedules in Kashmir valley. *Environment and Ecology*, **22**(Spl-3): 521-523.
3. Mahmood, A., Wahla, A.J., Mahmood, R., Ali, L. and Nawaz, M. (2014). Impact of Sowing Time on Yield Parameters of Selected Wheat Cultivars under Rice Wheat Cropping System of District Sheikhupura, Punjab, *Biological (Pakistan)*, **60**(1), 31-36.

4. Malik, R.K., Singh, R.C., Kumar, S. and Kadian, V.S. (2005). Effect of planting date on performance of wheat (*Triticum aestivum* L.) genotypes. *Indian Journal of Agricultural Sciences*, **75**(2): 103-1 05.
5. Sardana, V., Singh, R.P., Gupta, S.K. and Chakraborty, D. (2005). Influence of sowing time and nitrogen on productivity and quality of durum wheat (*Triticum aestivum* L.). *Annals Agriculture Research, New Series*, **26**(3): 411-415.
6. Shirpurkar, G.N., Kashid, N.V., Garve, R.S. and Gavhan, V.N. (2006). Effect of date of sowing on grain yield and yield contributing characters of wheat. *Gaurav Society of Agricultural Research Information Centre, Hissar*, **7**(2): 592-593.
7. Sial, M.A., Arain, M.A., Shamadad Khanzada, Naqvi, M.H., Dahot, M.U., and Nizamani, N.A. (2005). Yield and quality parameters of wheat genotypes as affected by sowing dates and high temperature stress. *Pakistan Journal of Botany*, **37**(3): 575-584.
8. Tan, FeiQuan, Jiang, HuaReng and Ren, ZhengLong (2009). Effect of sowing dates on growth and development, grain filling characters and yield of wheat cultivar J210 in Sichuan Basin. *Journal of Triticeae Crops*, **29**(1): 122-127.
9. Upadhyay, R.G., Rajeev Ranjan and Negi, P.S. (2015). Influence of Sowing Dates and Varieties on Productivity of Wheat under Mid Himalayan Region of Uttarakhand. *International Journal of Tropical Agriculture*, **33**(2):1905-1909.