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Yield and yield attribute of Wheat (*Triticum aestivum* L.) crop as influenced by different sowing dates and varieties grown under Agro-climatic conditions of Eastern Uttar Pradesh

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ABSTRACT

A field experiment was carried out at Agro meteorological Research Farm, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.) during rabi season of 2021-22 and 2022-23 to investigate the influence of different dates of sowing and varieties on wheat yield and yield attributes. The experiment comprised nine treatment combinations and conducted in split plot design and replicated four times. Treatment consisted of three dates of sowing *viz.*15th November, 1st December and 15th December with three varieties *viz,* Wb2, K1317 and K9423. Among the varieties, Wb2 took relatively longer duration for maturity compared to K1317 and K9423. Results reveal that 15th November and Wb2 obtained higher values of effective tiller m^{-2}, ear length, grains per ear, test weight followed by 1st December and minimum values were observed for crops sown on 15th December date of sowing during both year of experiment. There was significant variation observed in the grain yield, straw yield, biological yield and harvest index among the three distinct dates of sowing. The highest yield 43.9 and 42.7 q ha^{-1} were recorded under the 15th November, followed by 1st December (41 and 39.5 q ha^{-1}) and minimum at 15th December (38.3 and 37.2 q ha^{-1}) during both year of experiment respectively. Among the varieties, Wb2 has obtained the maximum values of yield 44.8 and 43.5 q ha^{-1} compared to K1317 (40.2 and 39.2 q ha^{-1}) and K9423 (37.9 and 36.7 q ha^{-1}) during 2021-2022 and 2022-2023, respectively.

Key words: *Wheat, Sowing dates, Varieties, Yield and yield attributes.*

Introduction

Wheat (*Triticum aestivum* L.) appertains to the family *Gramineae* and its most stable food in India. Even though India is second largest producer of wheat in the world with about 31.61 million hectares area,

109.59 million tonnes production and 3464 kg/ hectare yield. The major wheat producing states are Uttar Pradesh and Madhya Pradesh, which occupy 31.16 % (9.85 million hectares), 20.20 % (6.39 million hectares) in area and 32.42 % (35.50 million tonnes), 16.08 % (17.62 million tonnes) production of total wheat cultivation in the country, respectively (Directorate of Economics and Statistics, DA&FW, 2021)

India is endowed with both the fertile land and extremely suitable weather & climate ideal for growing crops. Wheat is highly adaptable to a wide range of climates, extending beyond tropical and subtropical zones to encompass temperate and varied humid to dry environments. After that, there are yet numerous aspects that cause for low average yield of wheat in this country. Sowing of wheat crop at optimum time according to environmental conditions is the best way to increasing crop growth and yield. It is susceptible to low temperatures in the early part of the growing season and hot temperatures in the later half. Another important aspect is choose of improved varieties which are having short maturity and suitable in the late planting phase condition due to relatively shorter growing period available to the crop. One significant climatic component that has a significant impact on the yield of Rabi crops is seasonal temperature. Seasonal temperature variations primarily impact phenological development processes, which in turn impact grain yield. Winter crops are particularly susceptible to high temperatures during the reproductive stages, and differing production settings have been shown to cause different crops to respond differently to temperature changes (rises) (Ram *et al*. (2012)

Materials and Methods

The field experiment was carried out during *Rabi* season of 2021-22 and 2022-23 at the Student Instructional Research Farm, Department of Agricultural Meteorology Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (26°.47′N, 82°.12′E and 113 m above mean sea level). Experiment was laid out with three date of sowings 15th November, 1st December, 15th December along with three varieties was (Wb2, K1317, K9423) under Split plot design, date of sowing as main plot treatment and varieties as sub plot treatment with four replication at semi-arid climatic condition of eastern plain zone of Uttar Pradesh zone.

The observations recorded included number of effective tillers/m^2, ear length; number of grains per ear, test weight, grain yield, straw yield, biological yield and harvest index .the data collected were analyzed statistically separately as per the procedure given by Panse and Sukhatme (1967).

Effective tillers/ m^2

Number of effective shoots were counted before harvesting from 3 randomly plots of one m^2 earlier fixed to record plant population, then averaged.

Ear length (cm)

Length of 10 ear heads randomly selected in each plot was measure from base to tip of ear head excluding awns and then averaged.

No. of grains per ear

The ear heads used to measure the length were threshed and number of grains were counted and averaged.

Grain, Straw and biological yield (q ha^{-1})

The crop from each net plot was harvested and tied. The total biomass weight (grain and straw) was obtained by weighing the bundles after proper sun-drying. The grain from each bundle was threshed out and the weights of cleaned grains were noted. The straw yield was obtained by subtracting the grain yield from the total biomass of respective treatments.

Test weight (g)

One thousand healthy grains from net plot were counted and weighed to get 1000 grain weight (g).

Harvest index (%)

The recovery of grain in total dry matter was considered as harvest index which was expressed in percentage and calculated by using following formula.

$$\text{Harvest Index (\%)} = \frac{\textbf{Grain yield (q per ha)}}{\textbf{Biological yield (q per ha)}} \times 100$$

Results and Discussion

Yield attributes

All yields attributes were significantly affected by the date of sowing, delayed sowing decreased number of effective tillers, ear length, grains per ear and test weight shows in Table 1. Sowing at November 15th significantly influenced the entire attributing

characters and significantly outperforming over 1st December and 15th December sowings. Analysis revealed that the timely sown condition brought about 13 percent higher number of effective tillers 14 percent higher ear length, 12 percent higher grains per ear, 7 percent higher test weight compare to late sown condition. This might be due to prevailing of favourable temperature required for wheat crop for higher photosysnth ate accumulation consequently results also in conformity Mukherjee (2010).

Further, data revealed that grains per ear, ear length and 1000 grain weight were significantly higher at November 15th sowing as compared to 1st December and 15th December in both years. These results are in the line with those of Shehzad *et al*. (2002). Decreased in test weight in December 15th due to delay sowing was mainly due to reduction in growth period and shriveling of grain due to high temperature prevailed during milk and grain filling stage. Higher grain yield in timely planting wheat was also recorded by Ram *et al.* (2012) due to increased higher growing degree days, photo-thermal units and yield attributes.

Variety Wb2, recorded higher ear length, more grain per ear and higher test weight than that of recorded with varieties K1317 and K9423 in first and second years. The higher yield attribute of wb2 can be due to prevailing of favourable temperature required for wheat crop variety for higher photosynthate accumulation consequently resulting in higher yield. Akhtar *et al*. (2002) and Kumar *et al*., (2005) also observed similar trend among the different varieties.

Table 1. Effect of date of sowing and varieties on yield contributing characters of wheat crop

Treatments	No of effective tillers m^{-2}		Length of ear (cm)		No of grain ear^{-1}		Test weight (g)	
	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23
Dates of sowing / Weather Variability								
15th Nov	373.3	371.1	10.5	10.1	42.6	41.8	38.4	37.4
1st Dec	349.5	348.8	9.8	9.5	40.1	39.2	36.4	35.4
15th Dec	328.9	328.9	9.2	8.9	38.1	37.3	36.0	34.8
SEm±	3.15	2.35	0.03	0.04	0.21	0.20	0.23	0.25
CD at 5%	11.14	8.29	0.11	0.14	0.72	0.64	0.81	0.72
Varieties								
WB2	349.5	348.1	11.5	11.1	38.3	37.6	33.5	32.5
K1317	360.0	359.3	9.6	9.4	39.7	39.0	37.3	36.3
K9423	342.2	341.4	8.1	8.0	42.7	41.7	39.9	38.8
SEm±	1.48	1.74	0.05	0.02	0.22	0.23	0.25	0.32
CD at 5%	4.4	5.21	0.14	0.12	0.67	0.59	0.76	0.81

Table 2. Effect of date of sowing and varieties on grain yields, straw yields, biomass yields and harvest index of wheat crop

Treatments	Grain yield (q/ha)		Straw yield (q/ha)		Biological yield (q/ha)		Harvest index(%)	
	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23	2021-22	2022-23
Dates of sowing / Weather Variability								
15th Nov	43.9	42.7	64.8	64.0	108.7	106.8	40.4	40.0
1st Nov	41	39.5	57.2	56.7	97.8	96.2	41.6	41.2
15th Dec	38.3	37.2	51.5	51.4	89.9	88.5	42.8	42.1
SEm±	0.21	0.28	0.4	0.18	0.66	0.42	0.30	0.33
CD at 5%	0.74	0.99	1.41	0.64	2.36	1.49	1.07	1.1
Varieties								
WB2	44.8	43.5	64.7	64.1	109.5	107.7	40.9	40.4
K1317	40.2	39.2	58.8	58.5	99.0	97.7	40.7	40.2
K9423	37.9	36.7	50.0	49.4	87.9	86.2	43.3	42.7
SEm±	0.22	0.21	0.38	0.34	0.53	0.56	0.16	0.20
CD at 5%	0.68	0.65	1.15	1.04	1.59	1.68	0.48	0.60

Yield

The results pertaining to grain, straw, biological yield and harvest index in relation to sowing dates and varieties are presented in Table 2. The wheat sown on 15th November produced significantly higher grain yield than 1st December and 15th December sown wheat in both years. Among varieties Wb2 was significantly superior over K1317. However, K1317 was significantly superior over K9423. The timely sown condition produced significantly higher harvest index than late sown condition. The different varieties also failed to cause significant effect on harvest index. Ram *et al*. (2012) also reported similar genotype variation in yield and harvest index.

Conclusion

Based on two years experiment it was concluded that 15th November is the best sowing time for wheat crop to obtained higher yield. Among varieties, Wb2 performed best in term of yield and yield attributes. All varieties resulted in significantly higher grain yield with 15th November sowing compared to 1st December and 15th December and showed good potential for sustainable production and proved to be quite remunerative in UP.

Conflict of Interest- None

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