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## Effects of Sowing Dates on Yield and Yield Components of Different Varieties of Wheat (*Triticum aestivum* L.) in Western Uttar Pradesh

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### Abstract

An experiment was conducted during *Rabi* season (November-December) of 2018–19 to study the effect of three dates of sowing (26<sup>th</sup> November, 11<sup>th</sup> December and 25<sup>th</sup> December) on growth, yield attributes and yield of five wheat varieties (HD-2967, HD-3086, WH-1105, PBW-343 and PBW-226) at Agricultural Research Farm of IFTM University, Moradabad (UP) India. The experiment was laid out in Factorial Randomized Design with two replications. Sowing was done at spacing of 22.5 cm in sandy loam soil. The observations were recorded on growth, flowering, maturity, yield and yield components. Analysis of variance showed the significant variations were observed for the characters viz. plant height, days to flowering, spikes per plant, days to maturity, grain yield, test weight, straw yield, biological yield and harvest index due to changing dates of sowing. However, varietal variations were recorded for plant height, days to flowering, spikes per plant, days to maturity and test weight. Wheat sown on 26<sup>th</sup> November recorded significant increase in plant height, tillers plant<sup>-1</sup>, spikes<sup>-1</sup> plant, grain yield and straw yield over late sowing on 11<sup>th</sup> December and 25<sup>th</sup> December. There was no significant variation among varieties for yield and yield contributing traits such as grains spike<sup>-1</sup>, grain and straw yield. Significant interaction effects between dates of sowing and varieties were found for days to flowering which showed that the variety HD-2967 is as best wheat variety for early sown and PBW-226 for late sown conditions in order to obtain better returns.

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**Keywords:** Growth, sowing dates, varieties, wheat, yield

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### 1. Introduction

Wheat (*Triticum aestivum* L.) is one of the major food grain crops of the world including India. India produced about 96.16 million tonnes of wheat from an area of 30.33 million hectares with an average productivity of 3171 kg ha<sup>-1</sup> (DES, 2020). Uttar Pradesh, which is one of the major wheat growing states, produced 32.59 million tonnes of wheat from 9.50 million hectares area ((DES, 2020). The influence of planting dates on productivity of agronomic crops assumes pivotal significance. Planting date is determined through occurrence of weeds, diseases and pests attacks, and temperature of soil and environment. The sowing date defines the environmental conditions to which the crop will be exposed in key moments of its developmental cycle (e.g., critical periods for yield and quality components). An appropriate planting time is different in various agroecological conditions. Optimum sowing date enhanced yield components and yield to ensure food security worldwide (Abbas et al., 2019). Proper time of sowing helps cultivars to express its growth patterns to its full extent in a diverse setting of environmental

dynamic beside genotype environmental interaction as it also helps scientist of particular environment (area) for maximizing the yield (Shah et al., 2006). Some researcher reported that wheat sown between 15–30<sup>th</sup> November gave more grain yield (Kumar et al., 2000; Akhtar et al., 2006). Appropriate sowing time of various field crops results in higher economic yield as it helps varieties to express their full growth potential. Thus, the sowing time of wheat crop plays a pivotal role where climatic conditions vary throughout the country and delay in sowing decreases wheat grain yield by 58.2 per cent (Ali et al., 2004). Ouda et al. (2005) reported that delay of sowing date in wheat till the end of December reduced grain yield by about 16%. Late planting of wheat results poor tillering and more chances of winter injury (Joshi et al., 1992). Under late sown condition wheat crop exposed to low temperature at the germination, which delayed the crop emergence and higher temperature at the reproductive phase leads to force maturity and resulted in reduction of the yield and yield attributes (Gupta et al., 2017). Being a temperature sensitive crop, late sown crop is exposed to low temperature at the time of establishment and to high temperature at the reproductive



phase that finally leads to accelerated maturity of crop and thus crops mature early in North Indian condition. This not only affects yield, but also affects the yield components and other aspects of the growth and development of wheat. It is generally associated with a reduced kernel weight (Radmehr et al., 2003), a reduced number of spikes per plant and per unit area (Stapper and Fischer, 1990), harvest index, grain number per spike, and leaf area index (Jessop and Ivins, 1970). Since wheat yield and end-use quality depend upon the environment, genotype, and their interaction; therefore, the present investigation was undertaken to study the effect of sowing dates on different wheat varieties.

## 2. Materials and Methods

A field experiment on wheat crop was conducted during rabi season (November-December) of 2018–2019 at the Agricultural Research Farm of IFTM University, Moradabad, Uttar Pradesh, India. The experimental site is situated in the village Lodhipur Rajput at Delhi Road NH-24, Moradabad, (U. P.) near the banks of Ram-Ganga River. This city is situated in western U.P. between 28°21' to 28°16' Latitude North and 78° 4' to 79° Longitude East and above mean sea level of 193.23 meters. The experimental plots have uniform topography with homogenous fertility and soil characteristics typical to suit wheat crops cultivation. The fields were fairly levelled and had good drainage having assured irrigation facility. Field experiment comprising of three dates of sowing, 26<sup>th</sup>

November, 11<sup>th</sup> December and 25<sup>th</sup> December and five varieties, HD-2967, HD-3086, WH-1105, PBW-343 and PBW-226 was laid out in Factorial Randomized Design with two replications. Sowing was done at spacing of 22.5 cm. The crop was fertilized @ 120:60:40 of N<sub>2</sub>, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O kg ha<sup>-1</sup>, of which half dose of the nitrogen, full dose of phosphorus and potassium was applied as a basal dose whereas remaining half of nitrogen was applied in two equal splits, first at CRI stage and second at maximum tillering. During the crop season, mean weekly maximum temperature ranged between 35.80°C to 12.28°C and minimum temperature between 3.0°C to 17.60°C. The observations were recorded on various quantitative characters such as growth, flowering, maturity and yield parameters. The data was statistically analysed using OP-state software following the procedure for two factor analysis in Randomized Block Design (RBD). The standard errors of mean were calculated for each factor of investigation and critical differences (CD) at 5% level were worked out for comparing the treatment means wherever 'F' test was found significant.

## 3. Results and Discussion

Analysis of variance (Table 1) showed that significant differences were observed for the characters viz. plant height, days to flowering, spikes per plant, days to maturity, grain yield, test weight, straw yield, biological yield and harvest index due to changing dates of sowing. However, varietal

Table 1: Analysis of variance for thirteen quantitative traits of Wheat as influenced by dates of sowing and varieties

Source of variation	DF	Days to flowering	Plant height	No. of tillers plant <sup>-1</sup>	No. of reproductive tillers plant <sup>-1</sup>	Spike plant <sup>-1</sup>	Spike length	No. of grain spike <sup>-1</sup>
Dates of sowing (D)	2	412.93**	52.57**	0.89	0.47	15.28**	1.00	127.47
Variety (V)	4	74.67**	26.31**	0.28	0.10	7.70**	0.12	43.77
Interaction (D×V)	8	11.27**	4.02	0.16	0.21	0.34	0.44	18.30
Error	15	0.50	2.38	0.35	0.26	1.37	0.50	41.05

Table 1: Continue...

Source of variation	Days to maturity	Grain yield	Test weight	Straw yield	Biological yield	Harvest index
Dates of sowing (D)	516.13**	645.90**	88.21**	376.06**	1829.61**	146.88**
Variety (V)	83.33**	21.68	30.45	36.40	72.49	18.84
Interaction (D×V)	0.133	29.86	4.60	12.96	49.56	16.20
Error	0.50	47.72	3.19	30.33	109.61	18.272

variations were recorded for plant height, days to flowering, spikes plant<sup>-1</sup>, days to maturity and test weight. Interaction between dates of sowing and varieties were found significant for days to flowering indicating selection of varieties for different sowing dates, delay in sowing resulted early flowering that might be due to prevalence of high temperature during vegetative phase. Kumar et al. (2017) also reported significant variation for growth, flowering, maturity, yield and yield attributing traits of wheat.

The effects of sowing dates on quantitative traits of wheat crop and different varieties have been presented in Table 2. Flowering in wheat was significantly affected by varied dates of sowing and varieties. Sowing done at November 26<sup>th</sup> took significantly maximum days (91.10) to flowering which followed by 11<sup>th</sup> December and 25<sup>th</sup> December. Among the varieties, PBW- 226 was too early (80.50 days) in flowering and HD- 2967, too late (89.93 days). The flowering in plant delayed with timely sown crop because crop exposed to favourable

Table 2: Effect of sowing dates and varieties on quantitative traits of wheat

Source of variation	Days to flowering	Plant height	No. of tillers plant <sup>-1</sup>	No. of reproductive tillers plant <sup>-1</sup>	Spike plant <sup>-1</sup>	Spike length	No. of grain spike <sup>-1</sup>
26 <sup>th</sup> Nov.	91.10	101.42	6.36	4.76	7.84	9.05	48.41
11 <sup>th</sup> Dec.	88.50	97.63	5.93	4.64	6.67	8.56	55.04
25 <sup>th</sup> Dec.	78.90	97.29	6.13	5.64	6.13	9.15	54.03
LSD	0.68	1.05	NS	NS	0.30	NS	NS
<b>Verities</b>							
HD-2967	89.93	99.87	6.22	4.71	7.40	8.99	52.72
HD-3086	85.83	98.38	6.28	4.67	7.30	8.79	55.51
WH-1105	86.50	96.13	6.00	4.80	6.37	9.08	53.80
PBW-343	88.17	97.85	6.23	4.82	7.15	8.98	52.23
PBW-226	80.50	101.67	6.56	5.10	6.17	8.75	48.22
LSD	0.88	1.93	NS	NS	0.39	NS	NS

Table 2: Continue...

Source of variation	Days to maturity	Grain yield	Test weight	Straw yield	Biological yield	Harvest index
26 <sup>th</sup> Nov.	126.90	41.51	38.00	53.28	94.04	47.10
11 <sup>th</sup> Dec.	117.90	40.76	35.00	46.73	88.23	43.23
25 <sup>th</sup> Dec.	112.70	27.23	32.06	41.03	68.25	39.43
LSD	0.68	6.69	1.72	5.33	10.14	4.14
<b>Verities</b>						
HD-2967	120.83	37.03	35.93	51.18	88.20	41.42
HD-3086	120.83	39.08	37.88	46.70	85.78	45.38
WH-1105	120.83	36.45	35.13	44.70	81.15	44.63
PBW-343	120.83	33.78	34.43	45.85	79.63	41.59
PBW-226	112.50	36.15	31.72	46.63	82.78	43.25
LSD	0.88	NS	2.22		NS	NS

weather during the whole life cycle and thus the different phases of plant life could be completed at appropriate timing. Under later sown condition the plants were forced to early flowering because of sudden rise in temperature coupled with hot wind. These results are in close conformity with the finding of Gupta et al. (2017).

Dates of sowing exhibited significant differences for plant height was noticed till maturity. Maximum plant height was recorded on sowing date November 26<sup>th</sup> (101.42 cm) and in variety PBW-226 (101.67 cm) at par with HD-2967 (99.87 cm) as compared to late sowing and other varieties. Plant height is mainly controlled by the genetic makeup, but it is also affected by environmental conditions. This attributed to maximum period of low temperature and short photoperiod was available for vegetative growth to 26<sup>th</sup> November sown crop in comparison to late sowing. The height of the plants appears to be modified by the adverse environmental conditions. The findings of this investigation were similar with those observed by Behera (1994); Shahzad et al. (2007);

Tomar et al. (2014); Kumar (2016).

Number of tillers plant<sup>-1</sup> and reproductive tillers plant<sup>-1</sup> was not significantly influenced by dates of sowing and varieties. This indicates the close genetic variation among five varieties taken for experiment. Management practices such seeding rate and N application timing can influence tiller development (Bauer et al., 1984; Tilley et al., 2015).

The number of spike plant<sup>-1</sup> of wheat was influenced by different sowing intervals and varieties. It is apparent from the results that the number of spike plant<sup>-1</sup> (7.84) was maximum in the crop was sown on 26<sup>th</sup> November, followed by decrease in average number of spike plant<sup>-1</sup> with delayed sowing. This indicated that the differences in the spike per plant of wheat were non-linearly associated sowing dates. Thus, crop sown in the first and second fortnight of November could produce many spikes. Among varieties, HD-2967 produced maximum spikes plant<sup>-1</sup> (7.40).

The results for the effect of sowing dates and varieties



indicated that no significant difference for spike length of wheat. In contrary, the results pertaining to spike length of wheat as influenced by various sowing dates were found significant in the findings of Vahid et al. (2010). Similarly, the number of grains per spike was non-significantly influenced by varied dates of sowing and varieties. These results are in contrary with the findings of Shahzad et al. (2002); Tahir et al. (2009).

Days to maturity in wheat were influenced by dates of sowing and varieties, the results are presented in the Table 2. The crop sown on 26<sup>th</sup> November took significantly maximum 126.90 days, followed by 11<sup>th</sup> December and 25<sup>th</sup> December. The variety, PBW- 226 took minimum 112.50 days reach at maturity and HD-2967, too late i.e. 120.83 days. The maturity in plant delayed with timely sown crop, the first planted crop was exposed to favourable weather during the whole life cycle and thus the different phases of plant life could be completed at appropriate timing and under later sown condition the plant was forced to maturity because of sudden rise in temperature. These results are in close conformity with the finding of Kumar (2016); Gupta et al. (2017) who have also reported delayed maturity with timely sown crop.

The dates of sowing had significant influence on grain yield of wheat which had close association among varieties. Highest grain yield (41.51 q ha<sup>-1</sup>) was recorded in crop sown on November 26<sup>th</sup> and in variety HD- 2967. The higher yields in timely sown crop in the month of November might be due to the reason that the crop received optimum environmental conditions for crop growth and get more time for attaining different phenophases. Grain yield is influenced by date of sowing and varieties as reported by Sial et al., 2010; Mumtaz et al., 2015.

The test weight of grains was significant due to varied sowing dates and among varieties. Maximum test weight of grains (38 g) was recorded on November 26<sup>th</sup> sowing date and in variety HD-3086 at par with HD-2967. This may be due to the production of more number of grains ear<sup>-1</sup> with lighter weight. The earlier sowing resulted in better development of the grains due to longer growing period. The results are in accordance with the findings of Shahzad et al. (2007).

The straw yield and biological yields of wheat were influenced by dates of sowing. The results showed that straw yield and biological yields were significantly decreased with delayed sowing from 26<sup>th</sup> November onwards. These findings are in agreements with those of Wajid et al. (2004). Whereas, among varieties, there was no significant difference for straw and biological yields that might be due to close genetic variation. This is in contrary to findings of Fayed et al. (2015) who also found significant variation in straw yield of different varieties.

The data on harvest index of wheat was influenced by dates of sowing which sowed significant decrease in harvest index with delayed sowing from 26<sup>th</sup> November onwards. However, all varieties were found at par for harvest index. Early sowing

enhanced biomass accumulation over late sowing reported by Wajid et al. (2004).

#### 4. Conclusion

It may be concluded based on findings that the variety, HD-2967 is suggested as promising one if sown on from 2<sup>nd</sup> fortnight of November to 2<sup>nd</sup> fortnight of December and PBW-226 for late sown conditions under Western Uttar Pradesh in order to obtain higher yield potential.

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