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# Effect of different dates of sowing on growth and yield attributes of different cultivars of wheat (*Triticum aestivum* L.) under Allahabad condition

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**Abstract**
The present study was conducted at the nursery of school of forestry, Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad to study the effect of different dates of sowing on growth and yield attributes of different cultivars of Wheat (*Triticum aestivum L.*) under Allahabad region during Rabi season 2016-17. The experiment was laid out in Randomized Block Design with three replications. The experiment consists of three dates of sowing $D_1$=5th November, $D_2$= 15th November and $D_3$=25th November. The varieties used were $V_1$=HD-2967, $V_2$=PBW-502 & $V_3$=PBW-154. Sowing dates and varieties both significantly affected the plant height, number of tillers, Number of spikelets per spike, test weight, straw yield and grain yield. In case of sowing dates significantly maximum grain yield (41.7q $ha^{-1}$) was obtained when crop was sown on 15th November ($D_2$) against the minimum grain yield (39.6q $ha^{-1}$) in case of late sowing i.e. 5th November ($D_1$). Among of varieties HD-2967 ($V_1$) gave significantly maximum yield (41.5q $ha^{-1}$) while minimum yield (39.1q $ha^{-1}$) was obtained by PBW-154 ($V_3$).

**Keywords:** Sowing dates, varieties, growth, yield, Allahabad

## 1. 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. World production of wheat was 757 metric tons, making it the second most-produced cereal after maize (1,016 million tons) (FAO Stat, 2017). Wheat is the important food crop of the world it provides food to 36% of the global population contributing 20% of the food calories for the world people and is a national staple in many countries. India ranks second among wheat producing country in the world. This phenomenal increase in production is by and large attributed to adoption of high yielding varieties. HD-2967 is a variety released by PAU, Ludhiana in 2011, which is most suitable for North Eastern plain zones of India, which includes a part of Uttar Pradesh also. It is an early maturing variety (125-135 days). It is suitable for irrigated condition and it gives an average yield of 45-50 quintals per hectare. PBW-154 {HD 2160*HD 2177} is a variety released PAU, Ludhiana. It is suitable for irrigated conditions. It gives an average yield of 41-45 quintals per hectare. It is performs well in North-Western plain zones. PBW-502 is a variety released by PAU, Ludhiana in 2003. It is suitable for irrigated conditions. It gives an average yield of 42-45 quintals per hectare. This variety is early maturing (120-127 days), resistant to karnal bunt & susceptible to loose smut disease. It performs well in North-Western plain zones. Among these three varieties HD-2967 is newly released & having Maximum resistance to diseases & pests with high yielding capacity.

The time of sowing & different varieties are of greater significance & these are the main factors which determines the good crop stand which in turn influences the yield & returns (Kabesh *et al*, 2009) [6]. Nokano & Morita (2009) are also of similar findings of kabesh *et al*., According to Munir *et al.,* (2002) [8] & Tanveer *et al.,* (2014) [16] early sowing leads to get higher yield (November 15th) due to longer growing periods. Whereas delay in sowing from 20th November onwards decreases the grain yield due to heavy cold during vegetative period & high temperature during reproductive stages (Singh and Uttam, 1994) [14]. Patil *et al.* (2001) [9] reported that sowing on 15th November resulted in the highest tillers per plant and total biomass at maturity. They concluded that November 15th is the optimum sowing date for this region. Chana & Bux (2016) [2] stated that early sowing of wheat leads to attack of leaf rust diseases in Sindh region & concluded that the optimum date of sowing is first fortnight of November. The varieties are losing their yield potential due to changes in various edaphic and environmental conditions. Therefore, continuous election of high yielding genotypes with

mid-range of adaptability to edaphic and environmental conditions is very essential to increase yield per hectare (Tahir *et al*., 2009) [15]. Keeping this in view, the present study was therefore, designed to determine the effect of different sowing dates on growth and yield of different cultivars of wheat (*Triticum aestivum* L.) under Allahabad condition.

## 2. Materials and methods

The experiment was conducted on wheat crop during Rabi season 2016-17 at farm research centre of college of forestry, Sam Higginbottom University of Agriculture, Technology and Sciences (Formerly- Allahabad Agricultural Institute), Allahabad (U.P). The soil of experimental land was sandy loam and slightly alkaline. The site of experiment is located at $25.57^0$ N latitude, $81.51^0$ E longitude and 90 meter above the sea level. It comes under agro-climatic zone-IV, which is named as Middle Gangetic Plains. Soil of this region is sandy loam and slightly alkaline. This region has Sub-tropical climate with extreme of summer and winter. The experiment was laid out in two factor Randomized Block Design (RBD) with three replications. The experimental treatments included) three date of sowing, 5 November ($D_1$), 15 November ($D_2$), 25 November ($D_3$) and ii) three wheat varieties viz. HD-2967 ($V_1$), PBW-502 ($V_2$), & PBW-154 ($V_3$). The field was cleaned & prepared properly to carry out wheat sowing. The graded and healthy seed of wheat crop was selected by using recommended seed rate @ 100-125 kg $ha^{-1}$.The seeds were sown manually with hand in previously opened furrow in field. The wheat crop varieties were sown in rows at 22.5cm as per treatment scheduled. Gap filling was carried out after 15 days of sowing while thinning operation was carried out to facilitate optimum plant population. Intercultural and hand weeding operations were carried out when required for soil aeration and removal of weeds. The first common irrigation was applied 5 days before sowing for the establishment of the seedling. Subsequently irrigation was applied to the crop as per requirement. The crop received full dose of $P_2O_5$ (60 kg/ha) and $K_2O$ (60 kg/ha) and N (60 kg/ha) as basal and remaining half nitrogen (60 kg/ha) was applied in equal doses, half at tillering and rest half at flowering stage. The sources of nutrient were urea, single super phosphate and muriate of potash for N, P and K, respectively. Other management practices were carried out as per recommended of the crop under irrigated condition. The crop was harvested when more than 90% of grains are matured. Data on growth, yield component and yield were recorded as per normal procedure. In calculation of economics, the purchase rates of input and the selling rates of outputs were assumed as per the prevailing local market rates. The observations were recorded on five randomly selected competitive plants in each replication for all the characters except for days to 50% flowering and days to maturity, which were recorded on plot basis. Five plants from each plot were randomly selected and tagged for recording a representative sample of the entire population. The data was recorded for following traits: pre-harvesting observations like emergence, plant height at different growing stages viz, 20, 40, 60, 80 & 100 days after sowing (DAS), number of tillers per plant at different stages 40 & 60 days after sowing (DAS). Post-harvest observations like length of spike (cm), number of Spikelet/spike, number of grains/spike, test weight (gm), grain yield (q/ha), straw yield (q/ha), harvest index (%) and benefit cost ratio was calculated. The data observed are subjected to statistical analysis as for the methods detailed by Gomez & Gomez (1984) [5].

## 3. Results and discussion

### A. Effect of sowing dates and variety

The yield of crop is always determined by its stand density that is function of its initial germination. The sowing dates significantly affected percent of germination. Germination percentage was highest (95%) in 15th November ($D_2$) sowing than 5th November ($D_1$) and 25th November ($D_3$) sowing (Table-1). In varieties HD-2967, it has highest germination percentage (96.2%) than PBW-502 & PBW-154 (Table-1) & the interaction between varieties & dates of sowing was found to be non-significant. Mina *et al*. (2015) found that the difference in germination mainly occurs due to the seed index of that variety or crop & also influenced by weather parameters like humidity & temperature. As the sowing delayed, the temperature falls this cannot fulfil the temperature requirement for seed germination. These results are in line with those of Razzaq *et al.*, (1986) [11] they reported that late sowing results in less germination count $m^{-2}$. Differences in germination among varieties might be attributed to their genetic diversity. These results are in accordance with those of Aslam *et al*., (2013) [12].

The data on plant height revealed that both the sowing dates and varieties affected the plant height significantly. The plant height was recorded under 20,40,60,80 & 100 DAS (DAS=days after sowing). Significantly maximum plant height was noticed under 15th November ($D_2$) sowing at 20,40,60,80 & 100 DAS are 18.3cm, 27.2cm, 43.3cm, 61cm & 76.9cm respectively (Table-1). In case of varieties HD-2967 ($V_1$) attained maximum plant height than other two varieties. The plant height attained by HD-2967 ($V_1$) at 20, 40, 60, 80 & 100 DAS are 19 cm, 27.6cm, 42.8cm, 62.6cm & 82.3cm respectively (Table-1). The interactions were found significant at 20, 40, 60, 80 & 100 DAS & found to be non-significant at 80 DAS only for plant height. From above findings we can say that the early sown crop may have enjoyed the better environmental conditions especially the temperature & solar radiation which resulted to tall plants. These results are in line with the findings of Shehzad *et al.* 2012. From the above findings we noticed that the plant heights at 20, 40, 60, 80 days are steadily increasing & thereafter the plant height slows down. Similar results were obtained by S.S. Patra *et al.* 2016. Din and Singh (2005) [3] observed that delayed planting reduces the plant height, days to heading, days to maturity and grain filling duration and ultimately shows reduction in yield and yield components.

Both the sowing dates and varieties affected the number of tillers per plant significantly. Number of tillers per plant was recorded at 40 & 60DAS. Under dates of sowing 15th November ($D_2$) recorded significantly highest number of tillers per plant at 40 & 60DAS i.e., 7 & 3.89 & significantly lowest number of tillers per plant at 40 DAS was under 25th November ($D_3$) i.e., 3.5 & 60DAS was noticed under 5th November ($D_1$) i.e., 6. In case of varieties concerned highest number of tillers per plant at 40 & 60DAS was noticed under HD-2967 ($V_1$) i.e., 3.8 & 7.3 respectively. Variety PBW-154 ($V_3$) attained least number of tillers per plant at 40 & 60 DAS i.e., 3.5 & 6. (Table-2).

The spike length was significantly affected by the date of sowing and varieties. The Highest Spike Length was observed under sowing date of 15th November ($D_2$) i.e. 13.17 cm &25th November ($D_3$) recorded lowest spike length i.e. 12.37 cm & it was found to be significant. However, in case of varieties PBW-502 recorded highest spike length i.e. 13 cm & PBW-154 recorded lowest spike length 12.4 cm & it was found to be significant. (Table-2). The number of spikelet/spike was

highest under sowing date of 15th November ($D_2$) i.e. 20.5 & 5th November ($D_1$) recorded lowest spikelet/spike i.e.19.6 & it was found to be significant. However, in case of varieties HD-2967 recorded highest spikelet/spike i.e. 20.6 &PBW-502 recorded lowest spikelet/spike 19.5 & it was found to be significant. (Table-2) From the above stated result HD-2967 has more number of spikelet/spike than the other two cultivars more the spikelet/spike more will be the grain per spike and more will be the grain yield & same lines were found with Tahir *et al.* (2009) [15].

The highest number of grains/spike was observed under the sowing dates of 15th November ($D_2$) i.e. 39.7 &25th November ($D_3$) recorded lowest number of grain/spike i.e.37.4 & it was found to be significant. In case of varieties HD-2967 recorded highest number of grain/spike i.e. 39.4 & PBW-502 recorded lowest number of grain/spike 37.4 & it was found to be significant. (Table-2). The 15th November sowing significantly enhanced the number of grains spike$^{-1}$ in the seasons. Above results are in line with Aftab Wajiid *et al.* (2004). The highest Test Weight was observed under the sowing dates of 15th November ($D_2$) i.e. 39.8 gm & 5th November ($D_1$) recorded lowest test weight (gm.) i.e.38.67 gm & it was found to be significant. In case of varieties HD-2967 recorded highest weight (gm.) i.e. 40.13 gm & PBW-154 recorded lowest test weight (gm.) 38.02 gm & it was found to be significant. This test weight difference may be due to slight changes in mean temperature during November (sowing period) and then between March to April (harvesting period), these results are in line with Ali *et al.* (2004) [1]. (Table-2)

The highest Grain yield was obtained under the sowing dates of 15th November ($D_2$) i.e. 41.77 q ha$^{-1}$ & 5th November ($D_1$) recorded lowest grain yield (q/ha) i.e.39.67q ha$^{-1}$ & it was found to be significant. In case of varieties HD-2967 recorded highest grain yield (q ha) i.e. 41.53 q ha$^{-1}$ &PBW-154 recorded lowest grain yield (q/ha) 39.11 q ha$^{-1}$ & it was found to be significant. (Table-2) From the above data it was concluded that early planting wheat resulted in higher yields as compared with late planting. Critical examination of data indicated that there were no significant yield differences of planting wheat from November 1 to November 20 but in case of meteorological efficiencies we have lot of differences. Further delay in planting beyond this progressively suppressed the grain yield. These results are in similarity with Ali (2004) [1].

The highest Straw yield was obtained under the sowing dates of 15th November ($D_2$) i.e. 46.78 q/ha &25th November ($D_3$) recorded lowest straw yield (q/ha) i.e.42.57q ha$^{-1}$ & it was found to be significant. In case of varieties HD-2967 recorded highest straw yield (q ha$^{-1}$) i.e. 45.57 q ha$^{-1}$ & PBW-154 recorded lowest straw yield (q ha$^{-1}$) 42.59 q/ha & it was found to be significant. (Table-2).The highest Harvest Index was obtained under the sowing dates of 15th November ($D_2$) i.e. 48.07% & 25th November ($D_3$) recorded lowest harvest index (%) i.e.46.45% & it was found to be significant. In case of varieties HD-2967 recorded highest harvest index (%) i.e. 48.07 % & PBW-502 recorded lowest harvest index (%) 46.10 % & it was found to be significant. (Table-2).

**B. Interaction effect of sowing dates and variety**

The effect of interaction between variety and date of sowing on the growth and yield parameters of wheat was significant (Tables 1, 2). The highest plant height at 100 DAS of wheat crop was recorded in $T_4$ (15th November+ HD-2967) i.e. 84.3 cm & lowest height was recorded by $T_9$ (25th November+PBW-154) i.e. 68.3 cm. The highest tillers were recorded in $T_4$ (15th November+ HD-2967) i.e. 12 & lowest tillers were recorded by $T_2$ (5th November + PBW-502) & $T_8$ (25th November+PBW-502) i.e. 9. The highest spike length was observed in $T_4$ (15th November+ HD-2967) i. e. 13.75 cm & lowest spike length was observed in $T_9$ (25th November + PBW-154) i.e. 12.01 cm. The highest spikelet/spike was observed in $T_4$ (15th November+HD-2967) i. e. 21.9 & lowest spikelet/spike was observed in $T_9$ (25th November+PBW-154) i.e. 19.4. The highest number of grain/spike was observed in $T_4$ (15th November + HD-2967) i. e. 41.6 & lowest number of grain/spike was observed in $T_3$ (5th November + PBW-154) i.e. 36.6.The highest test weight (gm.) was observed in $T_4$ (15th November + HD-2967) i. e. 41.4 gm & lowest test weight (gm.) was observed in $T_2$ (15th November+PBW-502) i.e. 37.79 gm. The highest grain yield (q/ha) was observed in $T_4$ (15th November + HD-2967) i. e. 43.3 q/ha & lowest grain yield (q/ha) was observed in $T_9$ (25th November + PBW-154) i.e.39.03 q/ha. The highest straw yield (q/ha) was observed in $T_4$ (15th November+HD-2967) i. e. 49 q/ha & lowest straw yield (q/ha) was observed in $T_7$ (25th November+HD-2967) i.e.41.67 q/ha. The highest harvest index (%) was observed in $T_4$ (15th November+HD-2967) i. e. 49.7% & lowest harvest index (%) was observed in $T_2$ (5th November+PBW-502) i.e.46.5%.

**Table 1:** Effect of Dates of Sowing on Germination (%) & Plant Height of Wheat Crop.

| DOS | Germination (%) | Plant Height (cm) | | | | | No. of Tillers/plant |
|---|---|---|---|---|---|---|---|
| | | 20 DAS | 40 DAS | 60 DAS | 80 DAS | 100 DAS | |
| $D_1$ | 11 | 17.3 | 26.1 | 41.9 | 60.3 | 76.1 | 6 |
| $D_2$ | 10.7 | 18.3 | 27.2 | 43.3 | 61 | 76.9 | 7 |
| $D_3$ | 11.2 | 17.5 | 25.1 | 39.2 | 58.5 | 72.3 | 6.6 |
| CD at 5% | 0.71 | 0.431 | 0.342 | 0.35 | 0.56 | 0.679 | 0.76 |

**Table 2:** Effect of Dates of Sowing on Yield & Yield Attributes of Wheat Crop.

| DOS | Spike Length (cm) | Spikelet/Spike | Grains/Spike | Test Weight (gm) | Grain Yield (q/ha) | Straw Yield (q/ha) | Harvest Index (%) |
|---|---|---|---|---|---|---|---|
| $D_1$ | 12.8 | 19.6 | 38.4 | 38.67 | 39.66 | 45.70 | 47.417 |
| $D_2$ | 13.1 | 20.5 | 39.7 | 39.8 | 41.77 | 46.78 | 47.901 |
| $D_3$ | 12.3 | 19.9 | 37.4 | 39.17 | 39.88 | 42.55 | 46.452 |
| CD at 5% | 0.032 | 0.429 | 1.052 | 0.614 | 1.466 | 1.435 | 0.870 |

***5th November= D1, 15th November =D2, 25th November =D3, DOS= dates of sowing.

**Table 3:** Effect of Varieties on Germination (%) & Plant Height of Wheat Crop.

| DOS | Germination (%) | Plant Height (cm) | | | | | No. of Tillers/ Plant |
|---|---|---|---|---|---|---|---|
| | | 20 DAS | 40 DAS | 60 DAS | 80 DAS | 100 DAS | |
| $V_1$ | 10.5 | 19.2 | 27.6 | 42.8 | 62.6 | 82.3 | 7.3 |
| $V_2$ | 10.9 | 17.5 | 26.1 | 41.5 | 59.5 | 72.9 | 6.3 |
| $V_3$ | 11.5 | 16.6 | 24.8 | 40.2 | 57.8 | 70.1 | 6 |
| CD at 5% | - | 0.431 | 0.342 | 0.35 | 0.56 | 0.679 | 0.076 |

**Table 4:** Effect of Varieties on Yield & Yield Attributes of Wheat Crop.

| DOS | Spike Length (cm) | Spikelet/Spike | Grains/ Spike | Test Weight (gm) | Grain Yield (q $ha^{-1}$) | Straw Yield (q $ha^{-1}$) | Harvest Index (%) |
|---|---|---|---|---|---|---|---|
| $V_1$ | 12.8 | 20.6 | 39.4 | 40.31 | 41.55 | 45.55 | 48.0 |
| $V_2$ | 13.0 | 19.5 | 39.1 | 39.31 | 40.66 | 46.89 | 46.1 |
| $V_3$ | 12.4 | 20 | 37.1 | 38.02 | 39.11 | 42.59 | 47.5 |
| CD at 5% | 0.032 | 0.429 | 1.052 | 0.614 | 1.466 | 1.435 | 0.87 |

## 4. Conclusion

From the present study it is concluded that variety HD-2967 sown on 15th November had produced highest grain yield (43.33 q $ha^{-1}$) followed by viz. PBW-502 (42.3 qt $ha^{-1}$) and PBW-154 (39.67 qt $ha^{-1}$) varieties.

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