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# Effect of varietal performance under different sowing dates on growth and yield of wheat (*Triticum aestivum* L.)

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**ABSTRACT**

The study titled "Varietal performance of wheat (*Triticum aestivum* L.) under different sowing dates" was conducted during the rabi season of 2017-2018 at the Agronomy Farm, Shree Guru Ram Rai University, Dehradun, to evaluate the impact of varying sowing dates on the performance of three wheat varieties. A split-plot design was employed with three replications and fifteen treatment combinations, consisting of five sowing dates (1st November, 15th November, 29th November, 13th December, and 27th December) and three wheat varieties (HS-542, HD-2967, and HD-4728). Results revealed that the variety HS-542 was significantly superior in growth parameters, yield attributes, and yield compared to other varieties. The 15th November sowing date combined with HS-542 recorded the highest grain yield (44.33 q $ha^{-1}$) and straw yield (63.00 q $ha^{-1}$). The findings concluded that sowing wheat during the second fortnight of November, particularly using the variety HS-542, optimizes growth, grain and straw yields. This study highlights the importance of timely sowing and varietal selection to achieve higher productivity in wheat cultivation.

***Key word:*** *Sowing dates, HS-542, Yield, Rabi season, Triticum aestivum.*

## Introduction

Wheat (*Triticum aestivum* L.) is the World's most important widely cultivated food crop. It originated in South West Asia. It is basically a short-day crop and primarily grown in temperate region and also at higher altitude under tropical climatic areas in winter season. It requires relatively low temperature for satisfactory growth and development. Wheat is the most important staple food crop of India. It is consumed as food by millions of people especially in developing countries. Therefore, it is called as "king of cereals". The productivity of any crop is the complex phenomenon governed by a number of factors such as an appropriate sowing time, sowing method, spacing, use of improved varieties, judicious use of water and nutrients with weed, pest and disease management. Among all these, sowing time, use of improved varieties and optimum plant population are the most critical factors for realizing desired yield potential. This productivity is just 50 per cent of the national average. This productivity of wheat in Maharashtra state is very low as compared to national average productivity. Wheat is sensitive to high temperature (both early and late heat) but magnitude of damage depends on the existing ambient temperature, stage of crop development and variety. The rise in temperature during December, the period of tillering and subsequently higher temperature above 300c during February and March at

the stages of anthesis, grain formation and filling has lead to decreased productivity during the last 4-5 years. It has been observed that increase in temperature reduced potential wheat grain yields at most places. The sowing time plays an important role among various agronomic factors, in influencing the quality and yield of wheat. Its time of sowing is one of the most important factors that govern the crop phenological development and efficient conversion of biomass into economic yield. Normal sowing has longer growth during which consequently provides an opportunity to accumulate more biomass as compared to late sowing hence manifested in higher grain and biological yields (Singh and Pal, 2003). Whereas, in case of delayed sowing the wheat crop is exposed to sub-optimal temperature at establishment and supra-optimal temperature at reproductive phases that leads to forced maturity and reduction in grain yield (Sardana *et al.* 1999). However, the higher protein yield, grain protein content, dry gluten content, beta carotene content and sedimentation index in late sown wheat have been reported by (Zende *et al.*, 2005). The sowing time may play a crucial role in the yield improvement of this crop. Growing degree day is a good estimator of wheat growth stages. Delay in sowing may not permit proper vegetative growth of the crop and it may face high temperature at its later growth stages leading to forced maturity and low productivity.

## Materials and Methods

The study titled "Varietal performance of wheat (*Triticum aestivum* L.) under different sowing dates" was conducted during the rabi season of 2017-2018 at the Agronomy Farm, Shree Guru Ram Rai, Dehradun, to evaluate the impact of varying sowing dates on the performance of three wheat varieties. The present study aimed to investigate the "Varietal Performance of Wheat under Different Sowing Dates." The detailed methodology adopted for the field experiment is described below, Sowing Dates (Main Plot Factor): S1: 1st Week of November S2: 3rd Week of November S3: 4th Week of NovemberS4: 2nd Week of December S5: 4th Week of December. Wheat Varieties (Sub Plot Factor): V1: HS 542 (Pusa Kiran), V2: HD 2967, V3: HD 4728 (Pusa Malvi). Number of Treatment Combinations is 15 (5 × 3).The seed rate is 120kg/hac., Line sowing at a spacing of 22.5 cm between rows. Five sowing dates (S1 to S5) were implemented, starting from 01st November 2018 to 27th December 2018. The first irrigation was applied immediately after sowing, followed by subsequent irrigations as per crop requirements.Two hand weeding were performed to maintain weed-free plots. Aphids and jassids were controlled using Dimethoate 30 EC (0.05%). Termite infestation was prevented with Phorate at 10 kg $ha^{-1}$ applied during sowing. Plant height and number of tillers recorded at 15, 30, 45, 60, 75, 90 DAS, and at harvest. Five plants per plot were randomly selected and tagged for observations. The crop was manually harvested at physiological maturity using a sickle. Harvested bundles were dried, threshed, and winnowed separately for each plot.Grain and straw yields were recorded for further analysis. The experimental data were statistically analysed using Analysis of Variance (ANOVA) appropriate for a split-plot design to determine the significance of sowing dates, wheat varieties, and their interactions.

## Results and Discussion

### Plant Height

Plant height increased progressively with the advancement of crop growth, with mean heights recorded at 7.03 cm at 15 DAS and 78.96 cm at harvest. Significant differences were observed due to sowing dates and wheat varieties. The plant height was significantly higher for wheat sown on 15th November across all growth stages, followed by 1st November. These dates likely provided optimal conditions such as moderate temperature and moisture availability, enhancing the photosynthetic rate and growth. Late sowing dates (13th and 27th December) exhibited reduced plant height due to less favourable conditions, including higher temperatures during critical growth phases. These findings align with earlier studies (Nainwal and Singh, 2000; Sardana *et al.*, 2005; Pandey *et al.*, 2010; Baloch *et al.*, 2012), highlighting the role of timely sowing in achieving optimal growth parameters. Among the varieties, HS 542 (Pusa Kiran) recorded the tallest plants across all stages, significantly outperforming HD 2967 and HD 4728 (Pusa Malvi). The genetic potential of HS 542 contributed to better nutrient absorption and hormonal regulation, leading to superior plant height. The interaction between sowing dates and varieties was found to be non-significant for plant height, suggesting that the effects of sowing dates

and varieties were independent of each other (Shirpurkar *et al*., 2008).

**Number of Tillers**

The number of tillers per meter row length increased until 60 DAS and gradually decreased thereafter, with a maximum mean of 177.11 tillers at 60 DAS and 120.13 tillers at harvest. Significant differences were observed due to sowing dates. The 15th November sowing recorded the highest number of tillers, significantly superior to later sowing dates. Early sowing (1st November) also produced a comparable number of tillers, with performance declining in the 13th and 27th December sowings. The reduction in tillers for late sowing could be attributed to increased temperatures during the tiller initiation phase, adversely affecting the process.Significant variation in tiller count was observed among the varieties, with HS 542 (Pusa Kiran) producing the maximum tillers. Similar results were observed by Upadhyay and Tiwari (1996), Nainwal and Singh (2000) and Gill (2009) Mukherjee (2012). The interaction effects of wheat sowing dates and varieties were significantly influenced the number of tillers at all growth phases. The interaction of 15 November (2nd week November) with HS 542 wheat variety recorded the significantly highest number of tillers at all growth stages than rest of treatment combinations.

**Leaf Area per Plant (dm²)**

The results on mean leaf area per plant as influenced by different treatments across various growth stages are presented in Table 13. The mean leaf area per plant at 15, 30, 45, 60, 75, and 90 DAS were recorded as 0.29, 0.58, 0.78, 0.94, 1.22, and 0.56 dm², respectively. The sowing dates significantly influenced the leaf area per plant at all growth stages. Among the different sowing dates, wheat sown on **15**th November recorded the highest leaf area, which was statistically at par with 1st November at 30, 60, and 75 DAS. This could be attributed to favourable climatic conditions during early sowing periods, which facilitated better vegetative growth. In contrast, late sowing dates (29th November, 13th December, and 27th December) resulted in a reduction in leaf area per plant due to increased temperature, which negatively impacted tiller formation and leaf expansion. These findings align with the results reported by Nainwal and Singh (2000) and Gill (2009), who also observed a decline in leaf area due to delayed sowing.Wheat varieties exhibited significant differences in leaf area per plant at all growth phases. The variety HS 542 (Pusa Kiran) consistently recorded the highest leaf area across all growth stages, demonstrating its superior genetic potential for larger leaf expansion. Conversely, the variety HD 4728 (Pusa Malvi) recorded the lowest leaf area at all

**Table 1.** Mean plant height of wheat as influenced periodically by different treatments

| Treatment | Days after Sowing | | | | | | |
|---|---|---|---|---|---|---|---|
| | 15 | 30 | 45 | 60 | 75 | 90 | At Harvest |
| *A. Sowing dates (S)* | | | | | | | |
| S1: (01st Nov. 2018) | 7.62 | 17.31 | 38.00 | 62.36 | 74.31 | 81.32 | 81.42 |
| S2: (15th Nov. 2018) | 7.98 | 17.87 | 38.33 | 63.14 | 75.40 | 82.63 | 82.73 |
| S3: (29th Nov. 2018) | 6.71 | 17.00 | 37.44 | 61.78 | 73.67 | 79.31 | 79.61 |
| S4: (13th Dec. 2018) | 6.68 | 16.97 | 36.22 | 60.25 | 71.29 | 76.82 | 76.99 |
| S5: (27th Dec. 2018) | 6.39 | 15.53 | 35.33 | 59.14 | 67.62 | 74.54 | 74.67 |
| S.E. m ± | 0.10 | 0.40 | 0.11 | 0.27 | 0.30 | 0.70 | 0.95 |
| C.D. at 5% | 0.33 | 1.33 | 0.38 | 0.88 | 1.00 | 2.28 | 3.10 |
| *B. Varieties (V)* | | | | | | | |
| V1: HS 542 (Pusa Kiran) | 7.29 | 18.50 | 38.59 | 62.94 | 73.96 | 80.79 | 81.34 |
| V2: HD 2967 | 7.08 | 16.70 | 37.05 | 61.41 | 72.24 | 79.03 | 79.01 |
| V3: HD 4728 (Pusa Malvi) | 6.87 | 15.27 | 35.27 | 59.33 | 71.07 | 77.09 | 76.94 |
| S.E. m ± | 0.081 | 0.12 | 0.15 | 0.16 | 0.14 | 0.31 | 0.64 |
| C.D. at 5% | 0.24 | 0.35 | 0.45 | 0.47 | 0.43 | 0.92 | 1.91 |
| *C. Interaction (S × V)* | | | | | | | |
| S.E. m ± | 0.18 | 0.27 | 0.34 | 0.36 | 0.32 | 0.69 | 1.45 |
| C.D. at 5% | NS | NS | NS | NS | NS | NS | NS |
| *General Mean* | 7.03 | 16.76 | 36.89 | 61.13 | 72.32 | 78.85 | 78.96 |

growth stages. This suggests that HS 542 has a better genetic capability for enhanced vegetative growth compared to the other tested varieties.

**Grain Yield, Straw Yield and Harvest Index**

The mean grain and straw yield of wheat were recorded at 36.36 and 53.33 q ha$^{-1}$, respectively, as presented in Table Sowing dates had a significant influence on grain yield. The highest grain yield (43.06 q ha$^{-1}$) was recorded for the 15$^{th}$ November sowing, which was significantly superior to all other sowing dates. The second-best sowing date was 1st November, yielding 40.33 q ha$^{-1}$, which was significantly higher than the yields obtained from later sowing dates (29$^{th}$ November, 13$^{th}$ December, and 27$^{th}$ December). The reduction in grain yield due to later

**Table 2.** Mean total number of tillers (metre-1 row length) of wheat as influenced periodically by different treatments

| Treatment | Days after sowing | | | | | |
|---|---|---|---|---|---|---|
| | 30 | 45 | 60 | 75 | 90 | At harvest |
| *A. Sowing dates (S)* | | | | | | |
| S1 : (01$^{st}$ Nov. 2018) | 80.08 | 142.42 | 182.69 | 160.25 | 149.20 | 122.77 |
| S2 : (15$^{th}$ Nov. 2018) | 82.52 | 144.87 | 184.58 | 162.59 | 151.53 | 123.77 |
| S3 : (29$^{th}$ Nov. 2018) | 76.22 | 137.00 | 179.00 | 157.22 | 145.67 | 120.11 |
| S4 : (13$^{th}$ Dec. 2018) | 75.86 | 135.65 | 175.91 | 154.81 | 143.76 | 118.43 |
| S5 : (27$^{th}$ Dec. 2018) | 74.19 | 133.65 | 163.91 | 141.47 | 138.42 | 115.99 |
| S.E. m ± | 0.34 | 0.88 | 1.88 | 1.68 | 1.25 | 1.20 |
| C.D. at 5% | 1.12 | 2.88 | 6.14 | 5.50 | 4.07 | 3.93 |
| *B. Varieties (V)* | | | | | | |
| V1 : HS 542 (pusakiran) | 80.41 | 142.16 | 180.49 | 159.90 | 150.22 | 122.67 |
| V2 : HD 2967 | 77.81 | 139.42 | 178.55 | 154.63 | 144.56 | 120.67 |
| V3 : HD 4728 (pusamalvi) | 75.15 | 134.62 | 172.35 | 151.30 | 142.42 | 117.07 |
| S.E. m ± | 0.41 | 0.72 | 1.39 | 1.22 | 1.29 | 0.93 |
| C.D. at 5% | 1.20 | 2.14 | 4.12 | 3.61 | 3.82 | 2.76 |
| *C. Interaction (S × V)* | | | | | | |
| S.E. m ± | 0.91 | 1.62 | 3.12 | 2.73 | 2.89 | 2.09 |
| C.D. at 5% | NS | 4.80 | 9.22 | 8.08 | 8.54 | 6.19 |
| General mean | 77.71 | 138.64 | 177.11 | 155.24 | 145.64 | 120.13 |

**Table 3.** Mean Leaf Area per Plant (dm$^2$) of wheat as influenced periodically by different treatments

| Treatment | Days after Sowing | | | | | |
|---|---|---|---|---|---|---|
| | 15 | 30 | 45 | 60 | 75 | 90 |
| *A. Sowing dates (S)* | | | | | | |
| S1: (01st Nov. 2018) | 0.29 | 0.59 | 0.80 | 0.96 | 1.25 | 0.62 |
| S2: (15th Nov. 2018) | 0.31 | 0.60 | 0.82 | 0.98 | 1.29 | 0.66 |
| S3: (29th Nov. 2018) | 0.29 | 0.58 | 0.78 | 0.94 | 1.23 | 0.54 |
| S4: (13th Dec. 2018) | 0.28 | 0.57 | 0.77 | 0.91 | 1.20 | 0.50 |
| S5: (27th Dec. 2018) | 0.26 | 0.55 | 0.75 | 0.88 | 1.14 | 0.45 |
| S.E. m ± | 0.003 | 0.005 | 0.004 | 0.006 | 0.013 | 0.012 |
| C.D. at 5% | 0.010 | 0.017 | 0.016 | 0.020 | 0.043 | 0.039 |
| *B. Varieties (V)* | | | | | | |
| V1: HS 542 (Pusa Kiran) | 0.29 | 0.59 | 0.81 | 0.96 | 1.26 | 0.59 |
| V2: HD 2967 | 0.28 | 0.57 | 0.78 | 0.93 | 1.22 | 0.55 |
| V3: HD 4728 (Pusa Malvi) | 0.28 | 0.57 | 0.77 | 0.92 | 1.18 | 0.52 |
| S.E. m ± | 0.002 | 0.002 | 0.004 | 0.004 | 0.010 | 0.003 |
| C.D. at 5% | 0.006 | 0.007 | 0.011 | 0.013 | 0.031 | 0.010 |
| *C. Interaction (S × V)* | | | | | | |
| S.E. m ± | 0.004 | 0.005 | 0.009 | 0.010 | 0.024 | 0.007 |
| C.D. at 5% | NS | NS | NS | NS | NS | NS |
| General Mean | 0.29 | 0.58 | 0.78 | 0.94 | 1.22 | 0.56 |

sowing dates can be attributed to temperature variations. The 15th November sowing period coincided with favourable post-anthesis conditions, including relatively low temperatures, which supported higher grain production. In contrast, late sowing (29th November, 13th December, and 27th December) resulted in lower yields due to suboptimal temperature conditions. Lower temperatures during early sowing may have negatively impacted seed emergence and tiller formation. Furthermore, delayed sowing shortened the anthesis-to-senescence period, leading to premature grain filling under high-temperature stress. Among the varieties tested, HS 542 recorded the highest mean grain yield (38.00 q $ha^{-1}$), followed by HD 2967 (36.23 q $ha^{-1}$) and HD 4728 (34.83 q $ha^{-1}$). A similar trend was observed for straw yield and harvest index. The superior performance of HS 542 can be attributed to its better adaptability to prevailing environmental conditions and enhanced yield-contributing traits. The grain yield of wheat as influenced by interaction effects are reported in Table 25. The interaction of HS 542 wheat varieties with sowing dates 1st November, 15th November, 29th November, 13th December and 27th December were recorded significantly higher grain yield (42.33, 44.33, 37.67, 34.50 and 31.17 q $ha^{-1}$, respectively) than the rest of interactions. However, interaction effects of wheat varieties HS 542, HD 2967 and HD 4728 with sowing date 1st November, 15th November, 29th November, 13th December and 27th December showed decreasing trend in grain yield of wheat. These results showed that delay in sowing of wheat varieties, could not able to assimilate the more biomass as result reduced grain yield of wheat. This result is in corroboration with Singh and Uttam (1994), Jadhav *et al.* (2001), Sardana *et al.* (2003), Mishra *et al.* (2003), Singh *et al.* (2008), Shirpurkar *et al*. (2008), Pandey *et al*. (2010) and Mukherjee (2012).

## Conclusion

The present study evaluated the effects of sowing dates and wheat varieties on growth, yield, and quality attributes. Based on the findings resulted in significantly higher growth and yield attributes compared to other sowing dates. However, sowing dates did not notably affect the quality parameters of wheat. The variety HS 542 (Pusa Kiran) exhibited superior performance in terms of growth and yield when sown on 15 November, suggesting that this combination is optimal for maximizing productivity. The interaction between sowing date and wheat variety was significant, with the 15 November sowing of HS 542 (Pusa Kiran) achieving the highest yield and yield-related attributes. From an economic perspective, sowing HS 542 (Pusa Kiran) during the 47th meteorological week offers a remunerative strategy for wheat cultivation. These findings provide a basis for optimizing sowing schedules to en-

**Table 4.** Mean grain and straw yields and harvest index of wheat as influenced by different treatments

| Treatment | Grain yield (q $ha^{-1}$) | Straw yield (q $ha^{-1}$) | Harvest index (%) |
|---|---|---|---|
| A. Sowing dates (S) | | | |
| S1: (1stNov. 2018) | 40.33 | 59.69 | 40.31 |
| S2 : 47 MW (15th Nov. 2018) | 43.06 | 61.61 | 41.13 |
| S3 : 49 MW (29th Nov. 2018) | 36.00 | 54.92 | 39.59 |
| S4: (13th Dec. 2018) | 32.33 | 46.57 | 40.98 |
| S5: (27th Dec.2018) | 30.06 | 43.85 | 40.68 |
| S.E. m ± | 0.25 | 0.38 | 0.26 |
| C.D. at 5% | 0.84 | 1.26 | 0.86 |
| B. Varieties (V) | | | |
| V1: HS 542 | 38.00 | 55.04 | 40.83 |
| V2 : HD 2967 | 36.23 | 53.65 | 40.31 |
| V3 : HD 4728 | 34.83 | 51.30 | 40.48 |
| S.E. m ± | 0.11 | 0.19 | 0.10 |
| C.D. at 5% | 0.34 | 0.56 | 0.32 |
| C. Interaction (S × V) | | | |
| S.E. m ± | 0.26 | 0.42 | 0.24 |
| C.D. at 5% | 0.78 | 1.25 | 0.72 |
| General mean | 36.36 | 53.33 | 40.54 |

hance wheat productivity. However, as this study was conducted over a single season, further multi-season investigations are recommended to validate these results under varying environmental conditions.

**Conflict of Interest** – None

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