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# Effect of Dates of Planting on Yield of Wheat

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## Abstract

A field experiment was conducted at the research station in G. Udayagiri of Kndhamal district during the *rabi* season 2020-2022, to evaluate dates of sowing of wheat. The experiment was applied using the randomized block design (RBD) with five replicates experiment method, where the planting dates were occupied (1/11, 15/11, 1/12 and 15/12). The results showed that the sowing date (1/11) was superior to the other dates of sowing. Plant height was 94.0 cm, no of tillers-5.2, grains/ear-37.2, yield -19.7q $ha^{-1}$ found during 1st November sowing which were superior to other dates of sowing. Hence, 1st November sowing is best for wheat in North Eastern Ghat region.

***Key words*:** *Triticum aestivum*, Planting dates, Shrivelled grains, Yield parameters

Wheat (*Triticum aestivum* L.), belonging to the family Poaceae, was at the forefront of strategic grain crops in the world. The grain consists of 63-71% starch, 8-17% protein, 8-17% water, 2-2.5% cellulose, 1.5-2% fat, -23% sugar, and 1.5-2% mineral elements. Wheat is a major food crop, ranked third in India and fourth in the world in terms of its production [1]. In India, spring wheat is sown during October-November and harvested during February-April [2]. In Odisha, yield of wheat was 1505 kg $ha^{-1}$ in 2022, this records a decrease from previous year of 1606kg $ha^{-1}$ during 2021. Studies have reported heat stress in wheat for temperatures between 35 °C to 49 °C [3] during the grain development stages. Beyond the temperatures of 35°- 50 °C, wheat fails to survive. High temperatures are terminal to wheat yield specifically in the flowering and grain filling stages during the second half of the growing season [4]. Planting cereal crops at a proper time is one means of realizing higher economic yields as it allows crops to give their full yield potential. Belated planting of wheat has been recognized as a foremost bottleneck for high productivity.

Long duration rice variety or delay in the land preparation also delays the wheat sowing [5]. Delayed planting of wheat provides a short period of growth and maturity time for wheat; the hot air blown in March/April leads to forced maturity of wheat resulting with shrivelled wheat grains. In contrast, at the time of maturity, the hot air movement causes the early maturation without physiological maturity, which sharply declines the wheat yield [6]. Studies that cover the impact of land management practices of irrigation and addition of 62 nitrogen input on crop production aid in giving an overall understanding of the scope of 63 improvement in planting and managing the crop to enhance production [7]. (Akhtar *et al*. [8] reported that mid-November sown wheat could produce maximum yield (3.05 ton $ha^{-1}$) as compared to early (mid-October) and late (mid-late December) sown (2.35 ton $ha^{-1}$). Delayed wheat planting resulted in serious decline in grain yield [9-11]. Even though India is the third largest wheat producer in the world, domestic production is barely sufficient to meet the country's demand for food and livestock feed (USDA. Elevation in temperature accelerates plant development while growth rate declined showing decline in leaf size, tillering capacity and spike size which ultimately result in low yield [12-13]. So, enhancing wheat productivity is the main task during the short crop period. The leading factors required for increasing the yield are breeding, recommended time, methods, other agronomical practices, and storage. But among them as the least-cost technologies and the top problem is the appropriate time of sowing [14]. The timely plantation provides an optimum environment for the crop to accumulate higher photosynthate and increase higher grain yield [15], while delayed it exposed to low temperature at the germination cause delayed emergence and low plant population and higher temperature at the reproductive phase leads to force maturity and resulted to reduction of yield of wheat [16]. Sowing wheat on a different date does not differ significantly because the vegetative growth period seems equal at all the different dates but the sowing date on 25th November shows the highest pH of 106 cm and the same date was reported by Fazily *et al*. [17]. One experiment was conducted during Rabi 2020-22 to evaluate the effect of dates of panting on yield of wheat for North Eastern Ghat Zone of Odisha.

## MATERIALS AND METHODS

The primary objective of this experiment was to evaluate the effect of different planting dates on the yield of wheat during the Rabi season of 2020-22. The experiment involved four different planting dates as treatments to determine their impact on wheat yield:

$D_1$: 1st November
$D_2$: 15th November
$D_3$: 1st December
$D_4$: 15th December

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*Experimental design*

*Design*: The experiment was set up using a Randomized Block Design (RBD). This design helps in controlling the variability among experimental units by randomizing treatments within blocks.

*Replications*: Each treatment was replicated three times to ensure the reliability and statistical significance of the results.

*Plot details*

*Plot size*: Each plot measured 5 meters in width and 6 meters in length, providing a total area of 30 square meters per plot.

*Row spacing*: The rows within each plot were spaced 20 centimeters apart. This spacing allows adequate room for plant growth and access for maintenance activities.

*Seed rate*: A seed rate of 100 kilograms per hectare was used, ensuring a consistent and adequate plant population density across all plots.

*Fertilizer application*

*NPK dose*: The fertilizer was applied at a rate of 100 kilograms of Nitrogen (N), 50 kilograms of Phosphorus (P), and 40 kilograms of Potassium (K) per hectare. This balanced nutrient application aimed to meet the essential growth requirements of the wheat crop.

*Methodology*

*Sowing*: The wheat seeds were sown on the specified dates ($D_1$, $D_2$, $D_3$, and $D_4$) as per the treatment schedule.

*Crop management*: Standard agronomic practices were followed for crop management, including irrigation, weed control, and pest management, to ensure uniform growth conditions across all plots.

*Data collection*: Various growth and yield parameters were measured, including plant height, the number of tillers per plant, grains per ear, and overall yield in quintals per hectare (q ha<sup>-1</sup>).

*Parameters measured*

*Plant height (cm)*: The average height of plants in each plot.

*Number of tillers*: The average number of tillers per plant in each plot.

*Grains per ear*: The average number of grains per ear in each plot.

*Yield (q ha<sup>-1</sup>)*: The total yield of wheat per hectare.

The experiment aimed to identify the optimal planting date for maximizing wheat yield. By analyzing the growth and yield parameters under different planting dates, the study sought to provide valuable insights for farmers in the North Eastern Ghat region to optimize their planting schedules and improve crop productivity. The results were expected to reveal the best planting date for achieving the highest wheat yield. This would help in formulating better planting strategies, ultimately contributing to enhanced wheat production and profitability for farmers in the region.

## RESULTS AND DISCUSSION

The data indicated that there is significant yield reduction of wheat from 1st November sowing (19.7q $ha^{-1}$) to 15th December sowing (15.0q $ha^{-1}$) (Table 1). Plant height was 94.0 cm, no of tillers-5.2, grains/ear-37.2, in 1st November date of planting. Hence, 1st November sowing is best for wheat in North Eastern Ghat region.

Table 1 Evaluation of dates of planting on yield and yield attributing parameters of wheat

| Dates of planting | Plant height (cm) | No. of tillers | Grains / ear | Yield (q $ha^{-1}$) |
|---|---|---|---|---|
| $D_1$: 1st November | 94.0 | 5.2 | 37.2 | 19.7 |
| $D_2$: 15th November | 86.7 | 4.5 | 32.3 | 17.0 |
| $D_3$: 1st December | 83.8 | 4.2 | 31.1 | 16.4 |
| $D_4$: 15th December | 82.0 | 4.0 | 25.5 | 15.0 |
| C.D. (0.05) | 3.68 | 4.49 | 4.5 | 1.22 |

The results can conclude that delaying or postponing by the proper planting date for the wheat crop caused a reduction in wheat yield by 30%. This could be attributed to shortening the vegetative growth period, as well as weak vegetation, lack of spikes, and grain atrophy due to the expulsion of late spikes, which is counterbalanced by high temperature in the grain filling, and also makes the crop more susceptible to disease insects. These results are in harmony agreement with those obtained by [18-22], which reported that increasing mean temperatures during the growing season have been reported to reduce grain yields of irrigated wheat crops under field conditions and the authors also attributed this to a shortening of the growing season, less light interception, and fewer kernels per unit area. This is also in consensus with the study of Wieg and Cuellar [23]. Decrease in the yield attributes i.e. grains/spike and 1000-grain weight due to delay in sowing date contributed to decrease in the grain yield for which the main reasons are the decrease in growing degree days [24], longer photoperiod and higher temperature during the reproductive stage [25] and the genotype. Rout Satapathy [26] observed higher plant height when wheat was sown on 21st November and 1st December than the preceding and succeeding dates of sowing. Baloch *et al*. [27] concluded that wheat cultivation on 25 October and 10 November produced the largest number of branches, plant height, the weight of 1000 grains, and grain yield and it decreased with the next planting dates. Delaying wheat sowing results in high temperature at anthesis and during grain filling stages, and this high temperature will reduce the final yield Dias *et al*. [28], Modarresi *et al*. [29]. Also, Joshi *et al*. [30] reported heat stress as major abiotic stress due to delayed sowing affecting the wheat cultivation.

## CONCLUSION

The data from the experiment conducted during the Rabi 2020-22 season indicated a significant reduction in wheat yield when sowing was delayed from 1st November to 15th December. Specifically, the yield decreased from 19.7 q ha<sup>-1</sup> for the 1st November planting date to 15.0 q ha<sup>-1</sup> for the 15th December planting date.

Additionally, the 1st November planting date resulted in the highest plant height (94.0 cm), number of tillers (5.2), and grains per ear (37.2). Consequently, the 1st November sowing date is recommended for wheat cultivation in the North Eastern Ghat region. The results demonstrated that delaying the planting date led to a reduction in wheat yield by approximately 30%. This decline can be attributed to a shortened vegetative growth period, reduced plant vigor, fewer spikes, and grain atrophy due to late spike emergence. These conditions are exacerbated by higher temperatures during the grain filling stage, making the crop more susceptible to diseases and insect attacks. These findings align with previous research, which has shown that increasing mean temperatures during the growing season can reduce grain yields in irrigated wheat crops due to a shorter growing season, reduced light interception, and fewer kernels per unit area. Delayed sowing also results in a decrease in yield attributes such as grains per spike and 1000-grain weight, primarily due to a reduction in growing degree days, longer photoperiods, and higher temperatures during the reproductive stage. In summary, to maximize wheat yield in the North Eastern Ghat region, it is best to sow wheat by 1st November. Delayed sowing significantly reduces yield and yield attributes, confirming the critical importance of timely planting in wheat cultivation.

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