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# Influence of NPK levels and method of sowing on growth and yield of wheat (*Triticum aestivum* L.) Prayagraj condition

**Vipin Patel, Lalit Kumar Sanodiya, Ajay Kumar, Sachchida Nand Singh, Anuj Kumar Singh and Shubham Dubey**

**Abstract**
The present research attempts, titled "Influence of NPK levels and system of sowing on growth and yield of Wheat (*Triticum aestivum* L.)." was conducted at the Agronomy Research Farm of the United University, Jhalwa Prayagraj, Uttar Pradesh, in the *Rabi* season of 2022-23 (U.P.). Ten treatment were used in the experiment *viz:* Three levels of RDF—50%, 75%, and 100%—as well as three sowing techniques-Normal practice, the System of Wheat Intensification, and furrow-irrigated raised beds with control—were used, as necessary, in a Randomized Block Design with three replications. The observation revealed that the different treatment used during the experiment had a substantial impact on all growth indicators and yield qualities. A 100% RDF application (NPK/ha 120:60:60 kg) combined with a furrow-irrigated raised bed (FIRB) resulted in better values for all yield-attributing features and wheat yield, including grain yield (6.38 t/ha), straw yield (7.43 t/ha), and harvest index (46.91%). The use of 100% RDF (NPK/ha 120:60:60 kg) and furrow-irrigated raised beds (FIRB) resulted in the highest gross return (Rs. 144579.6 $ha^{-1}$), net return (Rs. 90939.44 $ha^{-1}$) and net income per rupee investment of B: C (1.70).

**Keywords:** NPK levels, sowing methods, wheat, growth and yield

## Introduction
Wheat is known as the "King of Cereals." It is the third most produced cereal worldwide, behind rice and maize. It is India's second-largest crop behind rice in terms of production and acreage. The dinkale series (2n = 42) of common bread wheat, commonly known as Mexican Dwarf Wheat, is currently grown all throughout India. It was created by Dr. N. E. Borlaug at CIMMYT in Mexico. South West Asia is where I'm originally from. Wheat is a C3 plant, a cool-season crop that is self-pollinating and has long days (LDP). (Muchhadiya *et al.*, 2021) [7]. In India, wheat is the second most significant crop and a major source of calories consumed. It has been grown on the Indian subcontinent since the beginning of recorded history and is crucial to the nation's economy and food security. A systematic investigation into the crop has begun. The second most extensively farmed food crop in India is wheat (*Triticum aestivum* L.). Wheat, a crop grown during the *Rabi* season (winter), was extremely important in maintaining the nation's production of food grains. Chapatis are the most common type of consumption. Compared to other cereals, wheat contains greater protein (8–15% in grain form and 8–13% in flour). The DBW-187 variety produced plants with lower water requirements as well as higher plant height, tillers per plant, dry weight, grains per spike, spike length, grain yield, straw yield, and test weight. (Satish *et al.*, 2022) [8]. Wheat (*Triticum aestivum* L.), a major staple food for about 36% of the world's population. India is the second-largest producer of wheat after China with an area of 29.64 million hectares, a production of 92.46 million tonnes, and an average productivity of 3.12 t $ha^{-1}$. Uttar Pradesh is the nation's leader in terms of acreage (36.6%) and wheat production (39.3%). Out of the top 100 wheat-producing districts, 43 (each with a production of more than a lakh tonnes) are located in Uttar Pradesh, and of those, 19 are located in the western part of the state. Compared to Panjab and Haryana, these districts' wheat productivity is much lower. Since the middle of the 1980s, India's wheat yield has either fallen or stagnant. (Duxbury *et al.*, 2000; Tyagi *et al.*, 2020) [4, 9].
The timing and balance of NPK application has a significant impact on wheat production. Plant species, even within-species variants, differ in how they acquire and use NPK for grain production.

Nitrogen plays a vital role in growth processes as it is an integral part of chlorophyll, protein and nucleic acid. Phosphorus stimulates flourishing and seed formation. Due to its active role in the biochemical processes of the plant, such as the activation of numerous enzymes, enhancement of protein, carbohydrate, and fat concentration, development of drought tolerance, and development of resistance to frost, lodging, pest, and disease assault, potassium ($K^+$) is of remarkable relevance. (Malghani *et al*., 2021) [6].

The System of Wheat Intensification (SWI), which relies on low-tech methods, may need more labour than conventional methods, but it uses fewer seeds, insecticides, fertilizers, and water. SWI yield gains are twice as great as those from traditional methods. In a hectare, SWI utilizes only 25 to 30 kg of enhanced seeds, with a 25 cm gap between rows and plants. The crop roots can receive the appropriate moisture, aeration, nutrition, and light when the plants are sufficiently spaced apart and when two germinated seeds are sown at the same time. This promotes faster plant development. (Abraham *et al.*, 2014) [1]; (Muchhadiya *et al.*, 2021) [7]. It was found the furrow-irrigated raised-bed planting method (FIRBS), a type of tillage in which sowing is carried out on raised beds. This increases tillage efficiency, saves water, reduces lodging, and ensures better fertilizer use. The seed rate may be reduced to 75 kg/ha when using FIRBS. The advised sowing depth is 5-2 cm with a row spacing of 20–23 cm. (Aziz *et al*., 2013; Tyagi *et al*., 2020) [2, 9].

## Material and Methods

A field experiment was carried out in the *Rabi* season of 2022–2023 at the United University Agricultural Research Farm at Rawatpur, Jhalwa, Prayagraj (U.P.), India which is situated at $25.39^0$ N latitude, $81.75^0$ E longitude with an altitude of 113 meters above mean sea level. To investigate the effects of NPK levels and sowing practices on the development and yield of wheat (*Triticum aestivum* L.). The experiment was set up using a randomized block design with three replications. The experiment was comprised of ten treatment *viz*., $T_1$ RDF of 50% (NPK/ha 60:30:30 kg) + Normal Practice, $T_2$ RDF of 50% (NPK/ha 60:30:30 kg) + System of Wheat Intensification (SWI), $T_3$ RDF of 50% (NPK/ha 60:30:30 kg) + Furrow Irrigated Raised Bed (FIRB), $T_4$ RDF 75% of (NPK/ha 90:45:45 kg) + Normal Practice, $T_5$ RDF 75% of (NPK/ha 90:45:45 kg) + System of Wheat Intensification (SWI), $T_6$ RDF 75% of (NPK/ha 90:45:45 kg) + Furrow Irrigated Raised Bed (FIRB), $T_7$ RDF 100% of (NPK/ha 120:60:60 kg) + Normal Practice, $T_8$ RDF 100% of (NPK/ha 120:60:60 kg) + System of Wheat Intensification (SWI), $T_9$ RDF 100% of (NPK/ha 120:60:60 kg) + Furrow Irrigated Raised Bed (FIRB) and $T_{10}$ Control. Wheat variety 'Karan Vandana-187 (DBW-187)' was sown using a 15 kg per ha seed rate after pre-sowing irrigation. As suggested, a basal dose of 120 kg N, 60 kg P2O5, and 40 kg K was administered per hectare. Before sowing, FYM was administered to the field according to the treatment instructions and blended with the soil. The data collected for each character was subjected to statistical analysis using the "analysis of variance" technique. Overall differences were evaluated using the "F" test of significance at the recommended 5 percent level of significance. Cochran and Cox (1957) [3]. Critical differences at a probability threshold of 5% were calculated for comparing treatments.

## Results and Discussion

### A result for the growth parameters

At harvest, significantly highest plant height (106.63 cm), Plant dry weight (23.31 g), Crop growth rate (6.98 g/m$^2$/day) was recorded in the treatment with $T_9$ (RDF of 100% (NPK/ha 120:60:60 kg) + FIRB), over all the other treatments. However, the treatments $T_8$ (RDF of 100% (NPK/ha 120:60:60 kg) + SWI) and $T_7$ (RDF of 100% (NPK/ha 120:60:60 kg) + Normal Practice) was found to be statistically at par with $T_9$ (RDF of 100% (NPK/ha 120:60:60 kg) + FIRB).

Since it is a component of nucleic acid, protein, and chlorophyll, nitrogen is crucial to the processes involved in growth. Because of its function in substance synthesis, it is regarded as the key component. It makes up 1.5–5% of the dry weight of greater plant heights. Phosphorus promotes growth and the development of seeds. Due to its active engagement in a number of plant biochemical processes, including the activation of different enzymes, enhancement of protein, carbohydrate, and fat concentration, development of drought tolerance, and defence against frost, lodging, pest, and disease attack, potassium has an unusually important role. (Malghani *et al*., 2021) [6].

### Effect on yield attributes and yield

Significantly higher number of tillers (21.87), number of effective tillers/plant (19.05), number of grains per spike (47.67), test weight (46.15 g), seed yield (6.38 t ha$^{-1}$), stover yield (7.43 t ha$^{-1}$) and harvest index (46.91%) was recorded in the treatment with $T_9$ (RDF of 100% (NPK/ha 120:60:60 kg) + FIRB), over all the other treatments. However, the treatments $T_8$ (RDF of 100% (NPK/ha 120:60:60 kg) + SWI) and $T_7$ (RDF of 100% (NPK/ha 120:60:60 kg) + Normal Practice) was found to be statistically at par with $T_9$ (RDF of 100% (NPK/ha 120:60:60 kg) + FIRB).

The grain yield of wheat was much higher after applying Zn together with NPK than it had been after applying NPK alone, highlighting the importance of balanced fertilization for achieving greater productivity. Due to the phosphorus and potassium being left out of the fertilizer schedule, there may have been a decrease in Olsen-P and accessible potassium, which may have affected root development, caused bronzing yellowing of the leaf tips, and increased susceptibility to lodging. (Jat *et al*., 2020) [5].

**Table 1:** Effect of NPK levels and method of sowing on growth of wheat

| Tr. No. | Treatment combination | At harvest | | | |
|---|---|---|---|---|---|
| | | Plant height (cm) | Plant dry weight (g) | Crop growth rate (g/m$^2$/day) | Relative growth rate (g/g/day) |
| $T_1$ | RDF of 50% (NPK/ha 60:30:30 kg) + Normal Practice | 93.02 | 17.94 | 2.47 | 0.003 |
| $T_2$ | RDF of 50% (NPK/ha 60:30:30 kg) + (SWI) | 94.08 | 18.45 | 3.18 | 0.004 |
| $T_3$ | RDF of 50% (NPK/ha 60:30:30 kg) + (FIRB) | 96.13 | 18.84 | 2.76 | 0.003 |
| $T_4$ | RDF of 75% (NPK/ha 90:45:45 kg) + Normal Practice | 98.06 | 20.00 | 3.84 | 0.004 |
| $T_5$ | RDF of 75% (NPK/ha 90:45:45 kg) + (SWI) | 98.25 | 20.07 | 2.26 | 0.002 |
| $T_6$ | RDF of 75% (NPK/ha 90:45:45 kg) + (FIRB) | 98.96 | 20.46 | 2.23 | 0.002 |
| $T_7$ | RDF of 100% (NPK/ha 120:60:60 kg) + Normal Practice | 100.01 | 21.85 | 4.33 | 0.004 |
| $T_8$ | RDF of 100% (NPK/ha 120:60:60 kg) + (SWI) | 104.51 | 23.04 | 6.93 | 0.006 |
| $T_9$ | RDF of 100% (NPK/ha 120:60:60 kg) + (FIRB) | 106.63 | 23.31 | 6.98 | 0.007 |
| $T_{10}$ | Control | 86.35 | 16.50 | 4.29 | 0.005 |
| | SEm± | 2.99 | 0.80 | 2.21 | 0.002 |
| | CD (p=0.05) | 8.88 | 2.38 | - | - |

**Table 2:** Effect of NPK levels and method of sowing on yield attributes and yield of wheat

| Tr. No. | Treatment | Yield attribute | | | | Yield | | |
|---|---|---|---|---|---|---|---|---|
| | | No. of tillers | No. of effective tillers/plant | No. of grain per spike | Test weigh (g) | Grain yield (t ha$^{-1}$) | Stover yield (t ha$^{-1}$) | Harvest index (%) |
| $T_1$ | RDF of 50% (NPK/ha 60:30:30 kg) + Normal Practice | 15.47 | 14.67 | 42.80 | 42.16 | 5.19 | 6.10 | 47.11 |
| $T_2$ | RDF of 50% (NPK/ha 60:30:30 kg) + (SWI) | 15.87 | 15.27 | 43.47 | 42.99 | 5.27 | 6.33 | 48.96 |
| $T_3$ | RDF of 50% (NPK/ha 60:30:30 kg) + (FIRB) | 16.40 | 15.96 | 43.63 | 43.93 | 5.42 | 6.49 | 45.78 |
| $T_4$ | RDF of 75% (NPK/ha 90:45:45 kg) + Normal Practice | 17.73 | 17.12 | 45.13 | 44.49 | 5.55 | 6.62 | 46.11 |
| $T_5$ | RDF of 75% (NPK/ha 90:45:45 kg) + (SWI) | 18.00 | 17.80 | 45.58 | 44.98 | 5.74 | 6.76 | 47.71 |
| $T_6$ | RDF of 75% (NPK/ha 90:45:45 kg) + (FIRB) | 18.73 | 18.09 | 45.87 | 45.15 | 5.91 | 6.85 | 43.88 |
| $T_7$ | RDF of 100% (NPK/ha 120:60:60 kg) + Normal Practice | 20.80 | 18.61 | 46.68 | 45.73 | 6.07 | 7.08 | 45.78 |
| $T_8$ | RDF of 100% (NPK/ha 120:60:60 kg) + (SWI) | 21.33 | 18.73 | 46.80 | 45.81 | 6.25 | 7.21 | 43.35 |
| $T_9$ | RDF of 100% (NPK/ha 120:60:60 kg) + (FIRB) | 21.87 | 19.05 | 47.67 | 46.15 | 6.38 | 7.43 | 46.91 |
| $T_{10}$ | Control | 10.91 | 11.51 | 35.54 | 38.44 | 3.84 | 5.16 | 40.76 |
| | SEm± | 0.84 | 0.89 | 1.33 | 1.29 | 2.46 | 2.83 | 1.13 |
| | CD (p=0.05) | 2.48 | 2.65 | 3.96 | 3.83 | 7.30 | 8.42 | - |

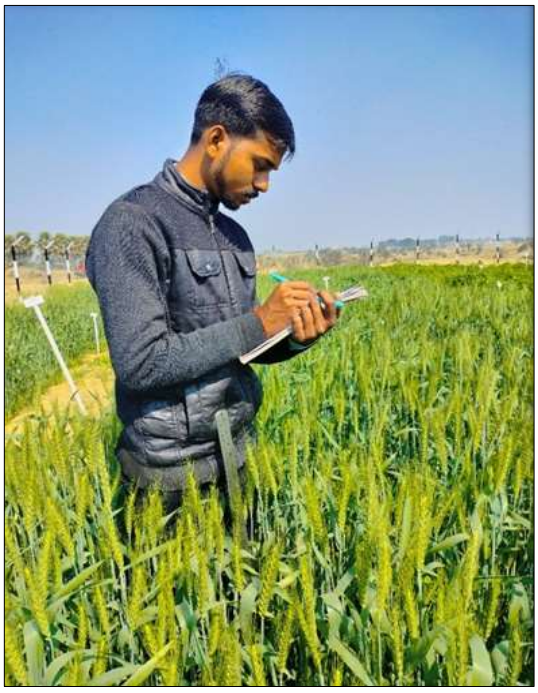

**Plate 1:** Observe the data on flowering stage

**Plate 2**: Finaly harvesting done research trial

**Plate 3:** Field view in flowering stage

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**Conclusions**
Thus, it can be inferred from the experiment that 100% recommended dose of fertilizer with furrow irrigation raised beds was found to be the best treatment for increasing the productivity of growth and yield as well as obtaining more net returns and benefit: cost ratios in wheat cultivation.

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