## *Original Research Article*

# Effect of organic and inorganic sources of nutrients on growth and yield of timely sown wheat (*Triticum aestivum* L.)


## Abstract

*An investigation on the impact of organic and inorganic sources of nutrients on growth and yield in wheat crop was conducted during Rabi season of 2020-21 at Student's Instructional Farm of C.S. Azad University of Agriculture and Technology, Kanpur. The experiment was laid out in Randomized Block Design and treatment was replicated three times where 8 treatments were tested viz.Control ($T_1$), RDF 100% (120:60:40) NPK kg ha$^{-1}$) ($T_2$). RDF + Azotobactor ($T_3$). RDF + Azotobacter + FYM @ 2.0 t ha$^{-1}$ + PSB @ 6.0 kg ha$^{-1}$ + Trichoderma @ 5.0 kg ha$^{-1}$ ($T_4$). RDF+ Vermicompost @ 2.5 t ha$^{-1}$ ($T_5$), RDF + FYM @ 2.0 t ha$^{-1}$ + Vermicompost @ 1.0 t ha$^{-1}$ + Trichoderma @ 5.0 kg ha$^{-1}$ ($T_6$). RDF + FYM @ 2.0t ha$^{-1}$ + Vermicompost @ 1.0 t ha$^{-1}$ + PSB @ 6.0 kg ha$^{-1}$ + Azotobacter ($T_7$). RDF + FYM @ 2.0t ha$^{-1}$ + Vermicompost @ 1.0 t ha$^{-1}$ + Azotobactor + PSB @ 6.0 kg ha$^{-1}$ + Zinc @ 5.0 kg ha$^{-1}$ + Sulphur @ 25 kg ha$^{-1}$ ($T_8$). The soil of field was Sandy-Loam and pH of 8.13. The wheat variety Shekhar (K-1006) was sown on 30 November 2020 at row spacing 20cm with seed @100 kg/ha. The result showed that the treatment of RDF + FYM @ 2.0t ha$^{-1}$ + Vermicompost @1.0 t ha$^{-1}$ + Azotobacter + PSB @6.0 kg ha$^{-1}$ + Zn @5.0 kg ha$^{-1}$ + Sulphur @25 kg ha$^{-1}$ ($T_8$) gave significantly better growth of plant i.e. Plant height, Fresh weight, Dry weight and Number of tillers plant$^{-1}$ and yield contributing characters viz., Spike length, Number of grains spike$^{-1}$ and Test weight of wheat crop as compared to rest treatments, respectively. The Grain yield, Straw yield and Biological yield were highest produced in treatment of $T_8$ by 52.77, 67.55 and 120.32 q ha$^{-1}$in comparison to treatment of $T_1$, $T_2$, $T_3$ and $T_4$ but at par in $T_5$, $T_6$ and $T_7$ treatment, respectively. The maximum gross income (Rs. 143076.00), net income (Rs. 86300.00) and B : C Ratio (2.52) was recorded in treatment RDF + FYM @2.0 t ha$^{-1}$ + Vermicompost @1.0 t ha$^{-1}$ + Azotobacter + PSB @6.0 kg ha$^{-1}$ + Zn @5.0 kg ha$^{-1}$ + Sulphur @25 kg ha$^{-1}$ on rest of the treatments, respectively.*



***Keywords:***Wheat, Microbial inoculants, Organic manure, Trichoderma, Zinc, Sulphur,




## INTRODUCTION

Wheat (*Triticum aestivum* L.) is the first important and strategic cereal crop for the majority of world's population. It is most important staple food crop of about 2 billion people (36% of the world's population). It is consumed all over around the world. It exceeds in acreage and production from every other grain crop (including rice, maize etc.) and is therefore the most important cereal grain crop of the world, which is cultivated over a wide range of climatic conditions. Worldwide,

wheat crop is grown in all the countries of the world. These countries are China, India, USA, Canada, European-union and

Australia. Globally, wheat occupies area around 217 million hectares. The production of wheat in the world is 760 million tones with an average productivity of 3.50 t $ha^{-1}$. The total cultivated area occupied by wheat in India is 31.4 million hectares. The total production of wheat in India is 108.75 million tones and productivity of wheat is 3.46 t $ha^{-1}$. Uttar Pradesh is the leading state in behalf of production of wheat and cultivable wheat area. In U.P wheatwas sown in the area of 97.86 lakh hectares. Wheat production in Uttar Pradesh is 32.59 million tones and productivity of wheat in U.P is 3.33 t $ha^{-1}$**(Anonymous, 2021)**. The production of chemical fertilizer which has been highly cost effective and depends on non-renewable fossil fuel that is in delicate shortage. We should use farm yard manure (FYM), vermicompost, Trichoderma and many more to give plant nutrients. Therefore, the present experiment was undertaken to assess the effect of organic and inorganic sources of nutrients on production potential of wheat crop.

**MATERIALS AND METHODS**

The field experiment was conducted at Students Instructional Farm (SIF) during Rabi season of 2020-21 of C. S. Azad University of Agriculture & Technology, Kanpur (U.P) situated at $25^{o}$ 56 to $28^{o}$ 58' North and Longitude $79^{o}$ 31' to $80^{o}$ 34' East and is located on an elevation about 125.9 meters above mean sea level in Gangatic plain. The seasonal rainfall of about 816 mm received mostly from $2^{nd}$ fortnight of June or first Fortnight of July to Mid-October with a few showers in winter season. The soil of experimental field was sandy loam (21.96% clay, 22.95% silt and 55% sand) of Indo-gangatic alluvial origin, whereas pH was 8.03 and EC was 0.10 $dsm^{-1}$. Before sowing initial soil sample analysis was made to determine organic carbon, available N, P and K which was determined as 0.41 percent, 180.0, 11.0 and 173.0 kg $ha^{-1}$, respectively. Eight treatments of superimposed nutritional doses of organic manure, microbial inoculants and inorganic fertilizers were selected for the experiment. The treatments consisted of Control ($T_1$), RDF 100% (120:60:40) NPK kg $ha^{1}$) ($T_2$). RDF + Azotobactor ($T_3$). RDF + Azotobacter + FYM @ 20 t $ha^{-1}$ + PSB @ 6.0 kg $ha^{-1}$ + Trichoderma @ 5.0 kg $ha^{-1}$ ($T_4$). RDF+ Vermicompost @ 2.5 t $ha^{-1}$ ($T_5$), RDF + FYM @ 2.0 t $ha^{-1}$ + Vermicompost @ 1.0 t $ha^{-1}$ + Trichoderma @ 5.0 kg $ha^{-1}$ ($T_6$). RDF + FYM @ 2.0t $ha^{-1}$ + Vermicompost @ 1.0 t $ha^{-1}$ + PSB @ 6.0 kg $ha^{-1}$ + Azotobacter ($T_7$). RDF + FYM @ 2.0t $ha^{-1}$ + Vermicompost @ 1.0 t $ha^{-1}$ + Azotobactor + PSB @ 6.0 kg $ha^{-1}$ + Zinc @ 5.0 kg $ha^{-1}$ + Sulphur @ 25 kg $ha^{-1}$ ($T_8$). The farm yard manure, vermicompost, azotobacter and PSB were mixed in soil before sowing. The treatments were replicated three times under Randomized Block Design. The seed was inoculated with Azotobacter and PSB before sowing and sown at row spacing of 20cm apart. The crop was irrigated with four irrigation. The wheat variety “SHEKHAR” was sown on 30 November 2020 and harvested on 20 April 2021. Other management practices were adopted as per recommendation of wheat cultivations.

## RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads:

### Growth attributes

The data pertaining to growth characters and yield attributes are summarized in Table: 1. The results revealed that organic and inorganic sources of nutrients did not affect initial plant population status, which was non-significant. More or less similar results were obtained in case of plant population of the crop. The growth in case of no. of tillers plant$^{-1}$ were significantly influenced by organic and inorganic nutrient treatments. The maximum tillers plant$^{-1}$ were recorded under $T_8$ (5.43), whereas minimum tillers plant$^{-1}$ was recorded under $T_1$ (2.79). The maximum plant height (cm) was recorded highest in $T_8$ (97.03), while minimum plant height (cm) was obtained in ($T_1$) control (74.63). The maximum fresh weight and dry weight was obtained in $T_8$ (57.76gm and 28.90gm), whereas minimum fresh weight and dry weight was found in $T_1$ (40.26gm and 20.90gm).Growth characters was reported by several scientists *viz.*,Mahato *et al.*,(2018) and Bahara *et al.*,(2007)

### Yield attributes

Significant proliferation was obviously observed in yield attributes *viz.*, length of spike, number of grain spike$^{-1}$ and Test weight of grain (Table:1). The maximum spike length (10.75 cm) and number of grains spike$^{-1}$ (53.46) were recorded in $T_8$ (RDF + FYM @2.0 ha + Vermicompost @1.0 t ha$^{-1}$ + Azotobacter + PSB @6.0 kg ha$^{-1}$ + Zinc @5.0 kg ha$^{-1}$ + Sulphur @25 kg ha$^{-1}$) whereas, minimum spike length (6.26 cm) and minimum number of grains spike$^{-1}$ was recorded in Control ($T_1$). Other treatments were significantly at par among themselves. The use of organic and inorganic nutrients leads to the significant improvement in the test weight. The maximum test weight was recorded in $T_8$(39.20 g). Similar findings were reported by Borse *et al.* (2019) and Satyavan *et al.* (2018).

### Yield and Economics

The data regarding Biological yield, Grain yield, Straw yield and Economic analysis are summarized in Table: 2. The super imposition of organic manure (FYM and Vermicompost) and microbial inoculants (Azotobacter and PSB) over recommended dose of fertilizer (RDF) found more effective than imposition of only organic manure or only microbial inoculant with RDF in terms of Biological and grain yield of wheat. The maximum biological yield, grain yield and straw yield (120.32 q ha$^{-1}$, 52.77 q ha$^{-1}$ and 67.55 q ha$^{1}$) were recorded under Treatment-8, while minimum 72.62 q ha$^{-1}$ biological yield, 30.75 q ha$^{-1}$ grain yield and 42.87 q ha$^{-1}$ straw yield was obvious in Control treatment ($T_1$).

The effectiveness of conjunctive use of organic manure + microbial inoculants with recommended dose of fertilizer on augmentation on grain and straw yield of wheat were reported by several scientists *viz.,* Kulkarni *et al.*(2018) and Kumar *et al.*(2020).

The total cost of cultivation (Table:2) was worked out maximum (Rs. 56776) in treatment$T_8$ and was found minimum in treatment $T_1$ (Rs. 44717.00 $ha^{-1}$). Maximum gross income was found in $T_8$ (Rs.143076) and minimum gross income was found in control $T_1$ (Rs. 83396). Maximum net return was found in $T_8$ treatment (Rs. 86300) and was found minimum in control treatment $T_1$ (Rs. 38679) whereas, the benefit cost ratio was found maximum in $T_8$ treatment (2.52). Economic parameters of wheat was reported by Fazily*et al.,* (2019) and Kumar *et al*. (2020).

**Conclusion**

The investigation at C.S. Azad University of Agriculture and Technology, Kanpur, on wheat crop nutrition during Rabi 2020-21, clearly demonstrates the superior efficacy of combining organic and inorganic nutrient sources. The standout treatment, T8, which amalgamated RDF with FYM, Vermicompost, Azotobacter, PSB, Zinc, and Sulphur, significantly enhanced wheat growth and yield parameters. This blend outperformed other treatments in plant height, weight, tiller number, spike length, grain number, and test weight. Notably, T8 achieved the highest grain, straw, and biological yields, marking a stark improvement over control and other nutrient combinations. Financially, T8 led with the highest gross and net income, and an impressive benefit-cost ratio of 2.52. This comprehensive approach, integrating various nutrient sources, holds great promise for sustainable and profitable wheat cultivation, offering a viable template for similar agronomic conditions.

REFERENCES

**Anonymous (2021):** Department of agriculture co-operation and Farmer,s welfare: https://www.researchgate.net.

**Bahara, U.K., Pradhan, S. and Sharma, A.R.(2007):** Effect of Integrated nutrient management practices on productivity of Durum wheat(*Triticum aestivum* L.) in the vertisols of Central India. *Annals of Plant and Soil research* **1**:21-24

**Borse, D.K., Usadadia, V.P., and Thorave, D.S. (2019):** Nutrient management in wheat (*Triticum aestivum* L.) under Partially Reclaimed Coastal Salt affected soil of Gujarat as well as yield attributes. *Journal of current microbiology and applied sciences,* 7**(6):** 418-423.

**Fazily Tamim and Hunshal, C.S. (2019):** Effect of organic manures on yield and economics of late sown wheat (*Triticum aestivum* L.). *International Journal of Research and Review,* 6**(1)**:168-171.

**Kulkarni, M.V., Patel, K.C., Patil, D.D., and Pathak Madhuri (2018):** Effect of organic and inorganic fertilizers on yield and yield attributes of wheat. *International Journal of Chemical Studies,* 6**(2)**:87-90.

**Kumar Manish, Singh, S.K., and Bohra, J.S. (2020):** Cumulative effect of organic and inorganic sources of nutrients on yield, Nutrients uptake and economics of wheat on Indo-Gangatic Plains of India, *Communications in Soil Science and Plant analysis,* 51**(5)**:658-674.

**Mahato Sanjay, Bhuju Sushmita and Jiban Shreshtha (2018)** Effect of Trichoderma viride as Bio-fertilizer on growth and yield of wheat *Malaysian Journal of Sustainable agriculture (MJSA)*2**(2)** (2018) 01-05.

**Satyavan, S.K., Bishnoi, D.K., Kumar Nirmal and Dhillon Ashok (2018):** Effect of integrated nutriebt management on yield and yield attributes and economics of wheat. *International Journal of Current Microbiology and Applied sciences,* 7**(5):** 618-628.

**Table 1: Effect of Organic and Inorganic nutrients on growth characters and yield attributes of wheat.**

| Treatments | Plant population($m^2$) | Plant height (cm) | Fresh wt. plant$^{-1}$ (g) | Dry wt. plant$^{-1}$ (g) | Tillers plant$^{-1}$ | Spike length (cm) | Grain Spike$^{-1}$ | Test weight (g) |
|---|---|---|---|---|---|---|---|---|
| Control | 104.30 | 74.63 | 40.26 | 20.90 | 2.79 | 6.26 | 39.06 | 33.72 |
| RDF 100% (120:60:40 NPK kg ($ha^{-1}$) | 106.20 | 83.50 | 43.06 | 22.96 | 3.05 | 6.63 | 41.70 | 35.47 |
| RDF + Azotobacter | 106.50 | 85.36 | 44.03 | 23.30 | 3.19 | 7.53 | 42.58 | 36.68 |
| RDF + Azotobacter + FYM @2.0t $ha^{-1}$+ PSB @6.0kg $ha^{-1}$ + Tricho. @5.0kg $ha^{-1}$ | 107.10 | 88.86 | 48.03 | 24.36 | 3.54 | 7.78 | 45.76 | 37.21 |
| RDF + Vermicompost @2.5t $ha^{-1}$ | 107.90 | 94.90 | 53.96 | 26.63 | 5.16 | 9.24 | 47.53 | 38.85 |
| RDF + FYM @2.0t $ha^{-1}$+ Vermi.@1.0t $ha^{-1}$+ Trichoderma @5.0kg $ha^{-1}$ | 107.60 | 92.40 | 50.66 | 25.53 | 4.10 | 9.18 | 46.46 | 38.65 |
| RDF + FYM@2.0t $ha^{-1}$+ Vermi. @1.0t $ha^{-1}$+ Azotobacter + PSB@6.0kg ha-1 | 108.40 | 95.90 | 54.60 | 27.63 | 5.23 | 9.81 | 51.36 | 38.98 |
| RDF + FYM@2.0t $ha^{-1}$ + Vermi.@1.0t $ha^{-1}$+ Azoto.+ PSB@6.0kg $ha^{-1}$+ Zn@5.0kg $ha^{-1}$+ Sulphur @25 kg $ha^{-1}$ | 109.40 | 97.03 | 57.76 | 28.90 | 5.43 | 10.75 | 53.46 | 39.20 |
| **S.E. (d) ±** | **2.30** | **2.89** | **1.60** | **1.20** | **0.23** | **0.40** | **1.80** | **0.72** |
| **C.D. at 5%** | **N.S.** | **6.20** | **3.40** | **2.50** | **0.49** | **0.80** | **3.80** | **1.54** |

**Table 2: Effect of organic and inorganic nutrients on yield and economics of wheat.**

| Treatments | Biological yield(q/ha) | Grain yield(q/ha) | Straw yield(q/ha) | Harvest index(%) | Gross income (Rs $ha^{-1}$) | Net return (Rs $ha^{-1}$) | B:C ratio |
|---|---|---|---|---|---|---|---|
| Control | 72.62 | 30.75 | 42.87 | 41.77 | 83396 | 38679 | 1.86 |
| RDF 100% (120:60:40 NPK kg ($ha^{-1}$) | 102.88 | 43.92 | 58.96 | 42.68 | 118644 | 67368 | 2.31 |
| RDF + Azotobacter | 109.79 | 47.12 | 62.67 | 42.91 | 126282 | 74806 | 2.45 |
| RDF + Azotobacter + FYM @2.0t $ha^{-1}$+ PSB @6.0kg $ha^{-1}$ + Tricho. @5.0kg $ha^{-1}$ | 111.72 | 48.22 | 63.50 | 43.16 | 128913 | 75737 | 2.42 |
| RDF + Vermicompost @2.5t $ha^{-1}$ | 116.54 | 50.67 | 65.87 | 43.48 | 135035 | 78759 | 2.40 |
| RDF + FYM @2.0t $ha^{-1}$+ Vermi.@1.0t $ha^{-1}$ + Trichoderma @5.0kg $ha^{-1}$ | 113.42 | 49.14 | 64.28 | 43.32 | 131357 | 76761 | 2.41 |
| RDF + FYM@2.0t $ha^{-1}$+ Vermi. @1.0t $ha^{-1}$+ Azotobacter + PSB@6.0kg ha-1 | 118.53 | 51.76 | 66.77 | 43.67 | 137681 | 82855 | 2.51 |
| RDF + FYM@2.0t $ha^{-1}$ + Vermi.@1.0t $ha^{-1}$ + Azoto. + PSB@6.0kg $ha^{-1}$+ Zn@5.0kg $ha^{-1}$+ Sulphur @25 kg $ha^{-1}$ | 120.32 | 52.77 | 67.55 | 43.86 | 143076 | 86300 | 2.52 |
| **S.E. (d) ±** | **3.32** | **1.80** | **2.0** | **0.35** | **2305** | **2775** | **0.10** |
| **D. at 5%** | **7.12** | **3.81** | **4.22** | **0.80** | **4944** | **6010** | **0.20** |