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# Effect of STCR Based Application of Organic and Inorganic Fertilizers on Growth, Productivity and Economics of Wheat *(Triticum aestivum L.)* in Inceptisol of Prayagraj, India

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

A field experiment was carried out during Rabi season of 2020-2021 and 2021-2022 at the Sam Higginbottom University of Agriculture, Technology& Sciences, Prayagraj (Uttar Pradesh) at research field of department of Soil Science to find out the "Effect of STCR based application of organic and inorganic fertilizers on growth, productivity and economics of wheat (*Triticum aestivum L.*) in Inceptisol of Prayagraj". The experiment was laid out in Factorial Randomized Block Design, with three replications. The Soil texture class Sandy loam, experimental area falls in order of

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Inceptisol. The Soil pH (7.6), EC at $25^0$c (0.63dSm$^{-1}$), organic carbon (0.42%), available nitrogen (94.50 kgha$^{-1}$),available phosphorus(31.5 kgha$^{-1}$)and available potassium (302.4 kgha$^{-1}$) were found in experiment field during 2021.The growth attribute like plant height was observed significant at 30,60,90 and 120 DAS on pooled basis(2020-2021 and 2021-2022).The best treatment combination was (T9) STB+FYM 15 tha$^{-1}$(150:15:150 NPK kgha$^{-1}$)+FYM 15 tha$^{-1}$ that showed the highest in grain weight in 1$^{st}$ year(46.52 g) and 2$^{nd}$ year(47.01g) respectively. From the economical point of view, the treatment (T9) combination gave the maximum net return of ₹ (44922.0 ha$^{-1}$) with B:C ratio of (1.84).

*Keywords: Wheat crop; STCR; integrated plant nutrients and soil properties.*

## 1. INTRODUCTION

In India, Uttar Pradesh (32.59 million tons) is highest producer of wheat followed by Madya Pradesh (19.61 million tons), Punjab (17.57 million tons) etc [1].

Wheat has been described as "Staff of life or king of cereals" and one of the most important staple food crops. "Wheat has its own outstanding importance as a human food; it is rich in carbohydrates, protein and calories. Wheat is cultivated in at least 43 countries of the world. The leading countries in wheat cultivation are China, India, Thailand, Indonesia and U.S.A and total production of wheat was 647 million tons under area of 218 million hectares with productivity of 2960 kg ha$^{-1"}$ [2].

"Developed the methodology of soil test based nutrient recommendation for targeted yield. It is a more quantitative, precise and meaningful approach because it involves combined use of soil and plant analysis, which provide information on real balance between applied nutrient and available nutrients of soil" [3].

"Soil Test Crop Response (STCR) approach provides the balanced supply of required quantities of nutrients to the crops thus avoiding the over and under usage of fertilizers. This prevents the environmental hazards and results in higher returns. Crop requirements are satisfied to produce the highest economic yields, ensure the quality of the produce and avoid excessive levels of nutrients" [4].

The STCR approach reach out to farmer through saving of fertilizer nutrient and a desired yield can be opined as per economic condition of farmers [5].

**Objectives:**

1. To study integrated use of chemical fertilizer and FYM on growth and yield of wheat.
2. To evaluate the best treatment for wheat crop.
3. To calculate benefit cost ratio (B:C), of different treatment combination of wheat.

## 2. MATERIALS AND METHODS

The field experiment was conducted during the rabi season 2020-2021 and 2021-2022, in Soil Science Research farm of Department of Soil Science & Agriculture Chemistry, Naini Agricultural Institute, at Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, (U.P.).

### 2.1 Experimental Site

The experiment was conducted at research farm of Department of Soil Science at Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj the area is situated on the South of Prayagraj on the right side of the river Yamuna on the South of Rewa road at a distance of about 6 Km from Prayagraj city. It is situated at $25^0$24'30" N latitude, $81^0$51'10" E longitude and at the altitude of 98 meter above the mean sea level (MSL).

### 2.2 Climatic Condition

Argo- climatically, Prayagraj District represents the subtropical belt of the South East of Uttar Pradesh, and is endowed with extremely hot summer and fairly cold winter. The maximum temperature of the location ranges between $46^0$C and seldom falls below $4^0$C-$5^0$C. The relative humidity ranges between 20-94%. The average rainfall of this area is around1100 mm annually.

#### 2.3 Collection of Soil Sample

The Soil sample were collected randomly from depth 0-15 cm and 15-30 cm depth from 5 spots of the experimental farm just before layout of experiment. The experiment was analyzed for

physical and chemical properties, after air dried and passed through 2.0 mm size and size of sample reduced by canning and quartering. A perusal of soil data categorized as sandy loam in soil texture class belongs to order Inceptisol and neutral to saline in reaction.

## 2.4 Treatment Details

The experiment was setup in a Randomized block design with three replication and nine treatments. The wheat variety PBW-343 was grown during the two experiment years 2020-2021 and 2021-2022.

**List 1. List of treatment combinations used for the study**

| Treatment | Treatment combinations |
|---|---|
| T1 | Farmers practice (Farmers practice (80:57:0 NPK kg $ha^{-1}$ ) |
| T2 | General recommended fertilizer dose (GRD) (120:60:40 NPK kg $ha^{-1}$ ) |
| T3 | GRD+FYM 5 t $ha^{-1}$ (120:60:40 NPK kg $ha^{-1}$ )+FYM 5 t $ha^{-1}$ |
| T4 | GRD+FYM 10 t $ha^{-1}$ (120:60:40 NPK kg $ha^{-1}$ )+FYM 10 t $ha^{-1}$ |
| T5 | GRD+FYM 15 t $ha^{-1}$ (120:60:40 NPK kg $ha^{-1}$ )+FYM 15 t $ha^{-1}$ |
| T6 | Soil test-based fertilizer dose (STB) (150:15:150 NPK kg $ha^{-1}$) |
| T7 | STB+FYM 5 t $ha^{-1}$ (150:15:150 NPK kg $ha^{-1}$ )+FYM 5 t $ha^{-1}$ |
| T8 | STB+FYM 10 t $ha^{-1}$ (150:15:150 NPK kg $ha^{-1}$ )+FYM 10 t $ha^{-1}$ |
| T9 | STB+FYM 15 t $ha^{-1}$ (150:15:150 NPK kg $ha^{-1}$ )+FYM 15 t $ha^{-1}$ |

**List 2. Initial soil status of the experiment field during 2021**

| Soil characteristics | Soil depth (0-15cm) |
|---|---|
| Soil pH | 7.6 |
| Electrical conductivity($dsm^{-1}$) | 0.63 |
| Organic carbon (%) | 0.42 |
| Available nitrogen ($kgha^{-1}$) | 94.50 |
| Available phosphorus($kgha^{-1}$) | 31.5 |
| Available potassium($kgha^{-1}$) | 302.4 |

## 3. RESULTS AND DISCUSSION

## 3.1 Plant Height (cm)

STCR-based application of fertilizers and manure leads to the statistically significant variation in plants height at all growth stage (Table 1). It is evident from the data that plant height was increased with increasing levels of NPK with FYM. It clearly shows that the plant height increased with the age of plants, and it was maximum at 120 DAS. In the second year (2021-2022) with treatment (T9) which was 30.66 cm at 30DAS, in treatment(T6) which was 55.22 cm at 60 DAS, in treatment (T8) which was 103.44 cm at 90 DAS and in treatment (T8) which was 107.11cm at120 DAS respectively. Also reported that 125 kg N $ha^{-1}$ significantly increased the plant height (95.2 &96.7 cm) by Chaturvedi [6]. This result corroborates the finding of Yadav and Chippa [7] who reported a significant increase in plant height by application of FYM up to 30 t $ha^{-1}$. Kavinder et al., [8] also report similar results in wheat, the farm yard manure along with 120 kg $Nha^{-1}$ was the best treatment in combination, played a significant role in marking highest plant height. Yugal et al., [9] reported that the plant height of wheat crop was significantly influenced with STCR dose with 5 t FYM $ha^{-1}$. Patel et al., [10] reported that the plant height of wheat was significantly more under 75% NPK with 10 t FYM $ha^{-1}$ as compare the use of recommended dose of NPK.

## 3.2 Soil pH

The lowest pH was observed (7.12) were recorded in treatment $T_8$((150:15:150 NPK kg $ha^{-1}$ +FYM 10 t $ha^{-1}$) and (7.17) recorded in treatment $T_3$(120:60:40 NPK kg $ha^{-1}$ +FYM 5 t $ha^{-1}$) in 1st year. These results were neutral in soil pH due to addition of FYM (Table 2). The study on soil pH of analysed soil samples varied from 7.12-7.27,7.50-7.60 and 7.35-7.42%, respectively, at 1st year and 2nd year and on pooled basis (2020-2021 and 2021-2022).

**Table 1. Effect of STCR-based fertilizers and manure recommendation on plant height of wheat in pooled (2020-2021 and 2021-2022)**

| Treatment | Treatment combination | Plant height(cm) | | | |
|---|---|---|---|---|---|
| | | 30 DAS | 60 DAS | 90 DAS | 120 DAS |
| T1 | Farmers practice (80:57:0 NPK kg $ha^{-1}$ ) | 24.44 | 49.44 | 94.10 | 104.27 |
| T2 | General recommended fertilizer dose (GRD) (120:60:40 NPK kg $ha^{-1}$) | 24.49 | 50.22 | 95.44 | 104.16 |
| T3 | GRD+FYM 5 t $ha^{-1}$ (120:60:40 NPK kg $ha^{-1}$) +FYM 5 t $ha^{-1}$ | 25.82 | 54.60 | 98.60 | 104.38 |
| T4 | GRD+FYM 10 t $ha^{-1}$ (120:60:40 NPK kg $ha^{-1}$) +FYM 10 t $ha^{-1}$ | 25.72 | 54.60 | 96.99 | 104.10 |
| T5 | GRD+FYM 15 t $ha^{-1}$ (120:60:40 NPK kg $ha^{-1}$) +FYM 15 t $ha^{-1}$ | 26.22 | 54.00 | 96.83 | 105.44 |
| T6 | Soil test-based fertilizer dose (STB) (150:15:150 NPK kg $ha^{-1}$) | 26.94 | 55.61 | 97.33 | 106.88 |
| T7 | STB+FYM 5 t $ha^{-1}$ (150:15:150 NPK kg $ha^{-1}$) +FYM 5 t $ha^{-1}$ | 26.55 | 53.55 | 100.05 | 105.72 |
| T8 | STB+FYM 10 t $ha^{-1}$ (150:15:150 NPK kg $ha^{-1}$) +FYM 10 t $ha^{-1}$ | 26.99 | 51.16 | 99.38 | 105.38 |
| T9 | STB+FYM 15 t $ha^{-1}$ (150:15:150 NPK kg $ha^{-1}$) +FYM 15 t $ha^{-1}$ | 26.88 | 51.10 | 99.99 | 105.16 |
| F-test | | S | S | S | S |
| C.D. Value 0.5% | | 0.51 | 0.24 | 0.91 | 0.68 |
| S.Ed.(±) | | 1.09 | 0.50 | 1.92 | 1.44 |

**Table 2. Effect of STCR-based fertilizers and manure recommendation on post-harvest soil pH (2020-2021 and 2021-2022)**

| Treatment | Treatment combination | pH | | |
|---|---|---|---|---|
| | | 1st year | 2nd year | Pooled |
| T1 | Farmers practice (80:57:0 NPK kg $ha^{-1}$ ) | 7.23 | 7.50 | 7.36 |
| T2 | General recommended fertilizer dose (GRD) (120:60:40 NPK kg $ha^{-1}$) | 7.27 | 7.57 | 7.42 |
| T3 | GRD+FYM 5 t $ha^{-1}$ (120:60:40 NPK kg $ha^{-1}$ )+FYM 5 t $ha^{-1}$ | 7.17 | 7.60 | 7.38 |
| T4 | GRD+FYM 10 t $ha^{-1}$ (120:60:40 NPK kg $ha^{-1}$) +FYM 10 t $ha^{-1}$ | 7.27 | 7.57 | 7.42 |
| T5 | GRD+FYM 15 t $ha^{-1}$ (120:60:40 NPK kg $ha^{-1}$) +FYM 15 t $ha^{-1}$ | 7.20 | 7.50 | 7.35 |
| T6 | Soil test-based fertilizer dose (STB) (150:15:150 NPK kg $ha^{-1}$) | 7.20 | 7.50 | 7.35 |
| T7 | STB+FYM 5 t $ha^{-1}$ (150:15:150 NPK kg $ha^{-1}$) +FYM 5 t $ha^{-1}$ | 7.21 | 7.53 | 7.35 |
| T8 | STB+FYM 10 t $ha^{-1}$ (150:15:150 NPK kg $ha^{-1}$) +FYM 10 t $ha^{-1}$ | 7.12 | 7.57 | 7.42 |
| T9 | STB+FYM 15 t $ha^{-1}$ (150:15:150 NPK kg $ha^{-1}$) +FYM 15 t $ha^{-1}$ | 7.23 | 7.53 | 7.38 |
| F-test | | NS | NS | NS |
| C.D. Value 0.5% | | 0.13 | 0.08 | 0.84 |
| S.Ed.(±) | | 0.27 | 0.18 | 1.78 |

**Table 3. Effect of STCR-based fertilizers and manure recommendation on grain weight of wheat in pooled (2020-2021 and 2021-2022)**

| Treatment | Treatment combination | 1000 grain weight (g) | | |
|---|---|---|---|---|
| | | 1st year | 2nd year | Pooled |
| T1 | Farmers practice (80:57:0 NPK kg $ha^{-1}$ ) | 45.66 | 45.46 | 45.56 |
| T2 | General recommended fertilizer dose (GRD) (120:60:40 NPK kg $ha^{-1}$) | 45.96 | 46.20 | 46.08 |
| T3 | GRD+FYM 5 t $ha^{-1}$ (120:60:40 NPK kg $ha^{-1}$) +FYM 5 t $ha^{-1}$ | 46.66 | 46.65 | 46.65 |
| T4 | GRD+FYM 10t $ha^{-1}$ (120:60:40 NPK kg $ha^{-1}$) +FYM 10 t $ha^{-1}$ | 46.50 | 47.11 | 46.80 |
| T5 | GRD+FYM 15 t $ha^{-1}$ (120:60:40 NPK kg $ha^{-1}$) +FYM 15 t $ha^{-1}$ | 45.96 | 46.80 | 46.38 |
| T6 | Soil test-based fertilizer dose (STB) (150:15:150 NPK kg $ha^{-1}$) | 46.48 | 46.91 | 46.69 |
| T7 | STB+FYM 5 t $ha^{-1}$ (150:15:150 NPK kg $ha^{-1}$) +FYM 5 t $ha^{-1}$ | 46.66 | 47.00 | 46.83 |
| T8 | STB+FYM 10 t $ha^{-1}$ (150:15:150 NPK kg $ha^{-1}$) +FYM 10 t $ha^{-1}$ | 46.21 | 46.88 | 46.54 |
| T9 | STB+FYM 15 t $ha^{-1}$ (150:15:150 NPK kg $ha^{-1}$) +FYM 15 t $ha^{-1}$ | 46.52 | 47.01 | 46.76 |
| F-test | | S | S | S |
| C.D. Value 0.5% | | 0.19 | 0.39 | 0.13 |
| S.Ed.(±) | | 0.41 | 0.82 | 0.29 |

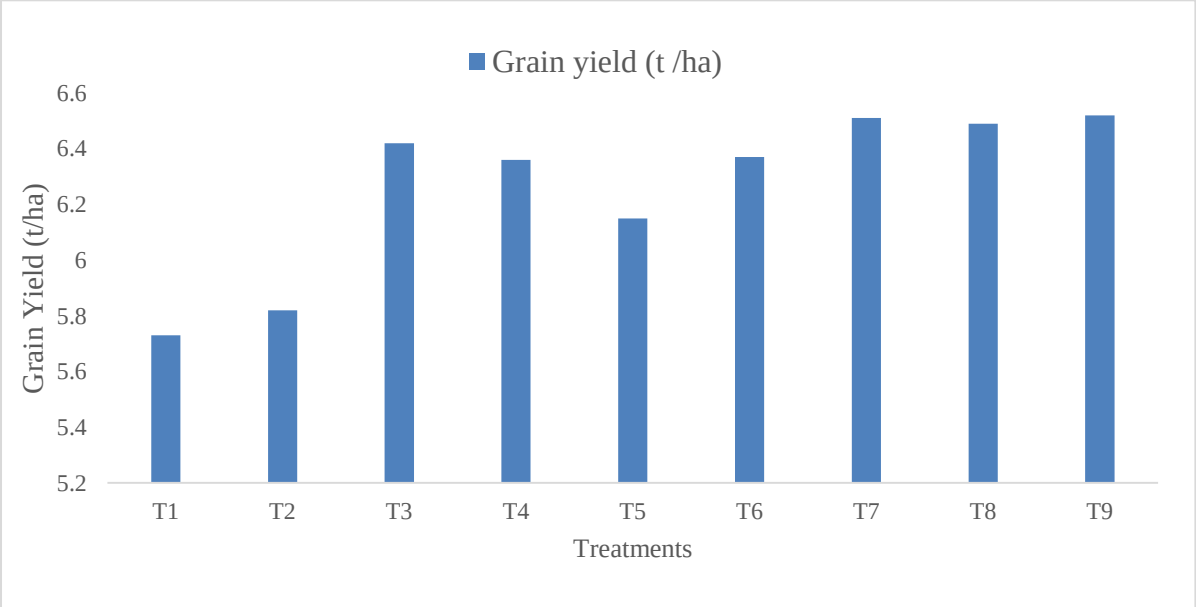


**Fig. 1. Effect of STCR-based fertilizers and manure recommendation on grain yield of wheat (2021-22)**

Bhatt et al., [11] reported that the soil pH. was significantly influenced when applied with inorganic fertilizers and organic fertilizers. This result corroborates the finding of Malik and Chaman [12] who reported the, among various treatments, soil pH (7.5 - 7.8) of harvested soil sample recorded from the plot receiving 100% NPK was applied through incorporation of farm yard manure. In a study conducted by Sephya et al., [13] related with the application of 100% NPK (50% NPK + 50% N through farmyard manure) to wheat was the best practice than the rest of the treatment for improving the soil pH. Similar results were obtained by Kumar et al., [14].

### 3.3 1000 Grains Weight (g)

Grain weight of wheat was significantly influenced by different level of fertilizers and manure application based on STCR approach. Maximum grain weight viz.46.66,46.66 and 46.52g was recorded in 1$^{st}$ year (2020-2021) with treatment ($T_3$), ($T_7$) and ($T_9$) respectively (Table 3). Chaturvedi et al., [6] also reported that 125 kg N ha$^{-1}$ significantly increased the 1000 grain weight (48.1g &49.8 g) of wheat. Yogesh et al., [15] who reported that the wheat cultivar PBW-343 recorded the highest 1000-grain weight (41.01 g), while cultivar HD-2329 recorded the lowest 1000-grain weight (31.83 g) on sandy loam soil texture class.

## 4. CONCLUSION

On the basis of above finding, it is concluded that application of STCR in treatment combination (T9) gave the maximum growth, yield, benefit cost ratio and physical, chemical and nutrient uptake was found best result of wheat. As it is result of on the two years study, it is concluded that prescription-based fertilizer application along with the application of FYM 15tha$^{-1}$ enhanced the soil properties and which will help enhancing yield for sustaining productivity and fertility of soil.

## 5. FURTHER RESEARCH

The inclusion of pulses in cropping systems and other practices such as crop residues recycling, crop diversification etc. influences grain yields and improve soil quality.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES


1. Agricultural Statistics at a Glance. Directorate of Economics and Statistics, GOI, Ministry of Agriculture, DAC., New Delhi; 2020.
2. FAO. The state of the world's land and water resources for food and agriculture. FAO/AGL Publication, FAO, Rome; 2012.
3. Ramamoorthy B, Narasimham RL, Dinesh RS. Fertilizer application for specific yield targets on Sonora 64(wheat). Ind. Farming. 1967;17(5):43-45.
4. Boldea M, Sala F, Rawashdeh H, Luchian D. Evaluation of agricultural yield in relation to the doses of mineral fertilizer. J. Cent. Eur. Ag. 2015;16:149-161.
5. Bhatt P, Singh S, Pant PK, Chandra R, Gautam P, Bhatt L, Alka A. Assessment of nutrient requirement for spring brinjal through soil test crop response approach on North Indian Mollisol. J. Ind. Soc. Soil Sc. 2021;69:162-170.
6. Chaturvedi I. Effects of different nitrogen levels on growth and yield and nutrient uptake of wheat (*Triticum aestivum* L.) Int. J. Agric. Sc. 2006;2(2):372-374.
7. Yadav KK, Chhipa BR. Growth, yield attributes, yield and net returns of wheat (*Triticum aestivum* L.) as influenced by soil applied FYM, gypsum and iron pyrite under irrigation with poor quality water. Ann Agric. Res. 2005;26 (4):554-560.
8. Kavinder Hooda VS, Malik YP, Devraj Harender, Kavita. Effect of farm yard manure and nitrogen application on growth and productivity of wheat under long term experimental conditions. Curr. J. Appl. Sc. and Tech. 2019;35(4):1-7.
9. Yugal KS, Chaubey AK, Mishra VN, Rajput AS, Bajpai RK. Effect of integrated nutrient management on growth and yield of rice (*Oriza sativa* L.). 2015;15(3):983-986.
10. Patel Tejalben G, Khushvadan C Patel, Patel Vimal. N effect of integrated nutrient management on yield attributes and yield of wheat (*Triticum aestivum* L.) Int.J. Chemical Studies. 2017;5(4):1366-1369.
11. Bhatt MK, Labanya R, Joshi HC, Pareek N, Chandra R, Raverkar KP. Long -term effects of inorganic fertilizers and FYM on soil chemical properties and yield of wheat under rice-wheat cropping system. Bulletin Himalayan Ecology. 2017;25:28-35.
12. Malik RVS, Singh C. Effect of integrated nutrient management practices on crop yield and change in physico-chemical properties of soil in rice-wheat cropping system. Agri Ways. 2016;4(2):185-193.
13. Sepehya S, Subehla SK, Rana SS, Negi SC. Effect of integrated nutrient management on rice-wheat yield and soil properties in a north western Himalayan region. Ind. J. Soil Cons. 2012;40(20):135-140.
14. Kumar S, Dahiya R, Kumar P, Jhorar BS, Phogat VK. Long-term effect of organic materials and fertilizers on soil properties in pearl millet- wheat cropping system. Ind. J. agric. Res. 2012;46(2):161-166.
15. Yogesh Kumar Singh, Vikrant Singh, Jagvir Singh. Response of various High Yielding Wheat varieties to different nitrogen levels in Aligrah region of Uttar Pradesh. Ann Agric. Res. 2007;20(2):122-123.




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