



P-ISSN: 2349-8528

E-ISSN: 2321-4902

[www.chemijournal.com](http://www.chemijournal.com)

IJCS 2020; 8(1): 528-531

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Received: 16-01-2019

Accepted: 22-02-2019

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## Response of soil test crop response (STCR) approach on available nitrogen, phosphorus and potassium status after Wheat (*Triticum aestivum* L.) harvest in an acid Alfisol

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DOI: <https://doi.org/10.22271/chemi.2020.v8.i2h.8821>

### Abstract

The field experiment was carried out on wheat during rabi, 2017-18 to study the prescription based fertilizer application on soil properties in a long term experiment of Department of Soil Science CSK HPKV, Palampur. The experiment was laid out by Randomized block design (RBD) consisting of eight treatments which are replicated thrice. The application of fertilizers based on soil test crop response (STCR) along with application of FYM @ 5t ha<sup>-1</sup> recorded significantly higher available N, P and K. Further the physical properties such as bulk density, particle density, porosity and water holding capacity were observed when compared to the other treatment combination carried out during the experiment viz., general recommended dose (GRD) of NPK, control, soil test based. Overall, we concluded that the input of STCR approach had positive effects on soil properties.

**Keywords:** Wheat, Soil test crop response (STCR), Randomized block design (RBD), general recommended dose (GRD)

### Introduction

Wheat is an important cereal crop of the world cultivated over an area of 30.60 million hectares with a production of 98.38 million tonnes in the country (Anonymous 2017) [1]. Among the various factors affecting the growth, nutrient management practices plays a vital role in sustaining the productivity of crops. Presently the chemical fertilizers are used as a major source of nutrients which increases the energy cost, economic pressure and increases environmental degradation. Due to escalating cost coupled with increasing demand of chemical fertilizers and deteriorating soil health necessitates the safe and adequate method of fertilizer application. The effective fertilizer recommendation should consider crop needs and nutrient already available in the soil (Tegegnetwork *et al.* 2015) [6]. Among the different methods of fertilizer recommendation viz., general recommended dose (GRD), soil test based recommendation, etc., soil test crop response (STCR) is unique in indicating both soil test based fertilizer dose and the level of yield can be achieved with good agronomic practices (Singh *et al.* 2005) [4]. Farm yard manure along with target yield based fertilizer application not only revamp soil health but also improves soil properties. As wheat is an important cereal crop after rice therefore, this study was conducted to investigate the effect of fertilizer prescriptions by different approaches on soil properties.

### Material and Methods

The present study was carried out in an ongoing long term fertilizer experiment in rabi, 2017-18 at Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur, India. Geographically the experimental field is situated at 32°6' N latitude and 76°3' E longitude at an elevation of 1290 m above mean sea level. The soil of the experimental site belongs to silty clay loam texture and soil order Alfisol. Climate of palampur region with the average maximum and minimum temperature is 36°C and 3.1°C respectively.

The experiment was laid out in RBD design with eight treatments which were replicated three times with plot size of 15 m<sup>2</sup>. Sowing of the crop was done in November 2017 with a seed rate of 100 kg ha<sup>-1</sup> with row to row spacing of 22 cm. Placement of solid fertilizers in the soil was

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done as basal dose in which half dose of nitrogen and full dose of phosphorus and potassium was applied at the time of sowing. Remaining half nitrogen was applied in two equal splits at tillering and flowering stages. The soil analysis results before sowing revealed that it was low in available nitrogen, medium in available phosphorus and potassium. The experiment has Eight treatments, Viz.,

- T<sub>1</sub>: Control
- T<sub>2</sub>: Farmers' practice i.e. 25% of GRD and FYM @ 5 t ha<sup>-1</sup>
- T<sub>3</sub>: General recommended dose (120 N, 60 P<sub>2</sub>O<sub>5</sub> :30 K<sub>2</sub>O)
- T<sub>4</sub>: Soil test based fertilizer application
- T<sub>5</sub>: Target 25 q ha<sup>-1</sup>
- T<sub>6</sub>: Target 25 q ha<sup>-1</sup> with FYM @ 5 t ha<sup>-1</sup>
- T<sub>7</sub>: Target 35 q ha<sup>-1</sup>
- T<sub>8</sub>: Target 35 q ha<sup>-1</sup> with FYM @ 5 t ha<sup>-1</sup>

The targeted yield equations developed for wheat crop were used for the calculation of fertilizer N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O:

$$FN = 5.27 T - 0.25 SN - 1.06$$

$$FP_2O_5 = 4.13 T - 0.38 SN - 0.98 OP$$

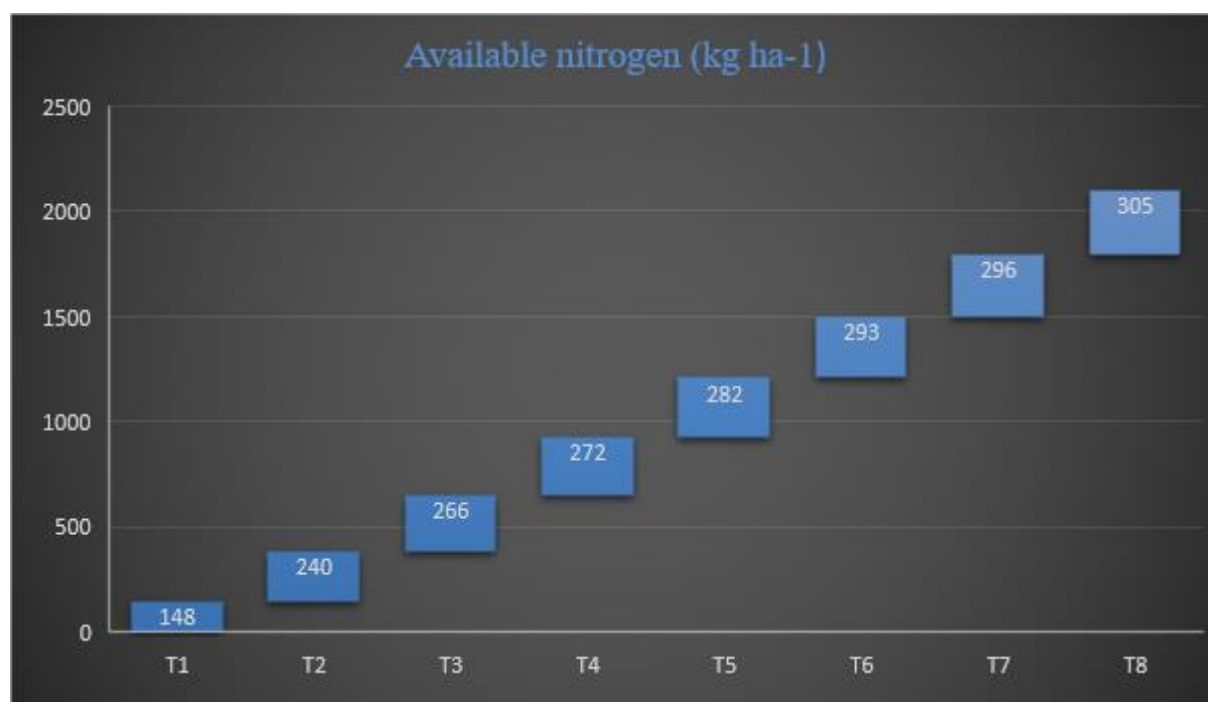
$$FK_2O = 2.87 T - 0.15 SN - 0.55 OK$$

Using the above adjustment equation the quantity of nutrient requirements for achieving 25 q ha<sup>-1</sup> and 35 q ha<sup>-1</sup> were worked out. The fertilizer N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O applied in T<sub>5</sub> and T<sub>7</sub> were 63:84:30 kg ha<sup>-1</sup> and 45:97:37 kg ha<sup>-1</sup>, respectively.

## Results and Discussion

### Available nitrogen

Data pertaining to soil available nitrogen (Fig. 1) ranged from 148 kg ha<sup>-1</sup> in control to 305 kg ha<sup>-1</sup> in treatment target yield 35 q ha<sup>-1</sup>. K<sub>2</sub>O. The available nitrogen under target yield 25 q ha<sup>-1</sup> were improved by 6.0 and 3.7 per cent over general recommended dose and soil test based fertilizer application, respectively. This might be due to the reason that prescription based fertilizer application provides balanced application of fertilizer nutrients (Singh *et al.* 2016) [5].



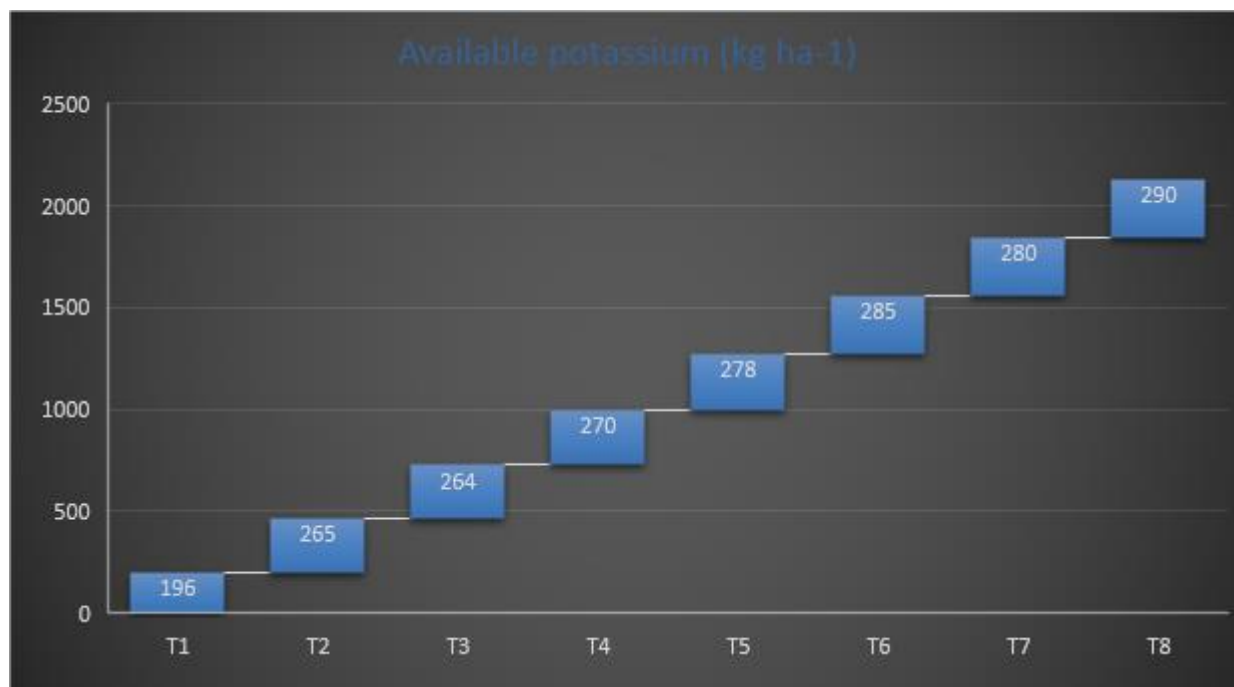
**Fig. 1.** Effect of prescription based fertilizer application on available nitrogen

The higher increase in available N incase of target yield 35 q ha<sup>-1</sup> with IPNS was due to the addition of FYM and also found to be statistically at par with same treatment but without FYM.

### Available phosphorus

Different nutrient management practices had significant effect on soil available phosphorus (Fig. 2). Treatment T<sub>8</sub> (target yield 35 q ha<sup>-1</sup>) was significantly superior over all other

treatments with a value of 70 kg ha<sup>-1</sup>. The farmers' practice improved it's content by 52.2 per cent over control. The treatment target yield 25 q ha<sup>-1</sup> without Fym recorded a significant increase in it's status by 2.1 and 14.3 per cent over general recommended dose and soil test based, respectively. This might be due to the specific balanced amounts of P fertilizer were prescribed based on the estimates of indigenous supply. Build up of available P with the application of NPK fertilizer alone or in



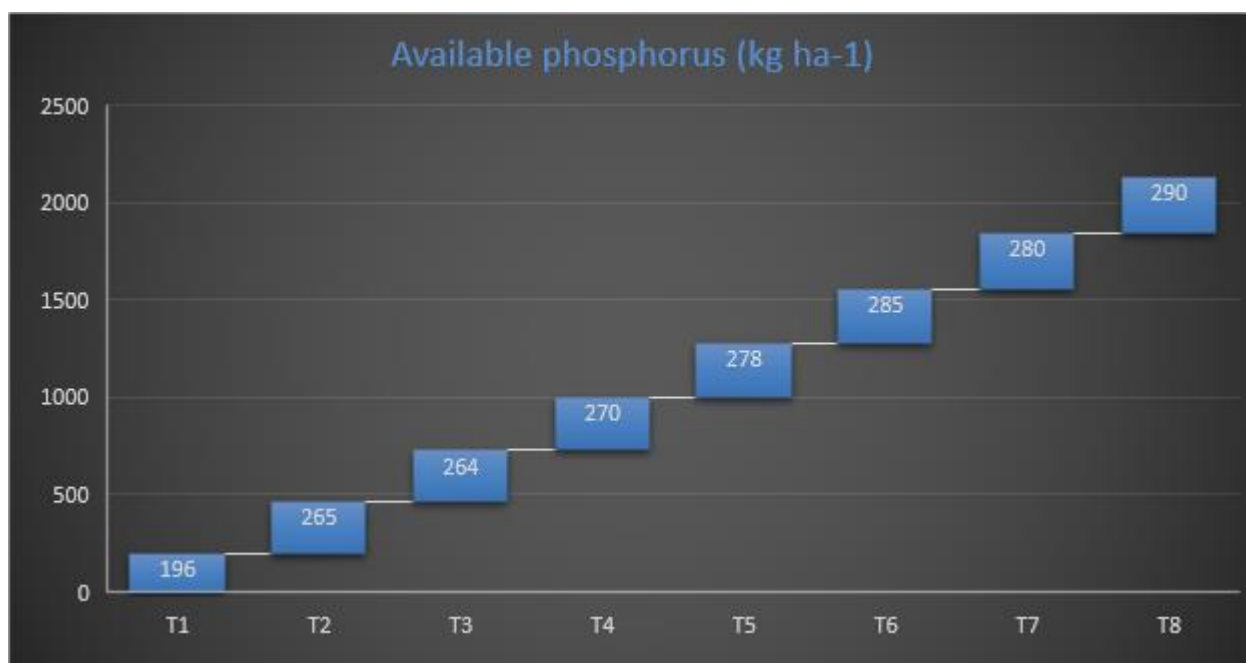
**Fig. 2.** Effect of prescription based fertilizer application on available phosphorus

Conjugation with FYM might be due to the release of organic acids during decomposition which in turn helped in releasing phosphorus through solubilizing action of native phosphorus in the soil (Sharma *et al.* 2016).

#### Available potassium

The results in figure 3 indicated that available potassium ranged from 196 kg ha<sup>-1</sup> in control to 290 kg ha<sup>-1</sup> in treatment

comprising of target yield 35 q ha<sup>-1</sup> with FYM. The farmers' practice and general recommended dose increased its content by 35.2 and 34.7 per cent over control. The depletion of available potassium in control might be due to continuous cropping, mining of soil native pool and also no addition of external sources.



**Fig 3:** Effect of prescription based fertilizer application on available potassium

The treatment target yield 25 q ha<sup>-1</sup> without FYM was found to be statistically at par with soil test based, target yield 25 q ha<sup>-1</sup> with FYM and target yield 35 q ha<sup>-1</sup> without FYM. However, the highest content in target yield treatments without FYM owing to the balanced application based on STCR approach which takes into account the crop removal and inherent capacity of soil and as such sustains the soil fertility status (Sahu *et al.* 2017) [2].

#### Conclusion

The results of this experiment revealed that prescription based fertilizer application for desired yield target significantly improved the available N, P and K status as compared to other approaches of fertilizer application. This positive effect may be due to the judicious use of fertilizers and integrated supply of nutrients. The specific yield equation will not only ensure

sustainable crop production but will also steer the farmers towards economic use of costly fertilizer inputs.

### Acknowledgement

A special thanks to CSK Himachal Pradesh Krishi Vishvavidyalaya Palampur (HP) for providing me the special facilities to conduct the investigation.

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