Eco. Env. & Cons. 28 (February Suppl. Issue) : 2022; pp. (S291-S293)

ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2022.v28i02s.048

Correlation of Chemical Attributes of Soil with Yield of Wheat Crop

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(Received 22 May, 2021; Accepted 17 June, 2021)

ABSTRACT

A long term field experiment on integrated management of compost, crop residue with inorganic fertilizer in rice-wheat system is in progress at the Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar since *rabi* 1988-89. The grain and straw yield of wheat increased significantly with increasing levels of NPK fertilizer. However, the yield at 150% NPK was at par with 100% NPK. Integrated effect of chemical fertilizer with organic manure and crop residue also augmented a build-up of available N, P, K and S. addition of different organic materials increased the organic carbon and also decreased the pH and EC. Correlation analysis is used for the study of relationship between different chemical properties and yield of crop. Most of the chemical attributes were positively correlated with the yield of crop.

Key words: *Correlation, Chemical parameter, Wheat*

In India, wheat is the second most important cereal crop after rice grown under sub-tropical environment during November to April, covering an area of 31.19 million hectare. India is the second largest producer of wheat with approximately 12% world's wheat production and it is also the second largest consumer of wheat after china. At present time wheat production system are facing multiple challenges like lower factor productivity, stagnation of yield, multiple nutrient deficiencies and climate change (Singh *et al.,* 2015). Application of imbalance or excessive nutrients led to declining nutrient use efficiency making fertilizer consumption uneconomical and producing combateffect on soil microorganism, soil enzymes activities and atmosphere (Aulakh and Adhya, 2005). Presently, the rice-wheat cropping system in the Indo-gangetic plains is showing a sign of fatigue due to continuous cropping of this highly nutrient and water exhaustive cereal-cereal system for the last three decades (Bhatt *et al.,* 2017). Earlier, to meet the challenges intensive cropping patterns were adopted which resulted in declining nutrient status of soil (Balyan and Idnani, 2000). The declining response to input has been received to be major issue challenging the sustainability of wheat based cropping system. Therefore, the most logical way to manage long term fertility and productivity of soil is integrated use of inorganic and organic sources of plant nutrients (Kakraliya *et al.,* 2017). Role and importance of integrated nutrient management system as a management strategy that can bring sustainability to the rice-wheat cropping system of the Indian subcontinent has also been reported by Sharma *et al.,* 2019. The effect of different integrated nutrient management practices on soil organic carbon as well as sustainability of the rice-wheat system were evaluated in long-term experiment at different agro-climatic zone of IGP by Nayak and Mohan, 2012. They reported that application of NPK either through in-

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organic fertilizer or through combination of inorganic fertilizer and organics such as FYM or crop residue or green manure improved the soil organic content. The amount of all cationic micronutrients such as Fe, Mn, Cu and Zn were progressively higher with the crop growth period suggesting a build-up of these micronutrients in soil resulting from adoption of integrated nutrient management system. Such build-up of micronutrients might be partially owing to release of native soil micronutrient resulting from the dissolution action of organic manure (Sur *et al.*, 2010). Therefore, the present study was undertaken to assess the relationship between soil chemical parameters with the yield of wheat crop.

Materials and Methods

To assess the impact of integrated nutrient management practices on soil properties and yield of crop, a field experiment was initiated during *rabi* 1988-89 on light textured highly calcareous soil at Research farm of Rajendra Prasad Central Agricultural University, Pusa, Bihar. The experiment was laid out in a split plot design with three replication. Four levels of fertilizer *viz*., No NPK, 50% recommended NPK, 100% recommended NPK and 150% recommended NPK were applied as treatments in main plot. The main plot was divided into four sub-plots in which treatment *viz*., no manure, compost @ 10 t ha^{-1}, crop residue and compost + crop residue were superimposed over NPK levels. The recommended dose of NPK (120:60:40) were applied to each crop of rice and wheat as urea, single superphosphate and muriate of potash. Rice *cv*. Rajshree was 37th and 39th test crop and wheat *cv*. HD 2733 as 38thand 40th test crop during the reported period of 2007-08 and 2008-09. The grain and straw samples were taken at the harvest of rice and wheat crops. Composite surface soil samples from each plot were collected at the harvest of wheat rotation. Soil samples were air dried and pulverized to pass through 2 mm sieve and kept in polythene bag for further chemical analysis, pH, EC, available N, P, K, S, Zn and B were analyzed the following standard methods. Simple correlation of grain and straw yield of wheat with some of the relevant chemical properties were worked out by standard statistical methods. The yield in crop plant is usually dependent upon the action and interaction of a number of important attributes, correlation is therefore helpful in determining the component character of a complex trait like yield (Elias, 1992).

Results and Discussion

The data showed that cation exchange capacity registered strong positive significant correlation (0.827**and 0.816**) with grain and straw yield of wheat, whereas free $CaCO_3$ showed only positive correlation (0.028 and 0.002) with grain and straw yield of wheat. Significant negative correlation of pH was found (-0.738** and -0.728**) with yield of grain. Similarly, significant negative correlation was showed by electrical conductivity (-0.916** and -0.918**) with grain and straw yield of wheat, respectively. On correlation study (Table 2) it was found that available N, available P_2O_5, available K_2O and

Table 1. Correlation between chemical properties and yield of crop

Parameter	Grain Yield (q ha^{-1})	Straw yield (q ha^{-1})
Cation Exchange Capacity (CEC)	0.827**	0.816**
pH	-0.738**	-0.728**
Electrical Conductivity (EC)	-0.916**	-0.918**
Free $CaCO_3$	0.028	0.002

Table 2. Correlation between available nutrients and yield of crop

Parameter	Grain Yield (q ha^{-1})	Straw yield (q ha^{-1})
Available N	0.851**	0.855**
Available P_2O_5	0.951**	0.951**
Available K_2O	0.842**	0.844**
Available S	0.908**	0.911*
Available Zn	-0.104	-0.109
AvailableB	-0.237	-0.174

available S (0.851**, 0.951**, 0.842** and 0.908**) showed significant positive correlation with grain yield of wheat. Similar trends were also recorded in case of straw yield of wheat. A negative correlation (-0.104 and -0.237) was showed by available Zn and available B with grain yield of wheat, respectively. Similar trend were also recorded with straw yield of wheat. Yield is a complex quantitative trait largely influenced by the environment. Direct selection of grain yield is less effluent in improving crop productivity. The selection efficiency can be enhanced by exploiting the relationship between yield and its related attributes. Correlation in general measure the extent and direction (positive or negative) of a relationship occurring between two or more variables. The estimate of correlation can help us to understand the role and relative contribution of various parameters on crop yield under given environmental condition (Akhtar *et al.,* 2007).

Conclusion

It was concluded that observations shows positive significant correlation of CEC, available N, P_2O_5, K_2O and S with yield of crop and negative correlation of pH, EC, available Zn and B with the yield of crop.

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