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CORRELATION OF AVAILABLE NUTRIENTS WITH YIELD OF RICE IN CALCAREOUS SOIL

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Abstract–Soil fertility is the function of nutrient availability in the soil. Soil properties and crop production are liable to change due to continuous cropping with long term fertilization. Correlation study is used for the study of available nutrients of agricultural soil with yield of crops. The objective of this study is to investigate the correlation between soils available nutrients and the yield of rice. The long term effect of fertilizers and manures on response of rice-wheat cropping rotation and changes in physical and chemical properties of sandy loam Typic Calciorthents was stated during *rabi* 1988-89 in split plot design with three replication. Four levels of chemical fertilizer were taken as main plot treatment and four levels of organic sources on nutrients were taken as sub plot treatments. The results showed that integrated use of compost and crop residue either alone or in combination of inorganic sources of nutrients augmented higher build of soil available nutrients. Soil available N, P, P_2O_5, K_2O and S were positively and significantly correlated and available Zn and B were negatively correlated with yield of rice crop.

INTRODUCTION

Rice the most important and staple food crop for more than two third of population of India. India is the second largest rice producing country in the world after China. Indian rice yield are well below the world are average, implying there is a great potential for increasing production. Under limited nutrient supply the possibilities of talking successful production of rice crop is feasible only through careful implementation of scientific agro-techniques (Sahu *et al.*, 2015). Soil, land and water are essential resources for the sustained quality human life and the foundation of agricultural development. Highly competitive and conflicting demand on soil, vegetation, water and other natural resources from increasing population pressure have resulted in over exploitation and mismanagement of our valuable natural resources. This has manifested on the agro-ecosystem, resulting in various kind of land degradation. These resources should be managed in a sustainable manner so that the changed proposed to meet the need of development are brought out without diminishing the potential for their future use (Kanwar, 1994). Fertility of the soil is the capacity of soil to supply nutrients in adequate amount which itself is function of nutrient resources in the soil. The optimum plant growth and yield depends not only on the nutrient reserve in the soil but also on their availability at a particular time which in terns is controlled by physical and chemical properties of the soil (Singh *et al.*, 2019). It has been noticed in Indo-gangetic plains that because of continuous rice-wheat cultivation fertility of soil is determining day by day, raising a serious problem to the sustainability of Indian agriculture. Integrated nutrient management is an effective management tool for increasing productivity of agricultural soil while maintaining sustainability (Sahrawat *et al.*, 2010). The objective of the present investigation is to assess the effect of integrated nutrient strategies and their contribution to soil fertility and to find out the relationship between soil properties and yield of crop. The estimates of correlation can help us to understand the role and relative contribution of various attributes on crop yield under given environmental condition (Akhatar *et al.*, 2007).

MATERIALS AND METHODS

A long term field experiment was conducted on a sandy loam Calciorthents at the Dr. Rajendra Prasad Central Agricultural University, Pusa, Bihar with a rotation of rice-wheat during *rabi* 1988-89. The climate of this area is sub-tropical with a mean annual temperature of 25.3 °C. The following 16 treatment replicated three times were laid out in a split plot design. Four levels of chemical fertilizer *viz*., No NPK, 50% NPK, 100% NPK and 150% NPK were taken as main plot treatments and four levels of organic manures *viz*., no manure, compost @ 10 t ha^{-1}, crop residue and compost + crop residue were taken as sub plot treatments. The 100% NPK dose was 120, 60 and 40 kg ha^{-1} of N, P_2O_5 and K_2O for both rice and wheat crop. The fertilizer used were urea, single superphosphate and muriate of potash. The application of compost @ 10 t ha^{-1} was done before the sowing and transplanting of wheat and rice crop, respectively. The crops rice (*cv*. Rajshree) and wheat (*cv*. HD 2733) were raised during *kharif* and *rabi* seasons, respectively by following recommended package of practices. The plot wise yield data were recorded after harvesting of each crop. After harvest of wheat surface soil samples were collected from each plot, processed and analyzed for different nutrients. Available nitrogen was determined by alkaline potassium permanganate distillation method as described by Subbaiah and Asija (1956). Available phosphorus content of the soil was extracted by 0.5 N sodium bicarbonate at pH 8.5 (Olsen *et al.,* 1954) and was estimated by ammonium molybdate method as outlined by Jackson (1973). Available potassium was extracted with neutral normal ammonium acetate at 1:5 soil to extract ratio and the content of potassium was estimated by flame photometer (Jackson, 1973). Available S was determined by Chesnin and Yien (1950) method after extracting the soil with 0.5% $CaCl_2$. DTPA extractable Zn was determined by methods described by Lindsay and Norvell (1978) and available B was determined by hot water method described by Berger and Truog (1939). Simple coefficient of correlation were worked out for soil available nutrients and crop yield.

RESULTS AND DISCUSSION

Identification of soil attributes most determinant to crop yield. Some of the variable measured organic carbon and available nutrients could be grouped to indicate a number of underlying common factors influencing crop yield. The correlation coefficient value of available nutrients such as available N, P_2O_5, K_2O, S, Zn and B with grain and straw yield of rice were worked out and presented in table-2. The perusal of data (table-1) revealed that correlation coefficient values varied from (r=0.964 to -0.208) with respect to grain yield of rice. The maximum correlation coefficient (r=0.964) was recorded with available N and minimum (r+-0.208) was noted for available B. Available N, P_2O_5, K_2O and S were positively and significantly correlated with grain yield of rice whereas available Zn and B were negatively correlated with grain yield of rice. Ahmad *et al*., 2014 conducted experiment at Assam Agricultural University, Jorhat to assess the effect of integrated nutrient management on yield and soil fertility in autumn rice in an Inceptisol, reported that the grain yield of rice has significant positive correlation with organic carbon, available N, available P and available K. positive and significant

Table 1. General properties of initial experimental soil

Parameter	Value
Bulk density (Mg m^{-3})	1.44
Pore space (%)	48.76
Water holding capacity (%)	31.22
pH (1:2 soil : water)	8.4
Electrical conductivity (dSm^{-1})	0.37
Cation Exchange Capacity [Cmol(P^+)kg^{-1}]	9.82
Free calcium carbonate (%)	34.34
Organic carbon (g kg^{-1})	5.0
Available N (Kg ha^{-1})	237.00
Available P_2O_5 (Kg ha^{-1})	19.90
Available K_2O (Kg ha^{-1})	100.00
Available S (Kg ha^{-1})	10.27
Available Zn (mg kg^{-1})	0.79
Available B (mg kg^{-1})	0.52
Total bacteria (x 10^6 cfu g^{-1})	28
Total fungi (x 10^4 cfu g^{-1})	16
Total actinomycetes (x 10^5 cfu g^{-1})	7
Organic carbon (g kg^{-1})	5.0

Table 2. Relationship between available nutrients with yield of rice

Parameter	Grain Yield (q ha^{-1})	Straw yield (q ha^{-1})
Available N	0.870**	0.869**
Available P_2O_5	0.964**	0.960**
Available K_2O	0.801**	0.812**
Available S	0.915**	0.934*
Available Zn	-0.062	-0.104
Available B	-0.208	-0.237

correlation of nutrient with grain yield was also reported by Shobharani and Latha (2017). Mondal *et al.* (2015) revealed that DTPA extractable zinc has negatively significant with organic carbon (r=-0.578**) in soils of Jammu district. Available Zn did not show any significant correlation with any chemical properties. Walley *et al*. (2002) investigated with relationship of physical and chemical attributes with yield of crops and reported that chemical attributed showed a strong spatial dependence. Strong and very strong correlation between parameters of soil nutrient regime and crop productivity was also reported by Bashirov (2009). The correlation coefficient value varied from r = 0.960 to r=-0.237 with straw yield of rice. Available N, P_2O_5, K_2O and S were strongly and positively correlated with straw yield of rice whereas available Zn and B were negatively correlated with straw yield of rice. The correlation coefficient (r) was defined between the studied parameters of nutrient regime of soil and productivity of winter wheat and barley. The majority of correlation between parameters of soil nutrient regimes and crop productivity were strong and very strong (0.56< r <0.89) (Splett *et al.,* 2007). Positive and significant correlation of organic carbon with available N, P_2O_5, K_2O and S were also reported by Bhat *et al*., 2017. Incorporation of compost and crop residue either alone or in combination with chemical fertilizers, resulted in build-up of organic carbon content in soil which is related to build up of available nutrients in soil, which in turns increase the yield of crop.

The correlation values were increased with the application of organic and inorganic sources of nutrients and conjoint use of organic and chemical fertilizer increased the availability of nutrients hence increased the yield (Singh *et al.,* 2019).

CONCLUSION

A significant and positive correlation was observed between soil available N, P, K and S and grain and straw yield of rice. Therefore, soil analysis must be used for sustainable yield of the cop.

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