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Original Research Article

Effect of Organic and Inorganic Fertilizer Nutrients on Yield of Soybean Crop

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A B S T R A C T

The field experiment was conducted in 2012-2013 at the Instructional Farm of Krishi vigyan Kendra Durg. Anjora (C.G.) in an ongoing since 2008, laid out in RBD with ten treatments comprised of 50,100 and 150 percent of recommended levels of N, P, K and organic sources Vermicompost @ 10q ha^{-1}, Vermicompost @ 25q ha^{-1}, and $ZnSo_4$ @ 10 kg ha-^{1} were applied. The results showed that the heighest yield of soybean uptake of nitrogen and phosphorus in treatment T_8 (100%NPK+FYM) and potassium, sulphur was recorded with treatment applied 150% NPK (T_4) of recommended NPK fertilizers.

Keywords

Organic and inorganic fertilizer, Fertility Status

Introduction

To feed a population of 1.4 billion by 2025, India will need to produce 301Mt food grains in addition to other commodities; at least 45 Mt of plant nutrients would be needed. Estimates show that with the current food production of 236 Mt in 2009-2010, India has the compulsive need to raise food grain output at rate of more than 5mt per annum. Technological adoption, using required inputs, especially seeds; plant nutrients, water and energy would be the major determinant to meet the challenges of food growth in future. Among these, fertilizer is the one of the most important inputs, demand of chemical fertilizers would be 35 Mt consisting from 5.6-8.8 Mt P_2O_5, 2.3-4.7Mt K_2O and the rest nitrogen. At least 10 Mt nutrients should come from organic sources, crop and Biofertilizer. The most conservative estimates have shown that hardly 270-300 Mt of organic manures of different kinds contributing around 4 to 6 Mt of NPK are available in the country. The food security of the future will be closely linked up with nutrient input as high profitable yields depend on mainly the proper nutrient balance in soils. (Tiwari, 2002). In India wheat crop is the second most important cereal crop after Rice, grown under diverse agro-climatic conditions and occupies more than 25 million hectare area with a production of about 70.26 million tones from an area of 24.23 million hectare with productivity of 2.9 t ha^{-1}(Motsara, M.R. –2004). In Chhattisgarh state the production of wheat was 97.26 thousand tones from an

area 102 thousand hectare with very low productivity of 952 kg ha^{-1} (Anonymous, 2003).As rice-wheat cropping system in Chhattisgarh is gaining importance and is being practiced by farmers in irrigated situation. Imbalance use of fertilizers has been one of the key factors in declining the crop productivity and sustaining the soil fertility. Hence, to evolve an efficient nutrient management system with organic, inorganic and biological sources of nutrients for sustainable productivity of Wheat crop with maintaining soil fertility summed essentially prioritized to increase farmer's profitability.

Materials and Methods

Field investigation was undertaken to study the effect of organic and inorganic fertilizer nutrients on yield and yield attributes in wheat crop during 2003-04 at the research farm of IGAU Raipur (C.G.). The region generally experiences for sub hot sub humid climate having annual precipitation in the range of 1200-1400 mm. The experimental soil was vertisol (kanhar) in order having pH 7.7, organic carbon 6.2 $g.kg^{-1}$, and EC 0.20 dsm^{-1}, in this soil was available N (kmno4), P (Olsens-p), K (Neutral 1 N NH4oAc - k) and Zn, Cu, Fe, Mn (Lindsey and Norvell) method respectively. The organic fertilizer applied in kharif only and residual effect of rabi crop. Treatment applied in kharif crop is T_1, control T_2, 50% NPK T_3, 100%NPK T_4,150%NPK T_5,100% NPK+S T_6,100%NP T_7,100%N T_8,100% NPK+FYM T_9 50% NPK+BGA T_{10},50%NPK+GM and in rabi crop only applied inorganic fertilizer

Results and Discussion

pH and Ec

The soil pH and Ec after harvest of wheat crop varied from 7.72 to 7.84 and 0.17 to 0.19dsm^{-1} with applied fertilizer treatments (T_1 to T_{10}). No statistically significant variation was observed with respect to applied different organic& inorganic fertilizer nutrients and over initial value (7.7). Soil pH and electrical conductivity showed no significant change over initial value and with the applied organics and inorganic fertilizer treatments. These results are similar with the findings of Dhane and Shukla (1995).

Soil organic carbon

The data on soil organic carbon after harvest of wheat crop are presented in Table-1, Soil organic carbon ranged from 6.2 to 6.8 g $kg^{-1}$and significantly increased with applied fertilizer treatments (T_2 to T_{10}) over control (T_1). The highest soil carbon content 6.8 g kg^{-1} was noticed under the treatment 100%NPK + FYM following by 150% NPK, 100%NPK + Zn and 100%NPK as compared to the applied 50%NPK treatments.

Relatively high soil organic carbon was observed with applied fertilizer treatments over the initial value The increase in SOC content with applied fertilizer nutrients can be ascribed due to higher contribution of root biomass as well as crop residue with residual influence of organics in form of FYM, green manure and BGA. The findings during experimentation revealed that integration of fertilizers with organic manure was improved the organic carbon status of soil i.e. soil health, supported by the findings of Singh *et al.*, (1999).

Available Nitrogen, Phasphorus and Potassium

The available nitrogen, Phasphorus and potassium content in soil after harvest of wheat crop are given in table 2.

Table.1 Effect of fertilizer treatments on physico-chemical properties of Soil after harvest of wheat

Treatment	Ec.(dsm^{-1})	pH(1:2.5)	SOC ($g\ kg^{-1}$)
T_1	0.18	7.81	6.2
T_2	0.19	7.74	6.4
T_3	0.17	7.74	6.6
T_4	0.19	7.72	6.7
T_5	0.18	7.72	6.7
T_6	0.17	7.79	6.5
T_7	0.18	7.74	6.2
T_8	0.18	7.74	6.8
T_9	0.17	7.84	6.3
T_{10}	0.17	7.74	6.4
SEm	-	-	0.14
CD at 5% level	NS	NS	0.04
Inisial	.17	7.7	6.2

Table.2 Effect of fertilizer treatments on available nitrogen, phosphorus and potassium status of Soil after harvest of wheat

Treatment	Available Nitrogen kg/ha	Available Phosphorus kg/ha	Available Potassium Kg/ha
T_1	211.70	12.10	414.70
T_2	221.22	16.57	426.85
T_3	225.54	20.80	434.4
T_4	235.59	23.60	445.10
T_5	225.61	21.02	431.85
T_6	232.30	19.48	408.85
T_7	252.40	12.18	418.20
T_8	243.00	24.00	442.08
T_9	223.03	17.91	425.35
T_{10}	226.76	17.30	423.23
SEm+	7.03	1.44	7.07
CD at 5% level	19.70	3.90	19.10
Inisial	236	22	474

Table.3 Effect of fertilizer treatments on DTPA extractable zinc, copper, iron and manganese ($mg\ kg^{-1}$) status of soil after harvest of wheat

Treatments	Available Zn	Available Cu	Available Fe	Available Mn
T_1	1.28	2.31	26.90	20.92
T_2	1.38	2.41	28.00	23.11
T_3	1.48	2.49	28.15	23.30
T_4	1.84	2.53	28.92	27.46
T_5	1.99	2.40	29.90	26.80
T_6	1.56	2.35	27.34	22.61
T_7	1.45	2.34	27.35	21.48
T_8	2.04	2.53	28.70	24.79
T_9	1.48	2.47	27.82	26.85
T_{10}	1.53	2.45	28.30	26.39
SEm+	0.108	0.118	0.122	0.533
CD at 5% level	0.305	0.309	0.354	1.44
Inisial	1.25	2.4	27.45	21.2

The mean value for nitrogen, Phasphorus and potassium ranged from 211.7 to 252.4, 12.1 to 23.6and 414.7 to 445.1 kg ha$^{1.}$ The available nitrogen content in soil was significantly increased with treatment T_8 (243.0), T_7 (252.4) and T_4 (235.5) kg ha^{-1}over the control T_1, Phasphorus and potassium content highest was T_4 150%NPK and lowest under 100% N alone treatment. In general after the harvest of the wheat crop lower residual available nitrogen content were found in treatments T_2 (241.3), T_9 (223.0), T_3 (225.5), T_5 (225.6) over the initial value. The improved status of available N, P and K at higher levels of applied fertilizer nutrients and with organics could be attributed due to use of recommended dose of fertilizer nutrients and with organics. Similar results have been reported by Sharma and Bapat (2000), Gupta and Tomar. (1992) at Kumar and Yadav (1993) and Bharadwaj *et al.,* (1994).Gupta *et al.,* (1988).

Available Zn, cu, Fe, Mn

The data on DTPA Zn,Cu,Fe and Mn content in soil after harvest of wheat crop was shown in table 3, ranged from 1.2 to 2.0, 2.31 to 2.53, 26.9 to 29.9 and 27.5 to 20.9 mg kg^{-1} Significantly highest zinc content was recorded with applied treatment T_8 (100% NPK+FYM), closely followed by T_5 100% NPK + Zn and T_4 150% NPK treatments over control (T_1) No significant effect of applied fertilizer treatment was noticed on residual Cu content over control and initial value i.e. 2.4 mg kg^{-1} after harvest of wheat crop. Highest Fe and Mn was recorded under T5 29.9 mg kg^{-1} and T_4 27.5 mg kg^{-1} and lowest was 27.4 with T_7 100% N alone. Increased contents of available zinc, copper, iron and manganese in soil with higher levels of applied fertilizer nutrients could be ascribed due to higher availability of crop residue, better microenvironment with efficient mobilization of mineral nutrients and residual effect of applied organic sources. The results are in conformity with the findings by Sinha *et al.,* (1997) Rao and Dekhore (1993), Bhoyer *et al.,* (1998) and Lal *et al.,* (1973).

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