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Nutrient Uptake and Physico: Chemical Properties of Soil Influenced by Organic and Inorganic Packages in Rice

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ABSTRACT

Field Study on Nutrient uptake and Physico – chemical properties of soil influenced by organic and inorganic packages in rice was carried out at Research Cum Instructional Farm IGKV., Raipur (C.G.) during *kharif* 2010 and 2011. The soil of experimental field was '*Inceptisols*' (*Matasi*), which was low in nitrogen, medium in available phosphorus and potassium. The experiment was laid out in randomized block design with three replication. The treatments consisted of Basmati type rice variety *viz.* Kasturi Comprising organic, inorganic and integrated nutrient management. Treatment T_1 (50% RDF + 50% N (CDM), T_2 (100% N((1/3 rd each CDM +NC+CCR) T_3 (100% N (1/3 rd each CDM + NC + CCR) + Green manure in rice), T_4 100% N (1/3 rd each CDM + NC + CCR) +Deep summer ploughing), T_5 (50%N(CDM)+RP+PSB+*Azos.*), T_6 (100%N(1/3 rd each CDM+NC+CCR) + Azos.+ PSB) and T_7 (100% RDF).among different nutrient management practiceshigher nutrient uptake in grain and straw were observed under treatment T_7(100% RDF).followed by T_1 (50% RDF + 50% N (CDM) an INM treatment.whereas water uptake was exceeding in100% N applied through 1/3 rd each CDM + NC + CCR + Green manure in rice. Bulk density, pH and EC were also exceeds in T_7, except T_6 (100% N CDM + NC + CCR + *Azos* + PSB) which has higher OC.

Key words: Cow dung manure, Green manure, Neem cake, Phosphorus Solubilising bacteria, *Azospirillum and* Crop Composted residue.

INTRODUCTION

Basmati rice is most preferred and therefore fetch a very high premium in both international and domestic markets. From a total area of 7 lakh hectare under basmati rice in country nearly 6 lakh tonnes of milled rice is produced annually. Organic food as is self explanatory needs large quantity of organic manures to supply nutrients in soil but on the contrary, there is a serious decline in organic matter in Indian soils particularly in arid, semi-arid and sub-humid climate. Application of organic manure not only improves the soil organic carbon for sustaining the soil physical quality but also increases the soil N. The replacement of external inputs viz., chemical fertilizers by farm-derived organic inputs normally leads to a reduction in variable input costs under organic management. In Chhattisgarh, by virtue of using less quantity of chemical fertilizers and pesticides and dependency upon naturally available sources of nutrients, producing organic food could have better opportunity towards high remuneration with premium price in market with inherent lesser cost advantage (Singh *et al* 2001). Therefore, an experiment has been conducted to evaluate different organic inputs, nutrients sources as well as to compare the chemical and integrated nutrient management in rice

MATERIALS AND METHODS

Field experiment was carried out during Kharif season of 2010 and 2011 at the Research-cum-Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (CG), which had adequate facilities for irrigation and drainage. During the

last seven years Rice-Potato-Fallow and rice - onion - fallow cropping system was adopted with recommended package for organic and integrated nutrient management practices. Bulk density (mg^{-3})1.35, Organic carbon (%) 0.64, pH 7.69, EC (dSm^{-1} at 25 °C) 0.21 ,Available N, P and K (kg ha^{-1}) content were 226.65, 19.83 and 324.42 kg ha^{-1} respectively the experiment was conducted in randomized block replicated Thrice With a Plot size of 10 x 10 m in Kharif season The seven Treatments comprise of 50% RDF+ 50% N (CDM), 100% N (1/3rd each CDM+NC+CCR), T_2+GM in rice, T_2+ DSP, 50% N (CDM) + *Azospirillum* + RP + PSB, 50% N (CDM) + *Azospirillum* + RP + PSB and 100% RDF 80: 50: 30 N: P_2O_5:K_2O Kg/ha). The seed was sown by drilling the seeds in lines in raised nurseries. The seed rate was 40 kg ha^{-1}. The transplanting was done with spacing of 20 x 10 cm row to row and plant to plant distance. The recommended dose of fertilizer was 80:50:30 kg NPK ha^{-1} respectively. The full dose of P and K and 30% of the N was applied at the basal dose and the remaining quantity N was given in 2 splits i.e. 40% at tillering stage and 30 % at PI stage. The P and K were applied through SSP and MOP, Rock Phosphate and biofertilizers namely PSB and *Azospirillum* .and other organic sources like CDM, Neem cake etc. Nitrogen was given in the form of urea, FYM, crop residues and neem cake. The CDM, crop residues, neem cake and green manure (*Sesbania rostrata)* and 30 % of N were applied as the basal dose. Two hand weeding was done at 30 and 50 DAT. Water management was given to the crop as per requirement. Water level of 5 ± 2 cm depth was maintained during the crop growth period. crops were harvested with the help of sickles. Soil samples for various soil physico-chemical properties i.e. pH, electrical conductivity, organic carbon, available nitrogen, available phosphorous and available potassium were analyzed after harvest of crop. Soil pH was determined by digital automatic pH meter in soil water suspension 1:2.5 (Piper, 1967). Electrical conductivity (EC) was determined by taking supernatural liquid of soil water suspension prepared for pH determining by using conductivity meter (Black, 1965). Organic carbon was estimated by Walkley and Black rapid titration method (Piper, 1967). Bulk density was determine by removing natural undisturbed core sample from soil up to 21cm depth with 7 cm intervals by core sampler the samples where oven dried 105 °C to a constant weight bulk density was calculated by following formula:

$$\text{Bulk density } (mg^{-3}) = \frac{\text{Weight of oven dry soil (mg)}}{\text{Volume of soil core } (m^{-3})}$$

Available nitrogen of the soil was determined by alkaline permanganate method of Subbiah and Asija (1956). Available phosphorous of the soil was estimated by Olsen's method (Olsen's *et al.* 1954). Available potassium was determined by flame photometer after 5 minutes shaking with 25 ml of 1 N ammonium acetate (Hanway and Heiddle, 1952). Whereas Water uptake is calculated by the following formula: (Hong and Song, 1998),

Water uptake (ml) = 100/2gm x Actual water absorbed

RESULTS AND DISCUSSION

N uptake in grain and straw

The data regarding nitrogen uptake in grain, straw and total are presented in Table (1) Plots treated with (100% RDF) resulted significantly higher uptake of N in grain and straw which was at par with T_1 (50%RDF + 50%N applied through CDM), over rest of the treatments. Poor most N-uptake in grain was recorded under (50%N applied through CDM + *Azos* + RP + PSB). As far, the total uptake of N, significantly higher total N uptake was recorded under T_7. On an average the 100% inorganic treatments showed higher N uptake in grain and straw and total followed by the INM treatment where as the treatment under 50% organic manure given the lowest N uptake in grain and straw. These results were in agreement with the findings of Hatwar *et al* (1992).

Water uptake in grain (ml)

Water uptake by rice have been evaluated and data are presented in table (1) Treatment T_3 (100% N applied through 1/3 each CDM + NC + CCR) + GM in rice recorded the highest water uptake followed by T_4 (100% N (1/3 each CDM + NC + CCR) whereas the treatments T_5 (50% N(CDM) + *Azos* + RP + PSB) gives the lowest value for water uptakes in grain. On comparison of inorganic , organic and integrated nutrients Practices, highest water required for its uptake by rice under organically produced crop (Sarawgi *et al*, 2006).

Table 1: Grain N uptake, Kg ha^{-1}, straw N uptake, Kg ha^{-1}, Total N uptake, Kg ha^{-1}, Water uptake in grain (ml) of rice as influenced by different nutrient management (pooled 2 years)

Treatments	Grain	straw	Total N uptake Kg ha^{-1}	Water uptake in grain(ml)
	N uptake Kg ha^{-1}	N uptake Kg ha^{-1}		
T_1 50% RDF +50% N (CDM)	32.02	17.13	49.15	261.33
T_2 100% N (1/3rd each CDM+NC+CCR)	29.46	13.09	42.55	265.00
T_3 T_2+GM in rice	30.11	14.89	45.00	271.67
T_4 T_2 +DSP	28.77	12.85	41.59	266.33
T_5 50% N (CDM) + *Azospirillum*+ RP+PSB	28.36	12.82	41.21	253.67
T_6 T_2 + *Azospirillum*+PSB	30.23	14.75	44.98	266.00
T_7 100% RDF	34.43	19.46	53.89	259.67
Sem+	1.33	0.94	1.14	4.08
CD(P=.05)	4.04	2.87	3.80	12.40
Overall Mean	30.48	15.00	45.48	263.38
Comparison				
100% inorganic fertilizers (T_7)	34.43	19.46	53.89	259.67
Integrated nutrient management (T_1)	32.02	17.13	49.15	261.33
100% organic fertilizer-mean of (T_2+T_3+T_4+T_6)	29.64	13.89	43.53	267.25
50% organic fertilizer (T_5) + *Azos* + RP + PSB	28.36	12..82	41.21	253.67

Table 2 : Available Nitrogen, phosphorus and potash in soil as influenced by different nutrient management after harvest (pooled 2 years)

Treatments	Available N Kg ha^{-1}	Available P Kg ha^{-1}	Available K Kg ha^{-1}
T_1 50% RDF+50% N (CDM)	244.00	19.70	261.00
T_2 100% N (1/3rd each CDM+NC+CCR)	230.00	18.10	252.00
T_3 T_2+GM in rice	246.00	20.60	254.00
T_4 T_2+DSP	226.00	18.70	250.00
T_5 50% N (CDM) + *Azospirillum* + RP + PSB	221.00	17.60	243.00
T_6 T_2 + *Azospirillum*+PSB	232.00	20.40	252.00
T_7 100% RDF	260.00	23.40	284.00
Sem+	4.00	0.77	6.00
CD(P=.05)	13.00	2.35	18.00
Overall Mean	237.00	19.78	260.00
Comparison			
100% inorganic fertilizers	260.00	23.40	284.00
50% organic manure + 50% inorganic fertilizers (INM)	244.00	19.70	261.00
100% organic fertilizer-mean of (T_2+T_3+T_4+T_6)	233.50	19.45	252.00
50% organic manures (T_5) + *Azos*+ RP + PSB	221.00	17.60	243.00

Table 3: Soil physico chemical properties (BD, pH, EC, OC %) as influenced by different nutrient management after harvest (Pooled 2 years)

Treatment		BDmg m^{-3}	pH	ECdsm^{-1}	OC%
T_1	50% RDF +50% N (CDM)	1.37	7.46	0.25	0.52
T_2	100% N (1/3rd each CDM + NC + CCR)	1.32	7.38	0.22	0.53
T_3	T_2+GM in rice	1.29	7.37	0.23	0.53
T_4	T_2 +DSP	1.33	7.35	0.26	0.52
T_5	50% N (CDM) + *Azospirillum* + RP +PSB	1.35	7.35	0.25	0.51
T_6	T_2 + *Azospirillum*+PSB	1.28	7.32	0.24	0.54
T_7	100% RDF	1.41	7.47	0.30	0.50
SEm ±		0.009	0.03	0.008	0.01
C.D. (P=0.05%)		0.026	0.09	0.026	0.03
Overall Mean		1.33	7.37	0.25	0.52
Comparison					
100% inorganic fertilizers		1.41	7.47	0.30	0.50
50% organic manure + 50% inorganic fertilizers (INM)		1.37	7.46	0.25	0.52
100% organic fertilizer-mean of (T_2+T_3+T_4+T_6)		1.30	7.35	0.23	0.53
50% organic manures (T_5) + *Azos* + RP + PSB		1.35	7.35	0.25	0.51

Available N, P and K status of soil (Kg ha^{-1})

Available N, P and K status of soil after harvesting of rice are shown in Table (2) Application of 100% RDF helped to accumulate higher N, P and K in soil over rest of the treatment. In different treatments available N ranged from 221-260 kg ha^{-1}, available phosphorous ranged from 17.60 to 23.40 kg ha^{-1} and available K ranged from 243 to 284 kg ha^{-1} (Urkurkar *et al*, 2010).

Physico chemical properties of soil

Bulk density was higher in 100% RDF (T_7) as compared to other treatments. Here significantly lower bulk density was recorded under T_6 (T_2 + *Azos* + PSB) which was at par with rest of the treatments Table (3). Whereas the value of pH ranged from 7.47 to 7.32 between different organic, inorganic and integrated nutrient management treatments however significantly higher pH value was recorded under treatment T_7 (100% RDF) and other treatments viz. T_1, T_2 recorded at par and T_4 and T_5 recorded the lowest pH value. While the reading of electrical conductivity ranged between 0.22 to 0.30 where T_7 (100% RDF) significantly resulted in higher value of EC over rest of the treatments T_2 (100% N 1/3 CDM + NC + CCR) recorded the lowest value of electrical conductivity. Lastly the organic carbon percentage which ranges from 0.50 to 0.54 where the maximum organic carbon was significantly recorded under treatment T_6 (100% N CDM + NC + CCR + *Azos* + PSB) which was at par with T_2, T_3, T_1, T_4 whereas the least organic carbon percentage was recorded under T_5. (50% N CDM + *Azos* + RP + PSB). These results was in collaboration with the findings of Bellakki and Badanur (1997).

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