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SOIL TEST-CROP RESPONSE CORRELATION WITH RICE UNDER IPNS SYSTEM IN *INCEPTISOLS* OF SURGUJA HILLS ZONE OF CHHATTISGARH

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Abstract

A field experiment was conducted during *kharif* 2014 in *Inceptisols* of Northern hills zone of Chhattisgarh to estimate the nutritional requirement, efficiencies of fertilizer, soil test and organic source (FYM) to estimate the fertilizer requirement for varying yield goals of rice crop based on soil test levels using INM approach. Rice crop required 1.47 kg N, 0.33 kg P and 2.06 kg K for one quintal grain production. Fertilizer and soil test efficiencies estimated were 36.97 and 16.70 percent, respectively for N, 23.88 and 55.41 percent, respectively for P and 121.4 and 17.57 percent, respectively for K. The FYM contribution in terms of N, P and K were estimated 6.26, 2.50 and 4.97 per cent, respectively. Based on these basic parameters, fertilizer adjustment equation for N, P and K were evolved for different yield targets of rice based on soil nutrients level using FYM as organic component in INM.

Key words*:* Soil test, *Inceptisols*, rice, nutritional requirement, INM approach.

Introduction

Rice (*Oryza sativa* L.*)* is called as "Global Grain" because it is important crop for 117 countries of the world. In Northern region of Chhattisgarh state, Rice is gaining popularly and improving climate the livelihood due to favourable climate with limited irrigation facility. The effective fertilizerrecommendation should consider crop needs and nutrient already available in the soil. Continuous use of inorganic nutrients may adversely affect the physico - chemical properties of soil and thereby affect the crop yields. In order to sustain the yield and reduce the dependency on inorganic fertilizer use, conjunctive use of organic manures and fertilizers is very much essential. Targeted yield concept strikes a balance between fertilizing the crop and fertilizing the soil. In the view of above facts, a study on refining the integrated plant nutrient supply on STCR basis was conducted as advocated by Ramamoorthy *et al.* (1967).

Materials and Methods

A field experiment on soil test crop response correlation study was conducted with rice (*var.* MTU 1010) during *kharif* season 2014 in *Inceptisols* at Rajmohini Devi College of Agriculture and Research Station, Ajirma, Ambikapur (Chhattisgarh). A special field technique developed by Ramamoorthy *et al.* (1967) was used for this study. The field was divided in to three long strips and was denoted as L_0, L_1 and L_2. These fertility strips had fertility gradient with respect to available P which was created during previous crop season. Each strip (treated as block) was divided in to 24 equal size plot. The fertilizer treatments constituted of different combinations of various levels of N (0, 50, 100 and 150 kg ha^{-1}), P_2O_5 (0, 30, 60 and 90 kg ha^{-1}) and K_2O (0, 30, 60 and 90 kg ha^{-1}) and FYM (0, 5 and 10 t ha^{-1}) were randomly distributed in each strip. The fertilizer materials used were urea,single super phosphate and muraite of potash. Full dose of P_2O_5 and K_2O were applied as basal and 1/3rd of N were applied as basal,remaining 2/3rd of N applied in two equal splits as top dressing at 25 and 45 days after transplanting. Before application of fertilizer, FYM @ 0, 5 and 10 t ha^{-1} as per treatments structure was applied and thoroughly mixed in soil. Plot-wise soil samples were collected before application of fertilizer

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and FYM treatments. Soil samples were analyzed for available N (Subhiah and Asija, 1956), P (Bray, 1948)and K (Hanway and Heidal, 1952). The MTU 1010 variety of rice crop was transplanted during the first week of august, 2014 and harvested in 2nd week of November, 2014. The yield data for grain and straw for all the plots were recorded at the end of the experiment. Grain and straw samples were analyzed for N, P and K content (Piper, 1966) and total nutrient uptake was computed using grain and straw yield data.

The basic parameter, *viz*. nutrient requirement (kg q^{-1}), contribution of nutrients from soil, fertilizer and organic sources were calculated as described by Ramamoorthy *et al*. (1967). These parameters were used for the formulation of fertilizer adjustment equations for deriving fertilizer doses and the soil test based fertilizer recommendations with organic source were prescribed in the form of ready reckoner for desired yield goal of rice.

Results and Discussion

Soil available nutrients : The range and mean values of available nutrients (N, P & K) (table1) indicate that soil test N, P and K varied with different fertility strips although soil test N and K variations with respect to fertility strip were marginal however, soil P variation in different strips were quite marked and it increased across the fertility strips.

Table 1: Range and mean value of available N, P and K (kg/ha)

Soil Nutrients	L_0	L_1	L_2	SD	CV %
Alkaline $KMnO_4$-N	181–224.4 (209.1)	186.5–231.2 (212)	188.9–230.2 (214.8)	11.55	5.45
Bray's	10.9–17.2 (13.8)	14.7–25.3 (20.4)	18.08–32.41 (26.4)	5.97	29.52
Amm. acetate extractable K	250.2–291.5 (272.3)	277.2–331.3 (308.9)	300.2–343.7 (328.6)	26.57	8.76

Values in parenthesis are average data

Crop yield: Table 2 gives the range and averages of rice yield in relation to different fertility strips. It was observed from the results that there was increasing trends in rice yields from L_0 to L_2fertility strip due to increasing P level. Highest yield of 64.9q/ha was observed in L_2 strip with a good response to the application of highest dose of fertilizer and 27.28 q/ha was observed in the L_2 strip without fertilizer (Control).

Table 2: Range and mean values of rice (Var. MTU 1010) yield (q/ha)

Locations	Fertility strips			SD	CV (%)
	L_0	L_1	L_2		
Ambikapur	16.05 - 63.8 (45.5)	19.4- 64.7 (47.2)	21.9 - 64.9 (48.4)	14.14	30.04

Estimation of basic parameters: Results presented in table 3 show the nutrient requirement (NR) for N, P and K (kg q^{-1}),efficiencies of fertilizer (Ef), soil test (Es) and FYM estimated based on the basic formula. The rice required about 1.47 kg N, 0.33 kg P and 2.06 kg K to produce one quintal of grain. Fertilizer efficiencies for P were less than soil test efficiencies. Contrary to this, fertilizer efficiencies for nitrogen and potash were observed higher than soil test efficiencies. The efficiency of FYM for N was found to be higher and minimum value was observed with phosphorous.

Table 3: Nutrient requirement, fertilizer, soil and FYM efficiencies

Nutrient	NR (kg q^{-1})	Fertilizer efficiency (%)	Soil test efficiency (%)	FYM efficiency (%)
N	1.47	36.97	16.7	6.26
P	0.33	23.88	55.41	2.50
K	2.06	121.4	17.57	4.97

Table 4: Fertilizer adjustment equation estimated based on response data (Ambikapur)

Fertilizer adjustment equations
FN = 3.97 Y - 0.45 SN - 0.17FYM
FP = 1.39 Y- 2.32SP - 0.10 FYM
FK = 1.70Y - 0.14 SK - 0.04FYM

Where, FN, FP and FK are fertilizer N, P_2O_5 and K_2O (Kg ha^{-1}) respectively. FYM is Farm Yard Manure (t ha^{-1}). SN, SP and SK are soil test values (kg ha^{-1}) for $KMnO_4$ N, Bray 's P and ammonium acetate extractable K and Y is targeted yield in q ha^{-1}.

The fertilizer adjustment equations for N, P and K with FYM have been presented in table 4. The ready reckoners for fertilizer N, P_2O_5 and K_2O along with 5 tonnes of FYM for specific yield targets of rice (var. MTU 1010) is presented in table 5. The ready reckoners show that the fertilizer requirements decrease with increase in soil test values. Therefore a slightly lower yield target may be considered for poor farmers.

Table 5: Ready Reckoners for soil test based fertilizer N P_2O_5 and K_2O recommendation ofrice (MTU 10101) in*Inceptisols* with 5 tonnes of FYM.

Soil Test values (kg/ha)			Yield Target of rice (q/ha)								
			50			60			70		
N	P	K	FN	FP	FK	FN	FP	FK	FN	FP	FK
100	**4**	**200**	113	46	40	153	60	57	192	74	74
125	**6**	**225**	102	41	36	141	55	53	181	69	70
150	**8**	**250**	90	37	33	130	50	50	170	64	67
175	**10**	**275**	79	32	29	119	46	46	159	60	63
200	**12**	**300**	68	27	26	108	41	43	147	55	60
225	**14**	**325**	57	23	22	96	37	39	136	50	56
250	**16**	**350**	45	18	19	85	32	36	125	46	53
275	**18**	**375**	34	13	15	74	27	32	114	41	49
300	**20**	**400**	23	9	12	63	23	29	102	37	46
325	**22**	**425**	12	4	8	51	18	25	91	32	42
350	**24**	**450**	12	4	5	40	13	22	80	27	39

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