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EFFECT OF NPK FERTILIZERS ON THE AVAILABILITY OF MICRONUTRIENTS IN SUBMERGED LATERITE RICE SOILS OF KERALA

The nutrients in soil undergo a variety of transformations as a result of submergence which would markedly influence the availability of native and applied nutrients during the crop growth. Nutrient transformations under submerged conditions have been reviewed by a few workers (Ponnamperuma 1972, Patnaik and Mandal 1982) citing mostly laboratory experiments which had been carried out under controlled conditions. In this study, the micronutrient availability in submerged soil with the soil-water- plant-ecosystem under different levels of NPK fertilizers has been studied.

Field experiment was conducted during kharif 1983 in a sandy loam laterite (Fluventic Dystropepts) soil of the RARS, Pattambi, having initial pH of 5.31, HN_4-N 18.3 ppm, Bray-IP 7.9 ppm, neutral normal ammonium acetate extractable K 52.9 ppm and DTPA extractable Fe 296 ppm, Mn 27.2 ppm, Cu 2.5 ppm and Zn 1.9 ppm. The treatments adopted were (1) 0:0:0 (2) 40:0:0 (3) 80:0:0 (4) 40:20:20 and (5) 80:40:40 of N: P_2O_5: K_2O kg/ha. The entire amount of P and K and 50% of N were applied as basal. One month after transplanting, 25% of N was applied and the remaining 25% was top dressed at panicle initiation stage. The fertilizers used were prilled urea, muriate of potash and single superphosphate. Soil samples were collected at 10 day intervals up to 80 days of crop growth from transplanting. The available micronutrients viz., Fe, Mn, Zn and Cu were extracted using DTPA (Lindsay *et al.*, 1969) and estimated using atomic absorption spectrophotometer.

Application of NPK fertilizers did not cause any significant variations in the micronutrient content of the soil. However, there was variation in the availability of micronutrients during different periods as a result of submergence and crop growth (Table 1). After submergence the concentration of available iron in the soil was found to increase up to 30 days after transplanting (DAT) due to the reduction of ferric iron to ferrous form (Ponnanperuma, 1972). There was no definite pattern of increase or decrease from 30 DAT onwards. This can be attributed to the differential rate of absorption of soluble ferrous iron by rice during different periods. In the case of available manganese a decrease in the concentration was noticed from 10 DAT. However, there was an increase in Mn concentration during the early period of submergence i.e., from transplanting (27.19 ppm) to 10 DAT (34 ppm) on submergence, because of the reduction from manganic to manganous form. The subsequent decrease is attributed to the precipitation of $MnCO_3$ following the urea hydrolysis and crop uptake (Ponnamperuma, 1981).

Available zinc and copper in the soil decreased continuously with the period of submergence and crop growth. Decreased Cu and Zn availability and increased uptake on acid soils due to flooding have been reported by Tiller (1981). The reduction in the content of Zn might be due to the pfecipitah'on of its hydroxide in carbonated form as a result of increased pH or CO_2 accumulation (Patric and Reddy, 1978).

The study revealed that fertilizer

Table 1. Effect of NPK fertilizers on the availability of micronutrients under different periods of submergence and plant growth

Treatment, kg/ha N : P_2O_5 : K_2O	Days after transplanting							
	10	20	30	40	50	60	70	80
				Iron (ppm)				
0 : 0 : 0	371	432	510	402	403	435	409	410
40 : 0 : 0	336	411	394	429	387	390	389	416
80 : 0 : 0	343	392	447	403	379	440	404	360
40 : 20 : 20	331	505	442	407	406	394	394	419
80 : 40 : 20	414	366	452	415	303	444	395	371
Mean	359	421	449	411	392	421	398	395
				Manganese (ppm)				
0 : 0 : 0	32.7	27.5	34.6	22.6	12.7	27.1	13.2	16.5
40 : 0 : 0	34.1	32.3	25.8	32.0	21.3	15.0	16.6	16.3
80 : 0 : 0	32.3	29.3	25.7	31.8	22.3	20.3	16.1	17.7
40 : 20 : 20	33.3	32.6	26.1	26.2	22.3	19.1	14.5	13.8
80 : 40 : 40	37.4	34.2	34.5	26.1	24.3	17.6	12.8	19.1
Mean	34.0	31.2	29.3	27.7	20.6	19.8	14.5	16.7
				Copper (ppm)				
0 : 0 : 0	2.28	1.57	1.40	0.78	1.42	1.28	1.02	0.97
40 : 0 : 0	2.21	1.99	2.03	1.19	0.99	1.40	1.04	1.05
80 : 0 : 0	2.18	1.83	2.29	1.48	1.34	1.28	1.05	0.99
40 : 20 : 20	2.41	2.01	1.36	1.03	0.95	1.12	1.07	0.98
80 : 40 : 40	2.44	2.33	1.91	2.07	1.35	1.23	1.17	1.05
Mean	2.30	1.95	1.80	1.31	1.21	1.26	1.07	1.01
				Zinc (ppm)				
0 : 0 : 0	1.62	1.88	1.76	1.26	1.32	1.00	0.99	0.83
40 : 0 : 0	1.78	1.91	1.60	1.32	1.52	0.97	1.11	0.74
80 : 0 : 0	1.93	1.66	1.63	•1.24	1.16	1.06	0.96	0.88
40 : 20: 20	1.97	1.83	1.07	1.16	1.21	1.09	0.96	0.91
80 : 40 : 40	1.85	1.80	1.53	1.52	1.09	1.33	1.15	0.81
Mean	1.83	1.81	1.52	1.30	1.26	1.09	1.03	0.83

application at different levels had no effect on the availability of micronutrients in low land acid laterite soils. The availablity of Fe and Mn increased, reached an early peak and then declined as a result of submergence and plant growth. The available Cu and Zn in the soil decreased continuously with the period of submergence.

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REFERENCES

Lindsay, W.L. and Norewell, W.A. 1978. Development of DTPA for soil test for zinc, copper, iron and manganese. *Soil Sci. Soc. Am.]*. 42 : 421-428

Patnaik, S. and Mandal, L.N. 1982. Chemistry of submerged rice soils. *Review of Soil Research in India.* Indian Society of Soil Sci., IARI, New Delhi, p 181-198

Patrick, W.H. Jr. and Reddy, K.R. 1978. Chemical changes in rice soils. *Soils and Rice.* Int. Rice Res. Inst. Los Banos, Philippines, p 361-379

Ponnamperuma, F.N. 1972. The Chemistry of submerged soil. *Adv. Agron.* 24 : 29-96

Ponnamperuma, F.N. 1981. Some aspects of the physical chemistry of paddy soils. *Proc. Symp. Paddy Soils.* Inst. Soil Science, Academia Sinica Science Press, Beiging, p 59-94

Tiller, K.G. 1981. The availability of micronutrients in paddy soils and its assessment by soil analysis including radioisotopic techniques. *Proc. Symp. Paddy Soils,* Inst. Soil Science, Academia Sinica Science Press, Beiging, p 273-289

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