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EFFECT OF CONTINUOUS CROPPING AND FERTILIZATION ON DEPLETION OF MICRONUTRIENTS

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Two field experiments were conducted in the Typic Haplustalfs and Typic Ustorthents soils of Tamil Nadu to determine the effect of continuous cropping and fertilization on the changes in micronutrient availability. There was a greater rate of depletion of micronutrients in Typic Haplustalfs than the Typic Ustarthents soils. Rate of depletion of micronutrient was highest for zinc followed by copper, manganese and iron in both these soils indicating the need for proper micronutrient fertilization in Typic Haplustalfs.

With the increasing use of high analysis fertilizer and advent of high yielding varieties, a situation is created where additional stress is laid on available micronutrients status in soils, tending to increase the incidence and extent of micronutrients deficiency. An assessment of the rate of depletion of micronutrients, under conditions of use of high level of fertilizer and intensive cropping is therefore of paramount importance and of dire need in the context of exploitive nature of agriculture being currently followed and the present study aims at providing sufficient data on the effect of continuous cropping and fertilization on depletion of micronutrients.

MATERIALS AND METHODS

Two field experiments one at black clay loam soil of Coimbatore (Typic Haplustalfs) and the other at red loam soil of Bhavanisagar (Typic Ustarthents) were conducted to find out the effect of continuos cropping and fertilization on the depletion pattern of micronutrients. The soils received graded doses of NPK fertilizers. There was an absolute control. There were three levels of fertilizer combinations representing medium (50, 25 and 25 kg/ha of N, P_2O_5 and K_2O), high (100, 50 and 50 kg/ha of N, P_2O_5 and K_2O) and very high (200, 100 and 100 kg/ha of N, P_2O_5 and K_2O). The treatments were replicated six times and the soils received continuously the graded doses of fertilizers for every crop and were grown continuously adopting a fixed crop rotation and the rotation being CSH 1 Sorghum - MCU 5, Cotton - Ganga 5 maize. In the first cropping sequence MCU 5 cotton in both centres were allowed to maturity and the sorghum and

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maize were grown as fodder crops. Subsequently due to difficulty in raising MCU 5 cotton, cowpea crop was included in the place of cotton and the cropping sequence of sorghum-cowpea-maize was followed as fodder crops. The crops were allowed to grow for 45 days and harvested and dry matter production was recorded Altogether seven crops in Coimbatore and fifteen crops in Bhavanisagar were raised Plant samples were collected plotwise and were processed by washing with dilute hydrochloric acid and ovendried at 70°C. Triacid digestion procedure was adopted for taking up the extracts of the plant samples (Piper, 1966). and the concentrations of the micronutrients, namely zinc, copper, iron and manganese in the extract were determined, using atomic absorption spectrophotometer (Model VarianTechtron A.A. 120). The fertilizers used were urea, diammonium phosphate and muriate of potash having the least amount of micronutrients. The initial soil samples were analysed for available nitrogen (Subbiah and Asija, 1956) available phosphorus (Olsen *et al*, 1954) and available potassium (Stanford and English, 1949). Soil reaction, conductivity and organic carbon were also analysed. Available micronutrient viz., zinc, copper, iron and manganese using 0.005 M/DTPA extractant (Lindsay and Norvell, 1978) and the total micronutrient contents following standard procedures (pratt 1965)were estimated.

A balance sheet has been worked out for each of the four micronutrient elements. For this purpose, the total micronutrients of the initial soil sample was taken into account. The amount of micronutrients removed by the first 7 crops in the case of Coimbatore centre and fifteen crops in the case of Bhavanisagar centre was calculated for each fertility level and this was deducted from the total to determine the per cent depletion at each fertility level. The rate of depletion of micronutrients with reference to each soil group was also calculated. For arriving at the sequence of depletion the mean values of per cent depletion for the four fertility levels were considered for each soil group.

RESULTS AND DISCUSSION

The two soils viz., black clay loam soil of coimbatore and red loam soil of Bhavanisagar were normal with respect to pH and EC and low in organic carbon content. The fertility status of the two soils were identical with respect to nitrogen, phosphorus and potassium being low, high and very high respectively with regard to the available micronutrients and both soils were deficient in zinc, copper, iron and manganese.

From the trend of results, it was obvious that fhe yield of crops generally attained the maximum at the highest fertility level, the dry matter yield as well as uptake values for individual crops also incresed in the red loam typic ustorthents soil of Bhavanisagar. But in the black

Table 1. Effect of continuous cropping on depletion of micronutrients (Yield of each crop kg/plot) 3.0 x 3.5m dry matter production *Coimbatore Centre* : Black clay loam soil (Mean of six replication)

Sl. No.	Treatments				CSH 5 Cholam (Fodder) Ist crop	MCU 5 Cotton (Kapas) IInd crop	Ganga 5 maize (Fodder) IIIrd crop	CSH 5 Sor-ghum IVth crop	CO 2 Cowpea (Fodder) Vth crop	Ganga 5 maize VIth crop	CO 23 sorghum (Fodder) VIIth crop
		N	P_2O_5	K_2O kg/ha							
1.	Low	0	0	0	14.94	2 112	15.930	7.15	5.12	9 64	1.370
2.	Medium	50	25	25	9.94	2 309	16 615	6.56	6.34	10.58	1.967
3.	High	100	50	50	8.00	2.497	16.760	6.77	6.89	11.75	2.057
4.	Very high	200	100	100	5.46	2.247	16.080	5.04	6.84	12,53	2.166

clay loam Typic Haplustalf soils of Coimbatore the trend showed that generally at high fertility level (i. e. 100:50:50 kg N: P_2 O_5 K_2 O/ha) only the yield and uptake of micronutrient were high (Table 1 and 2). Comparision of the data pertaining to the yield and uptake for the 7th, 8th and 9th crop of CO-23 sorghum, 2nd, 5th and 9th crop of Ganga 5 maize and 4th and 7th crop of CO 2 cowpea showed conspicuous reduction in dry matter yield as well as uptake of all the four micronutrient cations (Zn, Cu, Fe and Mn) at all the four fertility levels viz., low, medium, high and very high. This trend clearly depict the necessity of integrated nutrient supply (macro and micronutrients) for maximising the crop yield.

Analysis of postharvest soil samples showed that rate of depletion was high for Zn followed by Cu, Mn and Fe in the given sequence which again indicated the necessity of Zn fertilization in the lands which were under intensive agriculture. The rate of depletion of micronutrients with reference to the two soil groups were presented in Table 4. Tne pattern of changes revealed that Zn depleted at a higher rate followed by Cu, Mn and Fe (Table 3). The same trend was followed in both soils. But among the soils, the per cent depletion was found to be more in the case of black clay loam soil of Coimbatore than the red loam soil of Bhavanisagar which was due to more dry matter production at the Coimbatore centre than the Bhavanisagar centre.

Table 2 Effect of Continuous Cropping on Depletion of Micronutrients
Yield of Each Crop kg/plot (3x3.5m) Dry Matter Production
Bhavanisagar Centre : Red sandy loamy soil (Mean of four replications)

Sl. No.	Treatments	MCU.5 Cotton Ist crop	Ganga-5 Maize IInd crop	CSH-1 Cholam IIIrd crop	Co.2 Cowpea IVth crop	Ganga-5 Maize Vth crop	Co.23 Cholam VIth crop	Co.2 Cowpea VIIth crop	Ganga-5 Maize VIIIth crop	Co 23 Sorghum IXth crop	Co.2 Cowpea Xth crop	Ganga-5 Maize XIth crop	Co.23 Sorghum XIIth crop	Co.2 Cowpea XIIIth crop	Co. Cowpea XIVth crop	Ganga-5 Maize XVth crop
N P_2O K_2O Kg/ha																
1. Low	0:0:0	20.25	4.74	4.91	1 61	1.38	1.94	1.370	2.212	0.250	0.151	3.43	1.976	1.90	2.56	3.475
2. Medium	50:25:25	59.75	8.39	11.66	3 00	1 87	2.17	1.937	4.045	0.591	1.302	8.07	2.622	2.73	5.06	11.975
3. High	100:50:50	63.50	10.42	13.16	2.37	3.97	3 64	2 057	5 591	1,164	1.644	9.68	3.04	3.57	8.53	21.06
4. Very high	200:100:100	63 50	11.12	13.65	3.03	5.67	6.40	2.166	6 848	1,468	2.310	10.37	2 980	2.58	7.70	25.4

Table 3. Effect of continuous cropping on depletion of micronutrients. Summation of micronutrients removal (g/plot 3.0 x 3.5 m)

Sl. No.	Treatments				Coimbatore Black clay loam soil (Total for 7 crops)				Bhavenisagar Red loamy soil (Total for 15 crops)			
		N	P_2O_5	K_2O kg/ha	Zn	Cu	Fe	Mn	Zn	Cu	Fe	Mn
1.	Low	0	0	0	1.749	0.520	4 450	6.680	0.950	0.198	5.572	2 729
2.	Medium	50	25	25	1.783	0 635	4.761	8 021	1.375	0.234	0.744	4.222
3.	High	100	50	50	1.900	0.686	5 084	8.925	1.540	0.321	12.220	4 848
4.	Very high	200	100	100	1.745	0.671	4.937	8.398	1.482	0.321	13.572	5.798

Table 4. Effect of continuous cropping on depletion of micronutrients. Rate of depletion of micronutrients (Mean values of per cent depletion of four fertility levels)

Sl. No	Place and soil	% Rate of depletion			
		Zn	Cu	Fe	Mn
1.	Coimbatore (Black clay loam soil) (Typic haplustalf)	1.79	1.00	0.002	0.62
2.	Bhavanisagar (Red loam soil) (Typic ustorthents)	1.34	0.448	0.865	0.418

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