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ORGANIC CARBON AND TOTAL NUTRIENT CONTENTS OF INCEPTISOL UNDER LONG-TERM FERTILISATION

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ABSTRACT

Beneficial role of FYM in increasing the organic carbon content and total nutrients of the soil was evidenced when applied with inorganics (NPK). Application of NP fertilisers increased the nutrient status when compared to application of N alone. Regarding depth all the nutrients got decreased as the depth increased.

KEY WORDS : Long Term Effect, Organic Carbon, Total Nutrients, Inceptisol

High cropping intensity involving high yielding varieties accelerated the removal of plant nutrients and this added dimensions to the dynamics of soil ferility. Continuous application of fertilisers for a long term may result in the build up of soil nutrients, a part of which may be used by the crops grown in subsequent years. Such changes have been studied in a long term experiment carried out from 1972 and the resutls are presented here.

MATERIALS AND METHODS

A long term field experiment was started in the year 1972 at the Tamil Nadu Agricultural University with maize - cowpea - ragi rotation. The soil of experimental site represents clay loam. It was medium in organic C and P, low in N and high in available K.

The experiment was conducted during 1994 in a randomised block design, replicated four times with a plot size of 10 $m.^2$ The treatments were (1) 50% NPK (2) 100% NPK (3) 150% NPK (4) 100% NPK + hand weeding (5) 100% NPK + $ZnSO_4$ (6) 100% NP (7) 100% N (8) 100% NPK + FYM (9) 100% NPK (-S) (10) control. The fertiliser doses were based on initial soil test values. The sources of N, P_2O_5 and K_2O were urea, single super phosphate and muriate of potash for all the treatments except treatment 9 where it was supplie through sulphur free source of di-ammoniu phosphate and FYM added at the rate of 10 t ha. Recommended herbicide was applied to control th weeds in all the treatments except treatmen number 4.

Soil samples were collected at three depth *viz.*, 0-15, 15- 30 and 30-45 cm. The contents of organic carbon and total N (Piper, 1966), total P (Pemberton, 1945) and totalK (Jackson, 1973) were determined following standard methods.

RESULTS AND DISCUSSION

Organic carbon

There was a build up in soil organic C due to continuous application of manures and fertilisers. Among the treatments, FYM application conjointly with 100 per cent NPK registered the highest organic C content of soil (Table 1). The influence of FYM on the organic C status is universal and its application along with NPK might have influenced favourably the root growth and bio-mass yield thus consequently enhancing the organic C content in the soil. Similar observations have earlier been made by Mathan *et al.* (1979). The comparison made between 100 per cent N alone and 100 per

Table 1. Long term effect of organics and inorganics on organic carbon (%) and total N content (%) of soil at different depths (cm)

Treatment	Depth (cm) 0 - 15		15 - 30		30 - 45	
	OC	Total N	OC	Total N	OC	Total N
50% NPK	0.42	0.064	0.35	0.054	0.34	0.036
100% NPK	0.41	0.064	0.37	0.069	0.37	0.044
150% NPK	0.46	0.074	0.38	0.064	0.36	0.046
100% NPK + Hand weeding	0.41	0.063	0.35	0.057	0.35	0.045
100% NPK + $ZnSO_4$	0.45	0.058	0.35	0.057	0.34	0.048
100% NP	0.40	0.064	0.38	0.050	0.37	0.045
100% N	0.41	0.057	0.39	0.046	0.35	0.046
100% NPK + FYM	0.50	0.075	0.40	0.065	0.39	0.045
100% NPK (-S)	0.47	0.073	0.35	0.057	0.36	0.046
Control	0.44	0.045	0.35	0.045	0.35	0.036

Sources /	CD OC	CD Total N
T	0.0023	0.074
D	0.0012	0.024
TxD	0.0040	0.170

slight increase in plots receiving 100 per cent NP. Probably the P fertilisation had improved the root proliferation and thereby the organic C content of the soil. This is in accordance with the findings of Biswas et al. (1971). The low organic C content in plots receiving continous application of N could be ascribed to the increased rate of decomposition of soil organic matter. The decrease in organic C content observed with soil depth is quite expected.

Total N

The total N content was the highest (Table 1) in plots receiving 100 per cent optimal NPK + FYM. This is in accordance with the findings of several workers. Mathan *et al.* (1979) and Chaudhary *et al.* (1981) reported that continuous fertilisation with organics especially FYM besides compensating the losses of soil N due to crop removal is able to improve the soil N status. Besides organic manuring, the application of NPK aided in the build up of total soil N especially when applied at higher rates (*i.e*) 150 per cent optimal NPK. This is in consonance with the findings of Verma *et al.* (1987). Further it was evident that the content of total N decreased with depth irrespective of the treatments, suffering low organic carbon content in the lower layers.

Total P

Continuous addition of P fertilisers increased Bhriguvanshi (1988) reported that when fertiliser P (100 percent optimal P) was applied with 100 per cent NK and FYM, there was considerable build up in total P, which could be ascribed to the mineralisation of organic P present in FYM thus contributing towards its availability. In respect of continuous addition of 100 per cent N, an adverse effect on the content of total P in soil was evidenced. Similar findings have been reported by Panda and Sahoo (1989). According to them, there was P depletion in the absence of P fertiliser addition of all long term fertilizer experiment centres.

The total P content also declined with depth irrespective of the treatments. It may be ascribed to the reduction in organic matter as a result of cultivation.

Total K

An increase in the total K content of the soil was evident due to the addition of 150 per cent optimal NPK followed by the addition of 100 per cent optimal NPK + FYM. The unique feature of K is related to its behaviour in any system since it is always in the ionic form without being involved in the formation of any organic compounds. Because of this fact even the soils with high organic matter content showed very low potassium content as observed in the present investigation. Though there

Table 2. Long term effect of organics and inorganics on total P and K content (%) of soil at different depths (cm)

Treatment	Depth (cm) 0 - 15		15 - 30		30 - 45	
	Total P	Total K	Total P	Total K	Total P	Total K
50% NPK	0.075	0.215	0.035	0.245	0.025	0.255
100% NPK	0.055	0.235	0.045	0.280	0.013	0.260
150% NPK	0.063	0.260	0.052	0.280	0.025	0.280
100% NPK + Hand weeding	0.055	0.233	0.047	0.283	0.025	0.243
100% NPK + $ZnSO_4$	0.060	0.243	0.045	0.248	0.025	0.253
100% NP	0.035	0.243	0.052	0.237	0.027	0.245
100% N	0.030	0.237	0.055	0.243	0.025	0.248
100% NPK + FYM	0.065	0.260	0.058	0.243	0.227	0.290
100% NPK (-S)	0.025	0.233	0.065	0.280	0.047	0.245
Control	0.025	0.245	0.045	0.215	0.025	0.285

Sources	CD	
	Total P	Total K
T	0.010	0.005
D	0.004	0.003

practices it was not marked probably due to very high initial potash level in the soil of the long term fertiliser experiments, Coimbatore.

While comparing the total K content in soil with depth, it increased. The lower total K content observed at the surface could possibly be attributed to the release of non-exchangeable K and fixed K fraction in the soil solution to maintain the dynamic equilibrium among the different forms.

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IMPACT OF FERTILISATION AND INTENSIVE CROPPING ON PHYSICAL PROPERTIES OF VERTIC USTROPEPT SOIL

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ABSTRACT

Conjoint use of FYM with NPK over a long period had improved the physical properties of the soil, when compared to the application of inorganic fertilisers alone. Hydraulic conductivity of the soil increased while bulk density decreased. In respect of water holding capacity, the NP treatment recorded higher value as against N alone and it increased with depth.