

## Soil pH Electrical Conductivity and CEC Under Long Term Fertilization

P. MUTHUVEL<sup>1</sup>, P. KANDASWAMY<sup>2</sup> and K.K. KRISHNAMOORTHY<sup>3</sup>

The influence of long term application of organic manures and inorganic fertilizers under rainfed and irrigated conditions on the soil pH, EC and CEC was investigated with the soil samples collected from the permanent manurial experimental plots of Tamil Nadu Agricultural University farm at Coimbatore. Not much variation was observed in the case of electrical conductivity and pH value of electrical conductivity and pH values of soils to different treatments tried. Under rainfed conditions the CEC was higher in organic manure treatments.

In modern crop production, application of fertilizers has come to stay as an indispensable input. Consequent to the introduction of high yielding varieties possessing higher levels of fertilizer response the quantum of fertilizer applied to the soil has phenomenally increased. There is a general belief that long continued application of inorganic fertilizers appreciably alters the soil reaction and thereby the soil properties are changed.

Venkata Rao and Badiger (1971) and Prasad *et al.* (1971) were of the opinion that long continued dressings with ammonium sulphate lower the soil pH. Changes in CEC of soils due to long term fertilisation were studied by many workers (Soundararajan 1962; Randhawa, 1971 and Shinde and Ghosh, 1972). With a view to study the effects of long term fertilization on the soil pH, EC and CEC investigations were carried out and the results of the same are presented in this paper.

### MATERIAL AND METHODS

The soil samples from the new and old permanent manurial experimental plots at the Agricultural University farm Coimbatore were used for the investigation. The old permanent manurial experiment (OPM) was commenced in the year 1907 and it consists of ten treatments with one plot each having an area of five cents. The plots were under the same treatment year after year for 65 years. Initially it was maintained under irrigated conditions and from the year 1937, it was brought under rainfed cultivation.

The treatments were 1. Control (No manure), 2. N alone, 3. N and K, 4. N and P, 5. N, P and K, 6. P and K, 7. K alone, 8. P alone, 9. Cattle manure and 10. cattle manure residue.

The doses of treatments were N applied as ammonium sulphate at the

rate of one cwt/A, P as superphosphate at the rate of 3 cwt/A and K as sulphate of potash at the rate of 5 tons/ac. Treatments 9 and 10 received cattle manure in alternate years i. e. cattle manure (CM) plot would be the cattle manure residue (CMR) plot in the succeeding year and vice-versa.

The new permanent manurial experiment (NPM) started in the year 1934, is under irrigated conditions. The treatments were the same as under OPM excepting that the treatments were replicated to twice and called as Eastern and Western services. Farm yard manure at the rate of 2000 lb per acre per year was applied to all but the cattle manure residue plot in the Western series alone. The soil of the experimental plots is a calcareous red loam. Sorghum, finger millet and cotton were raised under these experiments in rotation.

Soil samples were collected from each of the treatments of OPM at the rate of three samples per treatment from three depths viz. 0 - 20, 20 - 40 and 40 - 60 cm. In the NPM also similar

samples were collected from the plots of both the series separately. The samples were air dried and a portion of the same was powdered and passed through 2 mm sieve and the sieved material waste taken for analysis. The pH and EC were estimated from soil water suspensions of 1:2 ratio using a potentiometer and conductivity bridge respectively. The CEC of soils was estimated as per the method of schollenberger (1930).

## RESULTS AND DISCUSSION

The details regarding the soil pH, EC and CEC are presented in Table I to III. From the results it could be seen that in the OPM as well as in the NPM plots there was not marked variation in the soil pH among the treatments tried. Ambika Singh (1964) has also reported similar observation. This could be due to the fact that the soils under investigation are calcareous in nature and hence much difference in pH of the soil due to different treatments would not be expected. Yet another factors which could be attributed to this is that the

TABLE I. Soil pH, EC and CEC-old permanent manurial experiment

Treatment	pH			EC (m mhos/cm)			CEC (me/100 g)		
	0-20	20-40	40-60	0-20	20-40	40-60	0-20	20-40	40-60
Control	8.0	8.1	8.2	0.18	0.19	0.25	15.5	20.2	24.2
N	7.8	7.8	7.8	0.17	0.17	0.20	15.0	20.9	25.0
NK	7.8	7.7	7.7	0.18	0.20	0.18	19.2	18.7	28.0
NP	7.3	7.7	7.8	0.18	0.16	0.20	16.3	15.1	16.9
NPK	7.9	7.7	7.8	0.16	0.19	0.25	16.6	18.7	19.4
KP	8.0	7.8	7.9	0.18	0.20	0.20	17.7	19.7	20.0
K	7.9	8.3	8.6	0.15	0.30	0.30	17.5	22.2	20.3
P	7.4	7.9	8.8	0.20	0.35	0.25	16.6	18.3	19.5
CM	7.9	8.0	8.	0.18	0.21	0.32	18.7	27.1	25.3
CMR	7.9	7.8	7.8	0.19	0.21	0.22	18.0	26.0	23.7

TABLE II. Soil pH, EC and CEC - New Permanent manurial Experiment - Western series

Treatment	pH			EC (m mhos/cm)			CEC (mc/100 g)		
	0-20	20-40	40-60	0-20	20-40	40-60	0-20	20-40	40-60
Control	8.3	8.2	8.1	0.35	0.90	0.90	18.7	23.5	27.1
N	8.3	8.5	8.2	0.38	0.80	0.90	20.9	22.8	28.5
NK	8.3	8.2	8.1	0.39	0.80	0.75	22.9	22.4	25.4
NP	8.2	8.2	8.2	0.35	0.70	1.00	22.8	21.7	23.1
NPK	8.1	8.2	8.1	0.35	1.10	0.70	21.0	14.6	25.8
KP	8.2	8.2	8.2	0.32	0.45	1.10	19.8	14.3	26.2
K	8.1	8.1	8.3	0.31	0.75	1.10	23.0	15.2	25.3
P	8.1	8.1	8.2	0.35	0.70	0.70	24.0	14.2	16.0
CM	8.2	8.3	8.2	0.35	0.65	0.95	25.0	11.9	14.5
CMR	8.1	8.2	8.1	0.32	0.65	1.00	22.9	9.7	16.5

TABLE III. Soil pH, EC and CEC — new permanent manurial experiment - Eastern series

Treatment	pH			EC (m mhos/cm)			CEC (me/100 g)		
	0-20	20-40	40-60	0-20	20-40	40-60	0-20	20-40	40-60
Control	8.4	8.2	8.3	0.38	0.75	0.50	22.6	18.8	12.5
N	8.2	8.1	8.0	0.29	0.60	0.54	23.2	15.0	12.7
NK	8.1	8.0	8.0	0.44	0.88	1.00	22.7	19.9	21.4
NP	8.1	8.0	8.0	0.35	1.05	0.70	23.8	24.0	12.5
NPK	8.1	8.0	8.3	0.41	0.85	0.71	20.6	21.3	13.5
KP	8.4	8.2	8.2	0.38	1.00	0.80	22.8	24.4	16.0
K	8.4	8.3	8.3	0.38	0.60	0.50	23.3	20.7	11.9
P	8.2	8.2	8.2	0.38	0.90	0.70	19.5	20.2	15.8
CM	8.2	8.3	8.4	0.38	0.98	0.70	18.0	20.7	12.5
CMR	8.3	8.3	8.2	0.35	0.85	1.10	18.2	24.2	26.8

quantity of ammonium sulphate (one cwt/acre) added is probably too to have any marked effect on soil pH.

The electrical conductivity values also did not vary much among the different treatments. The OPM plots are maintained under rainfed condition and since the accumulation of salts through

irrigation water applied to the NPM plots is free from salinity hazards and whatever little salts enter into the soil get leached out to the lower horizons as seen from the higher EC values of sub-surface samples.

An increase in the CEC of soils was observed under organic manure treat-

ments in OPM as well as in the Eastern series of NPM plots. However, in the Western series of NPM plots the trend was reverse. Due to organic manuring the organic matter content of soils was increased and hence naturally the CEC also increased. In the Western series of NPM plots farmyard manure is applied to all but the CMR plot. Hence the combined effect of organic and inorganic manuring results in increased CEC of those plots receiving fertilizer treatments also. The favourable effects of organic manuring in increasing the CEC were reported by Sahu and Nayak (1971) also.

#### REFERENCES

- AMBIKA SINGH. 1974. Effect on long term application of organic and inorganic sources of sugarcane and on soil fertility. *Emp. J. Exp. Agric.* 32 : 127.
- PRASAD, C.R. SHAMIUDDIN, B.N. SING., K. K. JHA and S. C. MANDAL. 1971. Effect of continuous application of manures, fertilizers and lime on some chemical properties of acid red loam soils of Bihar. *Proc. Int. Symp. Soil. Fert. eval.* 1 : 865-72.
- RANDHAWA, N.S. 1971. Rate of build up of organic matter and its relationship to cropping and soil management. ICAR. Technical bulletin. 22.
- SAHU, B.N. and B.C. NAYAK. 1971. Soil Fertility investigation under continuous application of ammonium sulphate alone and in combination with the organic manures in the Bhubaneswar long term fertility trial. *Proc. Int. Symp. Soil Fert. eval.* 1. 873-79.
- SCHOLLENBERGER, C.J. and F.R. DREIBELBIS. 1930. Analytical methods in base exchange investigation in soils. *Soil Sci.* 30: 161-73.
- SHINDE, D.A. and A.B. GHOSH. 1971. Effect of continuous cropping and manuring on crop yield and characteristics of a medium black soil. *Proc. Int. Symp. Soil Fert. eval.* 1. 905-16.
- SOUNDARAJAN, R. 1962. Influence of long term manuring on cation exchange properties of soils. *Madras agric. J.* 49: 293-98.
- VENKATA RAO and M.K. BADIGER. 1971. Studies on the effect of application of high levels of N over a period of years on soil reaction and yields in red soils of Mysore. *Proc. Int. Symp. Soil Fert. eval.* 1. 917-20.