https://doi.org/10.29321/MAJ.10.A02897

Madras agric. J. 67 (11): 729 – 733 November 1980

Manganese status of some soils of Malaprabha river valley project area in Karnataka

N. VASUKI[1], H. M. MANJUNATHAIAH[2], and T. SESHAGIRI RAO[3]

The available Mn status in 92 surface soil samples representing 12 major soil series in the Malaprabha river valley project area in Karnataka was studied. The easily reducible Mn is generally high in the soils studied. The low content of readily available Mn can be overcome by the addition of easily oxidisable organic matter to the soils.

Manganese is one of the essential micronutrients required for plant growth. Manganese is generally found in soils in different forms such as water soluble, exchangeable and higher oxides. The availability of Mn to the plants is influenced by factors such as pH, organic matter, calcium carbonate, etc. A study was undertaken to know the status of available Mn and its relationship with some of the soil properties in surface soils of Malaprabha river valley project area in Karnataka (parts of Belgaum and Dharwad districts).

MATERIAL AND METHODS

An area of about two lakh hectares of land comprising mostly of black soil is proposed to be benefitted by irrigation from the Malaprabha river through a canal system. Ninety two surface soil samples (0 – 20 cm depth) representing 12 soil series established by the soil survey section of the Department of Agriculture, Government of Karnataka, were sampled for the study. The soils were dried in shade and gently powdered to pass through a 2 mm plastic sieve. The soil samples were analysed for pH, organic carbon, exchangeable and easily reducible Mn by the methods described by Black (1965). Calcium carbonate was estimated by the rapid titration method (Piper, 1966).

RESULTS AND DISCUSSION

Exchangeable Mn ranged from trace to 51 ppm and easily reducible fraction from 42 to 670 ppm (Table I.) According to the critical limit suggested by Venkateswaralu (1976), 17% of soils studied were low, 20% were medium and 63% were high in exchangeable manganese (Table II.) Among the soil series studied, in only four series namely, Budihal, Timinal, Chimanakatte and Chicktadri, some area under deficiency has been noticed. However, based on the

1 – 3 Department of Chemistry and Soils College of Agriculture. Dharwad 580 005. Karnataka.

critical limit of active Mn (exchangeable + easily reducible) suggested by Kanwar and Randhawa (1969), none of the soils contained active Mn below the critical limit. According to the latter criterion about 72% of the soils were rich in Mn and the remaining 28% with medium Mn content. This indicates that the soils studied were high in easily reducible Mn and hence their deficiency due to low amount of readily available (exchangeable) Mn can be prevented by the addition of easily oxidisable organic matter (Kanwar, 1976).

Inter-relationships of two forms of manganese with soil properties:

i) pH : Exchangeable Mn was present in higher amounts in soils having pH values between 6 and 7. With increase in pH, its value decreased sharply. A highly significant negative correlation (r = −0.70**) was observed between pH and exchangeable Mn. Similar observations were made by Grewal *et al.* (1969).

ii) Calcium carbonate : The exchangeable Mn values were high in those soils having less than 1% calcium carbonate. A highly significant negative correlation (r = −0.41**) was observed between calcium carbonate and exchangeable Mn. The results are in agreement with the findings of Yadav and Kalra (1964) and Randhawa *et al.* (1961). But the significant positive correlation with easily reducible Mn (r = 0.41**) indicated that this fraction includes Mn fixed by adsorption on the surface of calcium carbonate particle. This binding appears to be strong enough and not easily released by *N* NH_4OAC solution alone but could be released by hydroquinone during the extraction of easily reducible Mn (Kanwar, 1976).

iii) Organic matter : The influence of organic matter on different forms of Mn was not clear. In the present study no relation could be established between exchangeable or easily reducible Mn with organic carbon.

REFERENCES

BLACK, C. A. (Ed.) 1965. *Methods of soil analysis Part 2.* Agron series No 9. Amer. Soc. Agron., Inc, wisconsin, USA.

GREWAL, T. S., D. R. BHUMBLA and N. S. RANDHAWA. 1969. Available micronutrient status of Punjab, Haryana and Himachal soils. *J. Indian Soc. Soil Sci.* 17 : 27-31.

KANWAR, J. S. and N S. RANDHAWA. 1969. *Micronutrient Research in Soils and Plants in India.* A Review I. C. A. R., New Delhi.

KANWAR, J. S. 1976. Micronutrients. In J. S. Kanwar (Ed). *Soil Fertility Theory and Practices* I C. A. R. Pub., New Delhi.

PIPER, C. S. 1966. *Soil and plant Analysis.* University of Adelaide, Australia.

RANDHAWA, N. S., J. S. KANWAR and S. D. NIJHAWAN. 1961. Distribution of different forms of Manganese in the Punjab Soils. *Soil Sci.* 92 : 106-12.

RAI, M. M., D. B. SHITOLEY., A. R. PAL, P. VAKIL and S. K. GUPTA. 1970. Available Micronutrient status of deep black soils of Madhya Pradesh. *J. Indian Soc Soil Sci.* 18 : 382-85.

VENKATESWARALU, J. 1976. Soil fertility evaluation-Soil testing and plant analysis in J. S. KANWAR (Ed.), *Soil Fertility theory and practices.* I. C. A. R. Pub New Delhi.

YADAV, J. S. P. and KALARA, K. K. 1964. Exchangeable Manganese in certain Forest Soils of India. *J. Indian Soc. Soil Sci.* 12 : 225-33.

TABLE I Soil properties and Mn status (Ranges) of different soil series

Soil series		pH (1:2:5)	EC mmhos/cm at 25°C	Organic carban (%)	$CaCO_3$ %	Exch Mn (ppm)	Easily Reducible Mn (ppm)
Neelgund	(7)	8.4 – 9.4	0.12 – 0.44	0.96 – 1.38	0.5 – 8.0	5.0 – 15.0	65.0 – 140.0
Narasapur	(7)	8.1 – 8.2	0.14 – 0.24	1.05 – 1.29	0.6 – 2.1	1.0 – 12 5	140.0 – 450 0
Budihal	(8)	8.3 – 9.0	0.11 – 0.42	0.39 – 1.05	1.7 – 4.6	Tr – 6.3	197.5 – 495.0
Khanapur	(9)	6.6 – 8.9	0.11 – 0.30	0 39 – 1.53	Tr – 8.2	Tr. – 46.0	42.5 – 560.0
Kabbalgeri	(6)	8.0 – 8.3	0.12 – 0.19	0.06 – 0.57	0.1 – 0 3	8.5 – 11.0	42 5 – 130 5
Tapaskatti	(7)	7.9 – 8.8	0.15 – 0.20	0.84 – 0.99	0.1 – 0 5	1.5 – 17.0	65.0 – 110.0
Hanumansagar	(7)	7.7 – 9.1	0.17 – 0.37	0 31 – 2.76	0 5 – 8.9	1.0 – 14 5	80.0 – 217 5
Chimmanakatti	(8)	6.6 – 9.2	0.11 – 0.41	0.27 – 1.08	0.1 – 5.7	Tr. – 51.5	90.0 – 270.0
Timinal	(10)	8.9 – 9.7	0.17 – 0.38	0.38 – 1.23	0.8 – 6 2	1.0 – 7.5	97.5 – 460.0
Katarki	(9)	7.5 – 8.8	0.13 – 0.30	0.27 – 1.20	0.1 – 4.7	Tr. – 32.5	42.5 – 340.0
Chicktadri	(8)	7.9 – 9.8	0.20 – 0.79	0.39 – 1.17	Tr. – 7.0	1.0 – 17.5	85.0 – 540.0
Bankanari	(6)	6.6 – 9.2	0.14 – 0.21	0.18 – 0.99	Tr. – 0.50	15.0 – 44.5	42.5 – 130.0

Figures in paranthesee indicate number of soil samples.

TABLE II Effect of effluent application on *bhendi* and soils.

Treatment	Post-harvest soil analysis *Available* N	P	K	Ca	Mg	Na	pH	E.C. (mmhos/cm)	Yield of bhendi fruits (g/pot)	Uptake of nutrients by *bhendi* (mg/pot) N	P	K
S_1 T_1	118	4.8	132	3890	2131	476	813	0.60	39.52	51.07	147.38	117.03
S_1 T_2	123	4.5	111	3886	1969	559	8.3	0.80	25.75	33.82	120.58	79.30
S_1 T_3	124	3.7	95	3803	1934	635	8.4	0.90	20.63	27.91	78.10	62.38
S_2 T_1	126	3.6	58	1914	1003	260	6.3	0.20	22.97	21.60	116.90	74.98
S_2 T_2	135	3.1	68	2006	994	313	6.6	0.25	12.18	11.80	61.53	44.56
S_2 T_3	133	3.6	73	2246	948	334	6.8	0.30	9.48	3.78	29.60	22.46

S_1 X Allunial soil. S_2-Red soil. T_1--Water alove. T_2--25% effluent. T_3--50% effluent.