shell medium thick. Kernel medium to big 1.12×0.83 cm–1.37×0.91 cm, round and plumpy, testa rose.

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Department of Agriculture, Tamil Nadu.

S. VARISAI MUHAMMAD
T. RAMANATHAN
V. BALASUBRAMANIAM
M. RAMACHANDRAN

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Effect of Superphosphate and Farm Yard Manure on Available Manganese in Two Soil Types of Madhya Pradesh

An attempt has been made to study the availability of Mn on the addition of farmyard manure and superphosphate in two Madya Pradesh soils.

Experiments were conducted in laboratory with surface (0–23 cm) medium black and alluvial soil, collected from Agriculture College farm, Indore and Agriculture Research Institute farm, Gwalior respectively.

The bulk soil samples were ground and passed through 2 mm sieve and four hundred grams of soil from each type were filled in individual earthern pots. Superphosphate and farm yard manure (FYM) were mixed with soils before filling the pots. Superphosphate and FYM were applied at the rate of 30 lb P_2O_5 and 450 lb and 900 lb, respectively. Moisture was maintained at 20% level every day in all cases. There were four replications of each treatment. Pots were kept at room temperature. The samples were drawn at the intervals of 30, 60 and 90 days for the estimation of available Mn and pH.

Soil reaction was determined according to the procedure given by Piper (1950). Available soil Mn was determined with spectrophotometer UNICAM Sp 600 model as per procedure described by Piper (1950).

Results indicating the available Mn content and pH changes due to application of superphosphate and FYM at different intervals for medium black soil and alluvial soil are presented in the Table.

TABLE. *Effect of Superphosphate and Farm Yard Manure on Available Manganese and pH*
(Mean of 4 replications and Manganese in ppm)

Treatments	Periods					
	30 days		60 days		90 days	
	Mn	pH	Mn	pH	Mn	pH
Medium black soil						
Control	2.14	7.57	2.32	7.56	2.68	7.56
Farm yard manure I dose	2.68	7.53	3.75	7.51	4.82	7.44
Farm yard manure II dose	3.57	7.53	5.36	7.50	8.04	7.41
SE.....	0.44	0.03	0.27	0.03	0.42	0.03
CD at 5%	0.99	0.07	0.60	0.06	0.95	0.07
Superphosphate I dose	2.50	7.55	2.68	7.55	2.86	7.55
Superphosphate II dose	2.86	7.55	3.21	7.55	3.39	7.54
SE.....	0.51	0.03	0.36	0.04	0.46	0.02
CD at 5%	1.44	0.07	0.81	0.08	0.04	0.05
Alluvial soil						
Control	5.89	7.30	6.25	7.30	6.25	7.29
Farm yard manure I dose	6.61	7.29	7.68	7.23	9.82	7.21
Farm yard manure II dose	6.79	7.29	8.04	7.21	11.86	7.20
SE.....	0.27	0.03	0.59	0.02	0.35	0.01
CD at 5%	0.60	0.07	1.33	0.06	0.78	0.03
Superphosphate I dose	6.07	7.30	6.25	7.29	6.79	7.25
Superphosphate II dose	6.25	7.30	6.61	7.29	6.96	7.24
SE.....	0.26	0.09	0.25	0.02	0.25	0.02
CD at 5%	0.59	0.22	0.57	0.06	0.57	0.04

Effect of Farm Yard Manure: Application of FYM caused a significant increase of available Mn at all the periods of analysis. Higher dose of FYM found effective after 60 days and 90 days in case of medium black and alluvial soil respectively. There was a slow but gradual decrease in pH, which might be a cause of reduction of higher oxides of Mn.

Arrhenius (1924) attributed the increase of available Mn content in soils due to increased microbial activity with the application of additional manure. There was a shift in the equilibrium in the direction of reduction due to increased microbial activity. Heintze and Mann (1949) propounded that if the organic matter added to the soil was of high C:N ratio, it caused an increase in the rate of reduction of higher oxides of Mn. They suggested that this may be due to a rapid breakdown of organic matter resulting in the limited supply of oxygen and thus the redox potential also becomes low.

Effect of Superphosphate : From the table it is clear that no change was observed in available Mn content for all the intervals of analysis in case of medium black soil. In alluvial soil a significant increase in available Mn was recorded, only after 90 days analysis. Donald and Williams (1954, 1957) observed decrease in pH by 0.056 unit for every hundredweight of superphosphate. Steckal (1948) also observed the increase in pH.

Gupta *et al* (1969) found an increased uptake of Mn with addition of phosphorus in the form of superphosphate in the soils of Jabalpur region where exchangeable and water soluble Mn was high *i. e.* 33.08 to 58.54 ppm. On the contrary Baser and Deo (1967) found decreased uptake of Mn in case of sorghum grown in Rajasthan soils where level of water soluble plus exchangeable Mn was less. Bingham (1963) noted variable effects of added phosphate on Mn uptake.

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Lecturer in Chemistry,
College of Agriculture,
Jabalpur-4 M.P. — S. K. GUPTA

University Professor of Biochemistry,
J. N. Agricultural University,
Veterinary College, Mhow (M.P.). — Y. B. RANGANEKAR

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