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Dynamics of manganese fractions in calcareous soils of Saurashtra region of Gujarat

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ABSTRACT

Dynamics of Mn fractions in soils of Saurashtra region of Gujarat was studied by collecting 169 surface soil samples (0-15cm) from tagged cultivated farmer's field during 1990 and 2000. The results showed that overall, there was depletion in EF, AF, RF, total, residual, per cent available and available total forms of Mn from 1.491, 6.222, 113.916, 288.132, 166.359, 45.131 and 121.644 ppm to 1.087, 4.544, 97.77, 225.698, 157.765, 36.627 and 103.462 ppm, respectively while only WS-Mn fraction of soil marginally increased from 0.0154 to 0.0614 ppm over a period of 10 years.

Key words : Dynamics of Mn, Mn fraction, DTPA available-Mn, Mn status, Available Mn.

Manganese plays an important role in the photosynthesis and detoxification of superoxide free radicals. It is an integral component of water splitting enzyme associated with photosynthesis II. Medium black soils of Saurashtra region derived from trap basalt, sand stone and lime stone under semi arid climate have unique properties of calcareousness, which affect the physico-chemical properties, nutrient availability and plant growth. Very little or no work has been done on Mn nutrition and status in soils of Saurashtra region so far. Hence it was planned to study dynamics of Mn fractions in different soil groups of Saurashtra region of Gujarat.

MATERIALS AND METHODS

Surface soil samples (0-15 cm) were collected from 169 tagged fields during 1990 and 2000 representing 10 soil groups of Saurashtra region of Gujarat *i.e.* 1. Shallow black-trap basalt (SBTB), 2. Shallow black-lime stone (SBLS), 3. Shallow-black-sand stone (SBSS), 4. Medium black-trap basalt (MBTB), 5. Medium black-lime stone (MBLS), 6. Deep black-trap basalt (DBTB), 7. Coastal alluvial shallow (CS), 8. Coastal alluvial deep (CD), 9. River alluvial deep (RAD) and 10. Stony. These soil samples were sequentially extracted for different Mn fractions as per the procedure described by Jackson (1973) and Viets (1962) as water soluble, exchangeable, DTPA available and reducible form. Total Mn status was determined by digesting the soil using HF: $HClO_4$ (5:1). These extracts were analyzed for their Mn content on Atomic Absorption Spectrophotometer. Residual form of Mn was calculated by deducting water soluble + exchangeable + DTPA available + reducible (*i.e.* available) from the total Mn status of the soil. The per cent available Mn status was calculated from available and total Mn .

RESULTS AND DISCUSSION

Water soluble-Mn (WS):

The data presented in the Table 1 reveal that soil group CD showed no measurable content of WS-Mn during the year 1990, while SBLS showed a little content (0.014 ppm). The soil group MBTB maintained the highest level of WS-Mn in the 1990 (0.033 ppm) and 2000 (6.161 ppm). Overall, there was very marginal increase in WS-Mn content of soil over time.

Exchangeable Mn (FF):

Overall marginal depletion from 1.491 to 1.087 ppm was found in exchangeable Mn fraction of soil after a span of 10 years (Table 1). All the soil group exhibited a marginal decrease in exchangeable Mn, except soil group CD where marginal increase was noticed after 10 years.

DTPA available-Mn:

Overall, the DTPA available Mn status declined from 6.222 to 4.544 ppm after a decade (Table 1).The lowest mean value of DTPA available-Mn was registered in DBTB (3.699 ppm) and SBLS (2.629 ppm) soil group, while the highest mean values were recorded in soil group CD (10.565 ppm) and (6.258 ppm) during the year 1990 and 2000, respectively. The DTPA available-Mn status of soil increased in soil group DBTB, MBLS and SBSS over a span of 10 years. Kumaresean *et al*. (1985) reported