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Dynamics of copper fractions in the calcareous soils of Saurashtra region of Gujarat

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ABSTRACT

The dynamics of Cu fractions in the soils of Saurashtra region of Gujarat was studied by collecting 169 surface soil samples (0-15 cm) from tagged cultivated farmer's field during the year 1990 and 2000. The result showed that overall there was decline in EF, AF, total, residual, per cent available and available total forms of Cu from 0.182, 1.232, 28.217, 26.558, 7.554 and 1.6565 ppm to 0.127, 0.834, 25.771, 24.509, 6.166 and 1.2676 ppm, while WS and RF of Cu increased from 0.0725 and 0.17 to 0.1206 and 0.186 ppm, respectively over a period of 10 years in different soil groups of Saurashtra region of Gujarat. The status of DTPA available Cu was quite above the critical level.

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

Modern agro-technologies along with high analysis inorganic fertilizers devoid of secondary and micronutrients leads to the deficiency of mineral nutrients essential for plant growth. This is particularly true in case of micronutrients. Continuous mining of these nutrients by growing more than two crops in a year leads to its deficiency. Hence, there was need to study the status and dynamics of different forms of Cu in different soil groups of Saurashtra region of Gujarat over time.

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 Cu fractions as per the procedure described by Jackson (1973) and Viets (1962) as water soluble, exchangeable, DTPA available and reducible form. Total Cu status was determined by digesting the soil using HF: $HClO_4$ (5:1). These extracts were analyzed for their Cu content on Atomic Absorption Spectrophotometer. Residual form of Cu was calculated by deducting water soluble + exchangeable + DTPA available + reducible (*i.e.* available) from the total Cu status of the soil. The per cent available Cu status was calculated from available and total Cu.

RESULTS AND DISCUSSION

Water soluble-Cu:

The data reveals that overall WS-Cu status in soil increased from 0.0725 to 0.1206 ppm after a period of 10 years (Table 1). The soil group SBLS, MBTB, MBLS and Stony soils recorded higher status of WS-Cu as compared to the rest of the soil groups. In soil group SBTB, DBTB and CS showed decline in Ws-Cu status after a period of 10 years. Cumakov (1991) also observed WS-Cu content range from 0.04 to 0.22 ppm with mean value of 0.12 ppm in typical soil of Slovakia.

Exchangeable-Cu:

The data indicate that overall and in almost all the soil groups exchangeable Cu content declined after 10 years, except in SBTB soil group where it increased slightly (Table 1). The highest value of exchangeable-Cu was recorded in stony group (0.406 ppm) in 1990, while in 2000 it was in MBTB (0.183 ppm) soil group. The stony group exhibited the highest decline in exchangeable form over time.

DTPA available- Cu:

During the span of 10 years there was considerable decline in the DTPA available-Cu in overall and most of the soil groups *viz.*, SBTB, SBLS, CS, CD and RAD and stony, while SBSS and DBTB showed slight increase in the levels, and MBTB and MBLS more or less maintained the levels (Table 1). Decline in DTPA available-Cu was reported by Sudhir *et al.* (1997) while Bellakki and