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Spatial Distribution of DTPA-Extractable Micronutrients in Arid Soils of Jhunjhunun District, Rajasthan

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Abstract: Based on 252 georeferenced surface soil samples (0-30 cm), the spatial variability of DTPA-extractable micronutrients viz., Zn, Fe, Mn, and Cu, in four major land uses in Jhunjhunun District, has been mapped in a GIS environment, and their adequacy determined as per the criteria followed in the soil testing laboratories. Zn content in soils varied from 0.28 to 3.6 mg kg^{-1}, Fe from 3.2 to 30.4 mg kg^{-1}, Mn from 3.4 to 40.5 mg kg^{-1} and Cu from 0.12 to 4.8 mg kg^{-1}. About 18% area (106704 ha) of the district is deficient in Zn, and 6.3% area (37346.4 ha) in Fe. Deficiency of Mn and Cu is negligible. Individual micronutrient deficiency is more prominent than deficiency of micronutrients in combinations. A broad positive correlation of the DTPA-extractable micronutrients is found with soil organic carbon and clay, while soil pH and $CaCO_3$ has negative influence on the availability of Zn, Mn and Fe.

Key words: Micronutrients, spatial variability, land use, GIS.

Micronutrients have an important role in balanced plant nutrition and stabilization of crop production. Their availability is influenced mainly by the soil properties, particularly pH, organic matter, $CaCO_3$, soluble salts, cation exchange capacity and soil texture. Micronutrient deficiencies in soils get enhanced due to mining by the plants (Rattan and Sharma, 2004; Shukla, 2011). Long and continuous mining can change the status from single-nutrient deficiency to multi-nutrient deficiencies. In India deficiencies of Zn and Fe are most widespread, followed by Mn and B, mostly because of the characteristics of some specific soil groups, intensity of cropping and climatic conditions (Shukla, 2011). The deficiencies have been found to get aggravated especially under the exploitative nature of modern agriculture that involves continuous and excessive use of chemical fertilizers with high concentration of macronutrients, but without organic matter input through organic sources, as well as due to the extremely low amount of crop residues recycling (Nayyar *et al.*, 2001). In arid region, the soils are generally coarse textured, alkaline in reaction and mostly poor in fertility, but systematic information on the content and distribution of micronutrients is meager and mostly based on some random sampling (Sharma *et al.*, 1985). Considering the above, and the apprehension that continuous cropping in the region might lead to enhanced deficiency of the soil micronutrients, a systematic mapping of the soil fertility status was undertaken in the arid western part of Rajasthan.

The present study was conducted in Jhunjhunun District (5928 km^2) in the north eastern fringe of Thar Desert, where the mean annual rainfall is 444.5 mm, received mainly during summer monsoon. Spatially, the rainfall decreases from 484 mm in the east to 331 mm in the west. The potential mean annual evapo-transpiration is 1578 mm, which always exceeds the precipitation and thus compel a short growing period of rainfed crops. Air temperature during summer vary between 39.8°C and 41°C while during winter the mean minimum temperature vary between 4.2 and 5.3°C.

The soils of the district are coarse textured, light brown, sandy, sandy loam to sandy clay loam, very deep, non-calcareous and well-drained. These are classified under Typic Torripsamments and Typic Haplocambids. Pearl millet, clusterbean, moth bean, mung bean and sesame are the important kharif crops. Wheat and mustard are grown with groundwater

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