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Dynamics Importance of Micronutrients in Agricultural Soil

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ARTICLE ID: 30

Abstract

Micronutrients are important for plant growth and they play a significance role in the balanced nutrition of the crop. They are essential for the proper growth and development of plants throughout their lives. Lack of a single micronutrient in the soil can limit plant growth, even when the other entire nutrients are available in adequate quantities. Micronutrient deficiencies are widespread in many areas due to the nature of the soil, high pH, low organic matter, and salt pressure, and persistent drought, high levels of bicarbonate in irrigation water and unbalanced use of fertilizers. In India, the most deficient in soil is micronutrient Zn, followed by B. In recent years, micronutrient deficiencies have increased significantly. Deficiency of Zn, and B in mainly due to their negative effects on human health and food production. Crops vary considerably in response to different micronutrients. Brassicas and beans are highly responsible for molybdenum(Mo) and boron(B), while corn and other grains are more responsive to zinc(Zn), and copper(Cu). Micronutrient deficiencies are more common in humid temperate regions as well as humid tropical regions, due to the intense leaching associated with heavy rainfall. Soil pH is one of the most important factors affecting the availability of micronutrients for plants. With increasing pH, the availability of these nutrients decreases except for Mo whose availability increase with increase soil pH. In most plant species, the leaves contain more nutrients than in other parts of the plant. Therefore, whenever possible, leaf samples should be taken to highlight the micronutrient status of

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crops. As Dekers and Stains are widespread in developing countries, which have poorer soil of Europe and North America. Many of these areas are located in the humid tropics with extremely barren, highly seasonal, and /or very loose soils, which are severely deficient in nutrients. The rest of such soils are in area adjacent to the semicircle and later areas, where alkaline and calcareous soil conditions severely limit the availability of micronutrients for plants.

Micronutrient	Rang (%)
Fe	0.5-5.00 %
Mn	0.02-1.00 %
Cu	0.0005-0.015 %
Zn	0.001-0.025%
B	0.0005-0.015%
Cl	0.001-0.10%
Mo	0.00002-0.0005%

The average values of soil pH, electrical conductivity, and soil organic carbon content were 7.48±0.95, 0.42±0.22 ds/m and 0.48±0.17%, respectively. The average values of available zinc, iron, copper and manganese were 0.83±0.36, 8.79±4.15, 0.99±0.43 and 8.79±4.06 mg/kg, respectively. A recent analysis of soil sample collected from agricultural field showed that on average 40.5, 36.5, 23.2 of zinc, boron, iron, manganese and copper Decrease in 12.8, 7.1 and 4.2% of the area in 12.8,7.1 and 4.2% of the area in India, respectively (Shukla et al.,2019).

It is very important to meet the micronutrient requirements of crops as well as their micronutrient requirements if they are to produce satisfactorily and get acceptable quality products (e.g., grains and fruits) of acceptable quality. The food response curve show that just by deficiency, So too can toxicity be reduced due to excessive concentration of these elements. It is therefore important to monitor the soil and /or crop to ensure that the amount of micronutrient in the soil is maximized. Not to low, not to high. There are reports of deficiencies in available micronutrients such as zinc, boron, iron, copper and manganese in the world's venetian crops andsoils. A recent analysis of Indian soils showed an average reduction of 36.5% for Zn, 23.2% for B, 12.8% For Fe
,7.1% for Mo, 4.2% for Cu.

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Area(%)	Range of available Nutrient (Mn mg kg^{-1})
10	>1.0 to <3.0
15	>3.0 to <5.0
14	>5.0 to <7.0
12	<7.0 to ≤9.0
58	>9.0
Area (%)	**Range of available Nutrient (Zinc mg kg^{-1})**
2	≤0.3
25	>0.3 to≤0.6
20	>0.6 to≤0.9
23	>0.9 to≤1.2
15	>1.2 to≤1.8
5	>1.8

Area(%)	Range of available Nutrient(copper mg kg^{-1})
2	>0.2 to≤0.4
10	>0.4 to ≤0.6
11	>0.6 to≤0.8
15	>0.8 to≤1.0
60	>1.0
Area (%)	**Range of available Nutrient (Iron mg kg^{-1})**
1	≤2.5
9	>2.5 to≤4.5
10	>4.5 to≤6.5
11	>6.8 to≤8.5
60	>10.5

SOURCE- Frequency distribution of soil area (%) under different ranges of available nutrients and associated soil properties of IGP,India.

However, research has clearly shown that by reducing soil conditions through appropriate management practices, applying micronutrient directly into the soil or as a plant use can reduce crop acidity and increase productivity. Furthermore, the exploitation of soil microbes such as micronutrient solubilizers and AM Fungi has been found to be a legacy in improving the amount of micronutrient and improving soil quality. Maintaining maximum soil organic matter content and using balanced fertilizers also leads to the production of bio-fortified farms, eliminates micro nutrient deficiencies and promotes soil and plant health. Maintenance of soil nutrients at sufficient levels for macro- and micronutrients remains prerequisite in ensuring sustained crop yields. Usually macronutrients, required in large quantities, are the focus of many interventions, unlike micronutrients that are required in small quantities. In sub-Saharan Africa, soil infertility remains one of the key factors responsible for declining crop productions. Challenges of soil infertility caused by various factors such as reduction in crop diversity have led to application of various interventions including use of inorganic fertilizers and agroforestry practices that deploy leguminous species.

Micronutrients quantities required by plants are very small, and the thresholds for sufficient, deficient, and toxic levels are also very close. Several review studies have summarized and suggested the micronutrients range based on extraction methods. Major

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sources of soil micronutrients are inorganic forms from parent material and organic forms within humus, though deficiency or toxicity can mostly be attributed to the parent material. Furthermore, factors which play important roles in regulating micronutrients include soil pH, oxidation state, organic matter, mycorrhizae, organic compounds, and stability of chelates.

Most soils vary in their micronutrient content, and deficiencies in supplying micronutrient are alarming. Deficiency of micronutrients can result in severe crop failure; hence attempts to improve crop production and soil management must be in line with micronutrients amendments.

Normally, concentrations of soil nutrients are affected by soil types, climate, topography, and management practices. For instance, declined vegetation cover and heavy precipitation may accelerate micronutrients leaching. Increased chances of leaching for micronutrients are due to their occurrence as free ions or soluble complexes in solution. Therefore, translocation of micronutrients along the elevation due to surface runoff in sloping terrains and depositions in the valley bottoms calls for proper soil management practices to address both nutrient transfers and crop yield.