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Management of Boron in Groundnut

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Abstract
Groundnut is an important food, feed and oilseed crop. Among micronutrients, boron deficiency is one of the most crucial constraint limiting crop yields. Boron being an essential micronutrient has significant impact on groundnut growth, yield and quality. Boron deficiency is found widespread in groundnut growing areas. Boron deficiency causes 10-50% yield losses in groundnut due to low pod filling and also causes hollow darkening in centre of kernel known as "hollow heart" disease of groundnut. Therefore, deficiency of boron in soil should be managed to enhance yield and quality of groundnut.

Keywords: Groundnut, Boron, Deficiency, Growth and yield etc.

Introduction
Groundnut, scientifically known as Arachis hypogaea L., is a prominent oilseed legume crop that serves as a source of both seed and feed. Due to its economic and nutritional relevance, this cash crop has been grown by millions of small farmers worldwide. Groundnuts typically have an oil content ranging from 45% to 50%, with protein content comprising 25% to 30%, carbohydrates contributing 20%, and fiber content amounting to around 5%. Groundnut can be cultivated in three distinct seasons, namely Kharif, Rabi, and summer, in various regions across the country. In India, groundnut is primarily grown as a Kharif crop under rainfed conditions during the monsoon season, almost 85 percent of the groundnut area comes under rainfed cultivation, and grown in various soils ranging from black to sandy soils. Boron (B) deficiency has been reported from many groundnut growing areas of India. But predominant in sandy soil of arid regions in Rajasthan. According to Shorrocks (1997), soil parent material and texture are key factors that contribute to the occurrence of B deficiency. These factors can be easily prevented and corrected through soil and foliar applications. Boron is considered to be of utmost importance, following zinc, for the micronutrient management of groundnut. Although, the bare minimum amount of B is required for optimal production. Boron is crucial for plant metabolism and has been found to significantly contribute to the transportation of sugar molecules. The high solubility of boron in water and its potential toxicity at relatively low soil concentrations pose challenges in managing it in sandy soils to achieve higher yields of groundnuts. Depending upon the severity, the B deficiency caused 15-26 % yield losses in groundnut in calcareous soils. "Hollow heart" in groundnut is a major cause that reduces value of seed. To correct the B deficiency it is necessary to supply boron during all growth stages especially from flowering to harvest of the crop. In groundnut,

fertilization with boron helps in root nodule development for higher nitrogen fixation, protein production, retention of more flowers and pegs, higher calcium utilization, and movement of sugars and protein from leaves to nuts. Therefore, management of B element in groundnut is very important research issue for sustainable groundnut production.

Deficiency symptoms in groundnut

Organic carbon content in soils has strong correlations with boron availability to the plants and plays very important role, therefore risk of boron deficiency increases when organic matter declines in the soil. Boron deficiency occurred when the boron of the soil was less than or in range of 0.2-0.4 ppm depending upon the soil and groundnut genotypes. While in plants, clear-cut deficiency symptoms were observed only when the leaf boron concentration fell below 15 ppm. The groundnut kernels containing boron less than 17 ppm showed the incidence of hollow-heart (Singh, 2004). One of the most frequently observed symptoms of B deficiency in groundnut plants is retarded growth, particularly in the apical portion of the stem. In addition, the death of the stem apex and regeneration from lateral buds may occur. The leaves may also exhibit malformation of the veins, chlorosis, and necrosis of the basal margins in emerging leaves. B deficiency symptoms commonly occur in the young tissues and apical meristems causing shortened growth and bushy appearance. B deficiency also causes low pod filling and "hollow heart" in groundnut. Many a times there were shrivelled seeds due to B deficiency.

Fig.1: "Hollow heart" in groundnut due to boron deficiency

Management of Boron Deficiency

In India, borax and boric acid are the two commonly used boron fertilizers through different methods. Soil application is the best methods of application for these fertilizers. Soil, foliar and drip application of B increased pod yield of groundnut. Application of 0.5-1.0 kg/ha B as borax or boric acid or foliar application of 0.05-0.1% aqueous solution of boric acid is effective in alleviating B deficiency of groundnut in the standing crop (Singh et al., 1993). Boron application increased pod filling, seed size, 100-seed weight, percent sound mature seeds and pod yield.

- Soil testing: Before sowing groundnuts crop, a soil testing is prerequisite to assess the boron levels in the soil. If the soil test indicates a boron deficiency, apply recommended dose of boron through fertilizers.
- Boron application: Apply 10 kg of borax and 400 kg of gypsum per hectare at 45 days after sowing, treat seeds with *Rhizobial* culture TNAU 14, *Azospirillum*, and

Phosphobacteria, Apply 5.8 kg of boric acid per hectare in black calcareous soil, apply 0.5 kg of boron per hectare to increase pod yield.

- Foliar application: Groundnut plants are showing symptoms of boron deficiency during the growing season, foliar application of boron-containing products may be necessary to address the deficiency quickly.
- pH management: Soil pH play very important role in the availability of boron to plants. A pH level that is too high or too low can affect the plant's ability to uptake boron. Therefore, managing soil pH 6.5 to 7.5 can help to improve boron availability.
- Crop rotation: Rotation with non-boron-sensitive crops can help mitigate potential issues with excessive boron levels in the soil, especially in areas where boron-containing fertilizers have been used consistently.

Conclusion

Effective management of boron is crucial for successful groundnut production. Maintaining optimal boron levels in the soil is very essential for promoting healthy plant growth, maximizing groundnut yield, and preventing the negative impact of boron deficiency or toxicity in the soil. Boron being an essential micronutrient has positive effect on groundnut growth, yield and quality. Hence proper diagnosis and management is need of the hour.

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