Boron – A Critical Nutrient Required for Root Growth and Potassium Uptake

A balanced supply of essential macro- and micronutrients is one of the most important factors to achieve higher crop yields. Boron (B) is one of eight micronutrients needed for proper plant growth. Lack of B in plant tissue can reduce cell wall function and stability, cell elongation, root growth, nutrient uptake and crop yields. This article describes the role of B in root growth and nutrient uptake, with a special emphasis on potassium (K).

Boron and Root Growth
Plants with low B supply undergo significant physiological and morphological changes. More than 90% of plant B exists in cell walls, indicating boron's very important role in plant growth (Brown, et al. 2002). In a B-deficient environment, structural stability and biological functions of cell walls are severely impaired, including a reduction of root growth and elongation. The quickest response to boron deficiency is a reduction in root growth, which can happen within hours after exposure to B-deficient conditions (Marschner, 2012). Root and shoot growth are severely reduced under low B supply; while during moderate B supply, which is common under field conditions, root growth is adversely affected at early growth stages, with minimal visible changes in shoot growth (Fig. 1).

Boron and K Uptake
Boron plays a key role in increasing the activity of a specific enzymatic system in roots that significantly contributes to nutrient uptake. This system creates a gradient in root cells (i.e., across the root cell membranes), and works as the driving force for active uptake and transport of some of the mineral nutrients, especially K. When B supply is low, this driving force necessary for K uptake is significantly reduced (Fig. 2). These results highlight the critical role of B in root K uptake.

Nutrient interactions in plants are generally measured in terms of growth response and/or change in shoot nutrient concentration. Ceylan and Cakmak (2017) measured the rate of K absorption by canola roots in low and adequate B environments. In this study, depletion (decrease) in K amount from the growth medium was measured over time (Fig. 3). Results showed that plants absorbed K rapidly when B supply was adequate, while under limited B supply (keeping all growing conditions similar), K uptake capacity was limited. Consequently, root K concentration was 5.1% at low and 6.1% at adequate B supply, and shoot tissue K concentration was 5.9% with low and 6.6% with adequate B supply. These results highlight the synergy between boron nutrition and K uptake. Similar studies conducted in different crops have also documented the role of B in K uptake (see suggested readings).
Conclusions

Boron plays an important role in plant cell walls, root growth and nutrient uptake. With low B supply, reduced cell wall stability rapidly diminishes root elongation, leading to significant root growth reduction. Low B supply also reduces the activity of enzymatic systems directly responsible for K uptake. Aspire® is a one-of-a-kind premium potash that contains K and B in every granule. Using this product results in a more uniform application of B compared to traditional blends, and can greatly reduce a B deficiency. Additionally, the K will be utilized more effectively with proper B nutrition.

Further Readings


