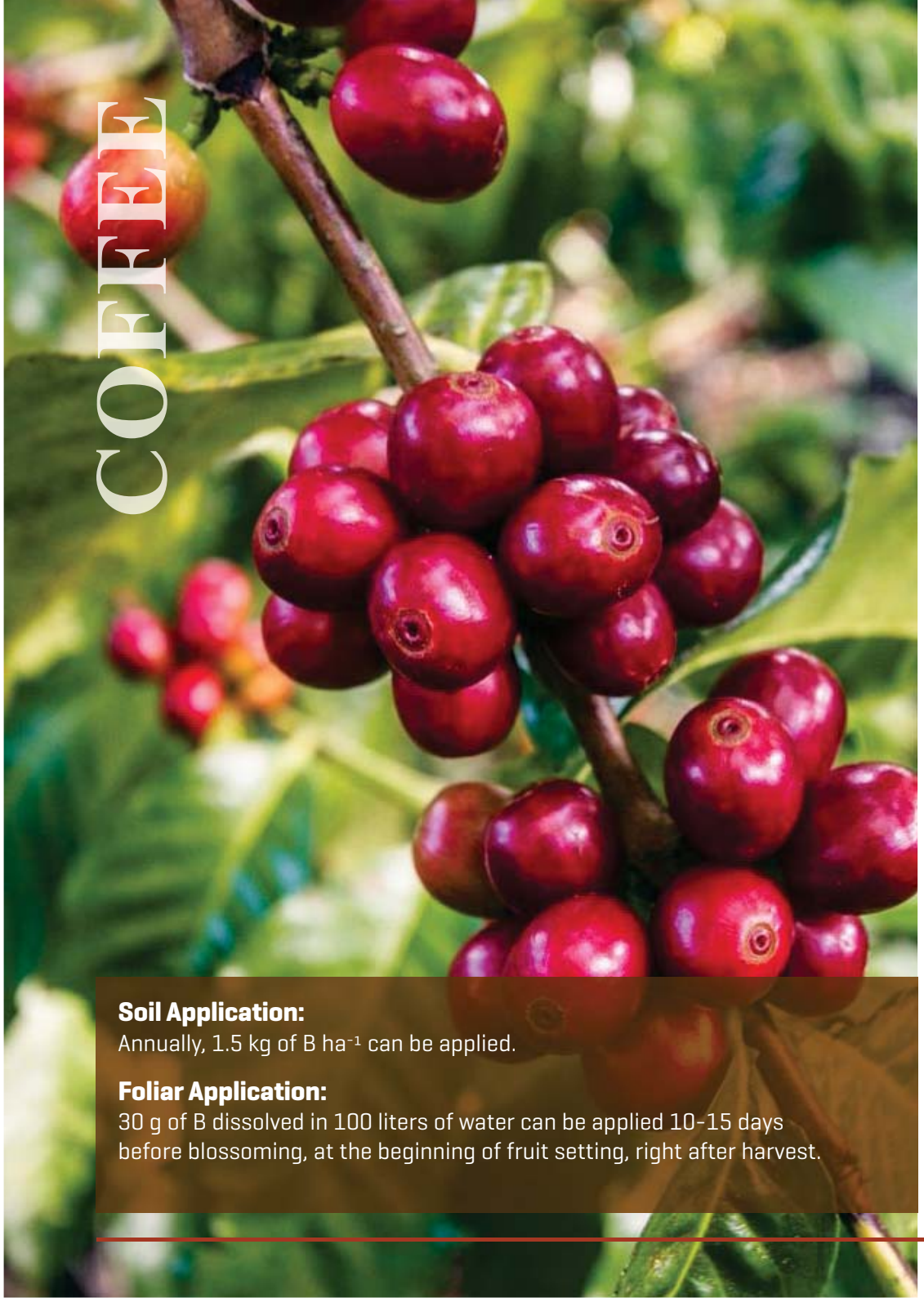
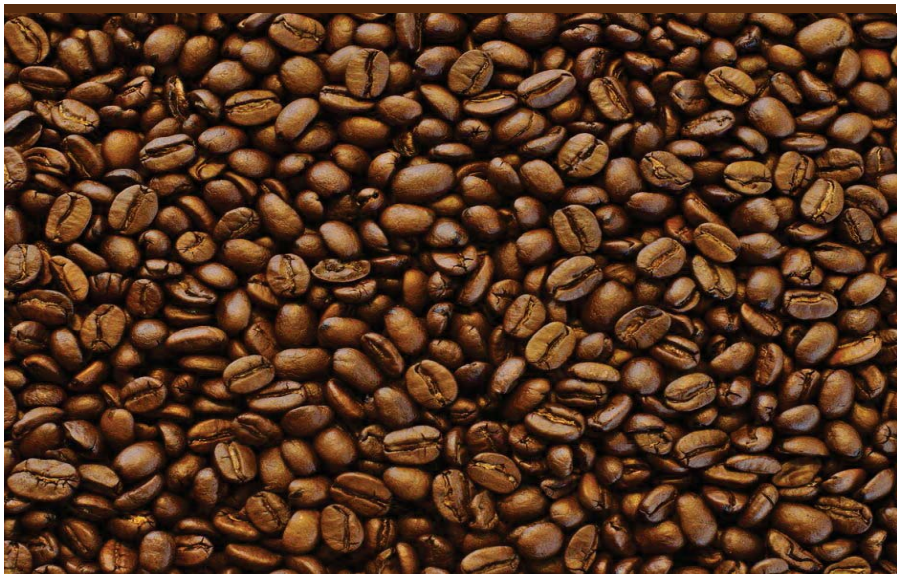


Soil Application:
Annually, 1.5 kg of B ha^{-1} can be applied.

Foliar Application:
30 g of B dissolved in 100 liters of water can be applied 10-15 days before blossoming, at the beginning of fruit setting, right after harvest.

COFFEE



Coffee is one of the most popular beverages in the world, the coffee trees are planted in more than 30 countries in the tropical and subtropical regions, and the livelihood of approximately 20 million farmers is attributed to coffee production.

Adequate balance of nutrients in plants is the fundamental factor in maintaining health of plants. Indeed, since nutrition can determine the boundary between the susceptibility and resistance of plants to diseases, complete and balanced nutrition should always be given priority in order to defend the plant against diseases.

Micronutrients contribute to reducing damage caused by pathogens through direct antagonism, or by strengthening the physiological defense mechanism of plants. Boron (B) is a micronutrient that plays a role in the synthesis and integrity of the cell wall, including lignification of cell walls and metabolism of RNA, respiration, and improving product quality and yield in plants. Boron also promotes the pollen germination and elongation of pollen tube, improving the percentage of fruit set.

Coffee is considered a crop that has high tolerance, with sensitivity to B. In coffee, B is the third most absorbed micronutrient by coffee beans after iron (Fe) and zinc (Zn). One ton of green coffee beans removes between 40 and 55 g of B. It is recommended to apply B as fertilizer when the B content in leaves is lower than 60 mg kg^{-1}, and when its content is lower than 45 mg kg^{-1}, the content of B in leaves is considered very low.

One of the most critical diseases that limits the yield of coffee is coffee rust. The role of B, a micronutrient, in reducing disease in plants is based on different mechanisms. The first mechanism involves strengthening the structure of the cell wall by forming a carbohydrate-borate complex that regulates translocation of carbohydrates and metabolism of proteins in the cell wall. The second mechanism occurs through the regulation of permeability, stability and function of cell membrane, and the third mechanism results from the function of B in the metabolism of phenol and lignin.

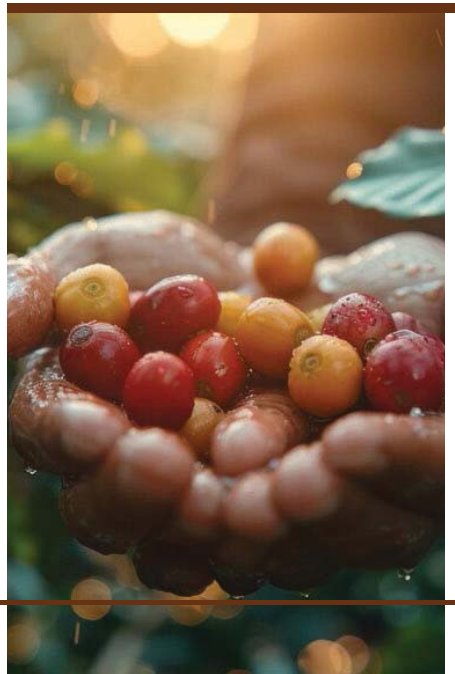
Lack of B in plants is a significant deficiency that can be encountered quite frequently in both acidic and calcareous soils. Boron deficiency reduces growth of roots, flowering, formation of fruits and growth phases. It also compromises the integrity of the cell wall. Cells will swell and divide, resulting in weakened intercellular bonds. As a result, the reduction of the physical barrier makes it easier for the pathogen to infect and colonize into the plant tissues.

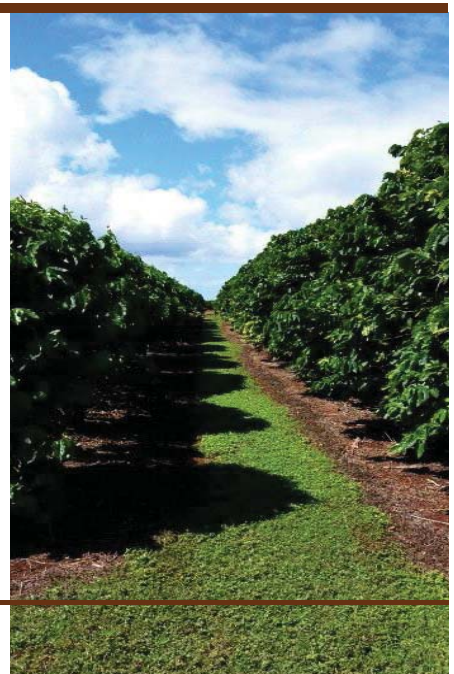
Boron deficiency in coffee first becomes apparent in newly growing leaves, which is a typical property of immobile nutrients. In case of B deficiency in coffee, the root system will become weaker, the existing flowers will drop, the fruits will be deformed, and as a result, the yield will decrease. In B deficiency, it is reported that the coffee plant has irregular vascular tissues, thinner xylem walls, fewer and deformed stomata on the leaves.

More than 90% of the total B in plant tissues is bound to cell walls by forming a strong complex with the pectin fractions ensuring membrane stability. Because of its important function and limited mobility in plants, B is a nutrient element that must be continuously provided to the plant throughout its life cycle.

The literature includes many studies that show the effects of B on the growth and yield of the coffee plant, and the studies conducted by Eti Mine Works General Directorate with coffee plants reported an increase of up to 100% in yield in Brazil with application of B with respect to the content of B that is already found in soil, and of up to 60% in yield of grains in Uganda.

The critical boron concentration at which the yield of coffee plants is expected to begin to decrease due to boron deficiency is reported to be 40 mg kg^{-1} for young leaves. For leaves, 40-100 mg kg^{-1} of boron is considered sufficient. In case of application of boron as fertilizer in soils, the recommended safe doses of boron are mostly 1.5 kg B ha^{-1}'. In foliar fertilization of boron, a solution containing 300 ppm of B can be considered. Soil analysis must be done before boron fertilization to determine the boron needs of the soil.





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