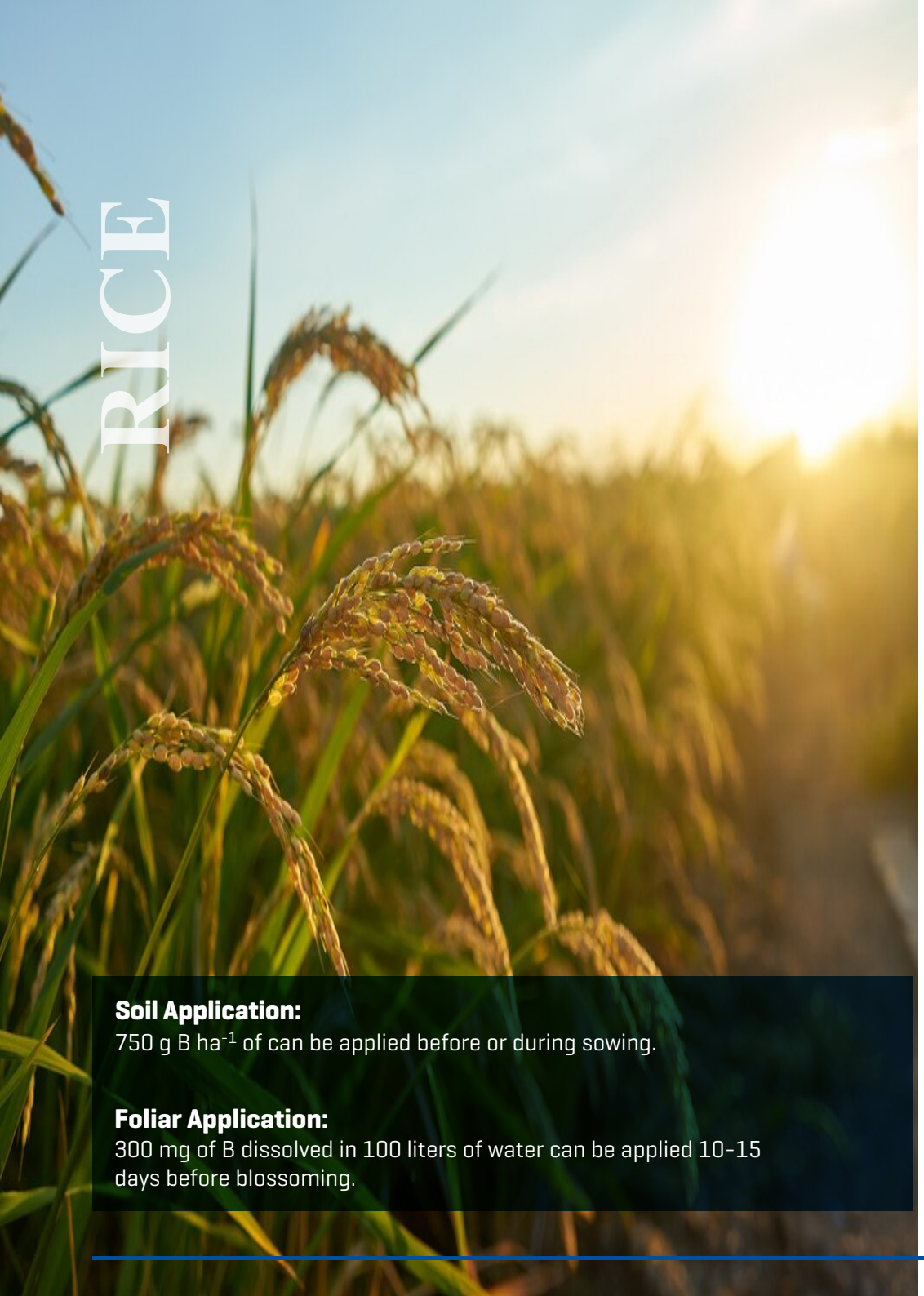

Soil Application:
750 g B ha^{-1} of can be applied before or during sowing.

Foliar Application:
300 mg of B dissolved in 100 liters of water can be applied 10-15 days before blossoming.

RICE

Rice is an important cereal crop that is used by the half of the world's population as the staple food. This plant globally meets 21% of the human population's need for energy and 15% of its need for protein. Rice is divided into two groups by cultivation areas: lowland rice (grown in waterlogged areas - anaerobic) and upland rice (grown under rainfall conditions without still water - aerobic). Yield of rice in agricultural production is threatened by the deficiency in micronutrients, especially in boron (B). Rice plants are generally grown in alkaline soils that have a high pH and low B content, exposing them to deficiency in B.

Boron is a micronutrient that is absolutely essential for the growth and development of plants, including rice. Deficiency in boron is reported to affect the yield of 132 crops in at least 80 countries worldwide. Boron is vital for basic functions of plants because it is an integral component of rhamnogalacturonan II (RG-II), which ensures integrity of membranes in plants and activates cell wall synthesis and indole acetic acid. In case of B deficiency, the chlorophyll content of plants decreases with inhibition of photosynthesis and poor development of chloroplasts. Boron is particularly responsible for pollination, seed formation and grain formation in plants, making it more important for the development of the reproductive parts of the plant than the vegetative parts. For normal pollen and grain development, the B content in reproductive organs of dicotyledonous plants, including the rice (>20 mg kg^{-1}), is higher than that of the vegetative parts (3 mg kg^{-1}). Under this concentration, substantial decrease may occur in reproduction and vegetative growth.

Monocotyledonous plants have less pectin in their cell walls compared to the dicotyledonous plants. Therefore, dicotyledonous plants that contain more pectin need more amounts of B, while monocotyledonous plants that contain less pectin need less amounts of B.

Deficiency in boron in the soil reduces yield of products, deteriorates quality and enhances susceptibility of plants to diseases. Deficiency in boron has been reported to cause a significant loss of yield in lands where rice is grown.

Symptoms of B deficiency in rice are poor development of pollens and anthers, thin branches, short and fewer tillers and sterility. Branches and leaves with boron deficiency become brittle. All such adverse effects reduce the number of grains per bunch in rice, therefore, the yield of grains.

Boron deficiency is considered to be a significant nutritional deficiency in lowland rice that is grown in waterlogged areas and to limit its productivity. There are several mechanisms that cause boron deficiency in rice: low content of organics in soil, strong adsorption of B over the pieces of soil, and losses of B due to seepages in the wet environment. In aqueous conditions, non-dissociated boric acid and borate anions move freely in water and are easily washed away from the soil. At high pH levels, the uptake of boron by plants decreases due to greater adsorption.

Aerobic rice cultivation system is a technology that saves water by planting seeds directly in the field in a dry environment instead of planting seedlings in a wet environment. In certain regions, deficiency in boron is observed in rice that is grown with this system due to the decrease in moisture content in the soil and the resulting decrease in the mobility of B towards the plant roots.

Historically, the rice plant was considered to be resistant to deficiency in boron. However, recent research has shown that deficiency in B in lands where rice is grown is an important cause of low grain yield, causing a serious decrease in grain weight (from 28% to 79%). The literature contains many studies that demonstrate the effects of B on the growth and yield of rice plants, and a study conducted by Eti Mine Works General Directorate with rice plants in Thailand reported that there was an increase of up to 15% in straw yield, 20% in the number of tillers per plant, 18% in the number of clusters and 5% in full grains with application of B.

The critical boron concentration at which the yield of rice plants is expected to begin to decrease due to boron deficiency is reported to be 5 mg kg^{-1} for the youngest mature leaf blade. For leaves, 6-15 mg kg^{-1} of boron is considered sufficient. The literature recommends to regularly apply 0.75 kg of B ha^{-1} as fertilizer under insufficient conditions in order to reduce the sterility of rice plants, to improve spurting and thus to achieve a higher yield. In foliar fertilization of boron, a solution containing 300 mg of B kg^{-1} per liter can be considered.

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