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
of

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The Effect of Micronutrients in Ensuring Efficient Use of Macronutrients

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Abstract: Micronutrient deficiency is widespread in many Asian countries due to the calcareous nature of soils, high pH, low organic matter, salt stress, continuous drought, high bicarbonate content in irrigation water, and imbalanced application of fertilizers. Some of the adverse effects of micronutrient deficiency-induced stress in plants include low crop yield and quality, imperfect plant morphological structure (such as fewer xylem vessels of small size), widespread infestation of various diseases and pests, low activation of phytosiderophores, and lower fertilizer use efficiency. The absence of micronutrient fertilizers results in inadequate absorption of trace elements by plants, which causes substantial yield losses in different crops and forages, and eventually results in poor health for domestic animals and humans. Calcareous soil research results of the last decade show that at the present time, among micronutrients, Zn deficiency is the most detrimental to effective crop yield. Other important micronutrients that increase crop yield (most to least effect) are Fe, B, Mn, Cu, and Mo. In the case of calcareous soils, the conventional notion that micronutrients increase crop yield by 15%-30% is an underestimated range. In fact, in some cases, especially with inefficient cultivars such as durum wheat (*Triticum durum* L.), micronutrients can increase grain yield up to 50%, as well as increase macronutrient use efficiency. By supplying plants with micronutrients, either through soil application, foliar spray, or seed treatment, increased yield and higher quality, as well as macronutrient use efficiency, could be achieved. In consideration of the important role micronutrients have in promoting and maintaining human health, more research is needed to determine the advantages of using the optimum level of micronutrients instead of their critical level as an indicator with regard to yield, quality, and enrichment objectives for the future.

Key Words: Micronutrient deficiencies, calcareous soils, bicarbonate in water, crop yield and quality, crop enrichment, health promotion

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