Exogenous Micronutrients Modulate Morpho-physiological Attributes, Yield, and Sugar Quality in Two Salt-Stressed Sugar Beet Cultivars.

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Abstract

Exogenously applied micronutrients (M) have been reported to boost salinity tolerance and improve yield and quality. However, very little is known about the effect of M mixture foliar application under saline soil condition. Our objective was to investigate the influences of M mixture foliar application on morpho-physiological traits, yield, and quality and nutritional status of sugar beet under saline (9.39 dS m^{-1}) soil. Two consecutive (2018/2019–2019/2020) field trials were conducted on both Romulus and Francesca sugar beet cultivars treated with M mixture (0 ppm; [M_0], 150 ppm [M_{150}; 75 Fe ($FeSO_4$), 50 Zn ($ZnSO_4$), 25 Mn ($MnSO_4$)], and 300 ppm [M_{300}; 150 Fe ($FeSO_4$) 100 Zn ($ZnSO_4$), 50 Mn ($MnSO_4$)]. M_{150} or M_{300} significantly boosted growth, water status, photosynthetic efficiency, nutritional status, and productivity of sugar beet. M_{300} increased root yield (RY) by 11.5% and 42.0% and true sugar yield (TSY) by 22.7% and 92.9% compared to M_{150} and M_0, respectively. M_{300}-treated plants had higher sucrose, true sugar, and quality index but lower loss sugar and non-sugar impurities M_{300} markedly improved sugar beet performance owing to increase leaf hydration status, photosynthetic efficiency, nutrients (K^+, Fe^{2+}, Zn^{2+}, and Mn^{2+}) uptake, and K^+/Na^+ ratio. Romulus exhibited enhanced growth, yield, and quality, reflecting more salt tolerance when compared with Francesca. Stepwise regression indicated plant fresh weight, SPAD chlorophyll, and leaves number $plant^{-1}$ are the most influential RY- and TSY-attributed characteristics in salt-stressed sugar beet. M_{150} or M_{300} are more effective and may offer a potential economic alternative for salinity-stress alleviation in salt-stressed sugar beet.