Effects of Water Stress and Microbial Fertilization on Environment in Rhizosphere Soils of Greenhouse Grape

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Abstract

In grape cultivation, incorrect water and soil microbial conditioning regulation will lead to significant water wastage and deteriorated soil conditions, which in turn will change soil structure and disrupt soil nutrient cycling processes. This study aimed to investigate the effects of different water and microbial fertilization regulation treatments (by setting adequate water availability and no fertilizer (W0F0, CK), mild water stress with small microbial fertilization (W1F1), mild water stress with maximize microbial fertilization (W1F2), moderate water stress with small microbial fertilization (W2F1), and moderate water stress with maximize microbial fertilization (W2F2)) on soil physical-chemical properties and enzyme activity in greenhouse grape during the growing season. The result showed that the W1F1 treatment had a negative impact on the build-up of dissolved organic carbon (DOC), nitrate nitrogen (NO3-N), and available phosphorus (AP). Throughout the reproductive period, the water stress decreased the soil's microbial biomass carbon (MBC) and microbial biomass nitrogen (MBN) contents, and MBC was more vulnerable to water stress. Both small amounts of microbial fertilization and maximize amounts of microbial fertilization additions increased the MBC/MBN contents in the early stages of greenhouse grape growth. During the peak growth period, Soil urease, catalase and sucrase activities were increased in the 10-40 cm soil layer under W1F1 treatment, whereas small additions of microbial fertilization did not significantly increase soil enzyme activities at the early stage of grape growth. These findings suggested that W1F1 treatment can effectively enhance the soil ecology of greenhouse farmland and improve the microbial environment in rhizosphere soil of greenhouse grape. Therefore, W1F1 treatment was the most effective water and microbial fertilization regulation measure for local greenhouse grape cultivation.

Keywords

Water Stress and Microbial Fertilization, Physical-Chemical Properties, Microbial Biomass, Soil Enzyme Activity