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咸水负压渗灌对番茄生长和土壤盐分的影响

Effects of negative pressure irrigation with saline water on tomato yield and soil salt

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中文摘要:

该研究旨在探讨日光温室条件下咸水灌溉对番茄生长发育和土壤盐分积累的影响。试验采用负压渗灌设备在番茄不同生育期(全生育期、花果期、果实膨大期、采收期)、使用不同质量浓度咸水(淡水、3、5、7、9 g/L)和土壤基质势(0、-40、-80 hPa)下进行咸水灌溉,研究咸水灌溉对番茄产量、根质量、耗水量、水分利用效率和土壤盐分的影响。结果表明,番茄不同生育期耐盐能力差异明显,花果期对土壤基质势与盐胁迫比较敏感,采收期忍耐力最强。咸水灌溉的盐分浓度临界值全生育期与花果期为3 g/L,果实膨大期为5 g/L,采收期可以用较高浓度咸水灌溉。咸水灌溉会造成温室生产系统土壤的盐分积累。适量咸水灌溉,对植株发育具有“控上促下”调节效应,利于降低耗水量、提高番茄产量与水分利用效率。因此,依据番茄不同生育阶段耐盐性的差异,利用一定浓度的咸水灌溉不仅可替代淡水资源,还可提高水分利用效率。

英文摘要:

Abstract: This research was to test the effect of salt water irrigation on tomato growth and development, water use, and soil salty accumulation situation in a greenhouse. In the treatments, the negative pressure irrigation facilities were applied to irrigate tomatoes at different growth stages (whole growth period, blooming and fruit period, fruit enlargement period, and harvest period), using different concentrations of salt water (fresh, 3, 5, 7, 9 g/L) and soil matric potential (0, -40, -80 hPa) to research the effect of salt water irrigation of the tomato production, root weight, water consumption, water use efficiency, and soil salinity. The results indicate that there are remarkable differences of salt-tolerance capacity at different growth periods of tomatoes. That means the blooming and earlier fruit periods are more sensitive to soil matric potential and salt stress than other stages. The most adapted one to salt stress is the harvest period. The data shows that the salinity of salt water irrigation should be less than the 3 g/L at both the whole growth period and the blooming and the fruit period, and less than 5 g/L at the fruit enlargement period. Relatively, high concentration salt water irrigation of 7 g/L-9 g/L can be used at the harvest period. The result is a difference between the relationship of yield at different growing periods and the soil matric potential, based on the concentration of salt. The conicoid relationship was found in the tomatoes yield and the concentration of salt, the soil matric potential at the whole growth period and the blooming and the fruit period, and the effect on the yield was significant. However, only the concentration of salt has significant effects on the yield at the fruit enlargement period, and there is a parabolic relation between the concentration of salt and the tomatoes' yield. The two factors at the harvest period have no effects on the tomatoes' yield. The relationship between the concentration of salt, the soil matric potential, and the root weight could be expressed by a conicoid relationship. The concentration salt at whole growth period has significant effects on the root weight, and there is a significant interaction between the concentration salt and the soil matric potential. Only the concentration of salt has significant effects on the root weight at the blooming period, and there is a parabolic relation between the concentration of salt and the tomatoes' root weight. The effect of the tomatoes' root weight is not significant at the fruit enlargement period and the harvest period. The positive linear relationship is shown between the soil salinity and the concentration of salt, the soil matric potential in all growth stages. The salt content would be increased 50% -400% by using the brackish water resources with a mineral concentration between 3-9 g/L to irrigate. Salt water irrigation will result in soil salt accumulation in green house production systems. The water consumption of irrigating tomatoes is positively correlated with the soil matric potential at every growth period, however, it is negatively correlated with the concentration of salt. Hence, the effect of salt water irrigation on plant growth appeared in the "from control to promotion" regulating trends when a moderate amount is chosen, which will help reduce water consumption and improve tomato yield and WUE. As a result, based on the characteristics of salt tolerance of tomatoes at different growth periods, the use of a certain concentration of salt water irrigation can not only replace fresh water, but also improve WUE.

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