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地下水位较高条件下不同根区湿润方式对梨树根与茎液流及其水分平衡的影响

Effects of Partial Rootzone Drying on Sap Flow and Water Balance of Pear Trees Under a Shallow Ground Water Table Condition

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英文关键词：sap flow; water balance; ground water table; partial rootzone drying; pear tree

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中文摘要：

为了探讨地下水位较高条件下根区湿润方式对梨树根和茎液流及水分平衡的影响，开展了较系统的试验研究。试验共设三种处理，即传统畦灌（CFI），部分根干燥灌溉（PRD）和分根区交替灌溉（ARDI），分别使用土壤水分监测系统（EnviroSCAN）和热脉冲探针监测土壤水分动态和梨树根和茎液流。结果表明在PRD和ARDI情况下湿润根区的根液流不仅大于干燥根区，而且也大于CFI情况下的相同区域。复水后，ARDI干燥区的根液流比PRD的恢复和提高快得多，并且比CFI的大；ARDI的茎液流比CFI的小，但比PRD保持一侧根干燥时的大。在只有一侧根区灌溉时，ARDI和PRD的日耗水量比CFI的小。ARDI和PRD中湿润侧的根系具有水分吸收补偿效应，当干燥根区复水后能够提高水分的吸收能力，其程度与根区持续干燥的时间长短有关。逐日根液流与参考作物蒸发蒸腾量关系密切，但随着表面灌溉方式和湿润根区的不同这些关系明显的不一样。逐日茎液流与参考作物蒸发蒸腾量有关，而且在不同的表面灌溉方式下，土壤含水率相同时茎液流和参考作物蒸发蒸腾量的比率不同。与CFI相比，ARDI和PRD大约少用50%的灌溉水量，但是梨树的水分消耗量和茎液流并没减少相同的比例。表面湿润方式对水量平衡和液流的作用明显受到地下水位的影响。在ARDI和PRD条件下的地下水利用量比CFI条件下有明显增加。

英文摘要：

The experiments were conducted to test sap flow and water balance of pear trees response to partial rootzone drying under a shallow water table condition. Three treatments, i.e. conventional flood irrigation (CFI), fixed 1/2 partial root zone drying and the other 1/2 part irrigated (PRD), and alternate 1/2 partial rootzone drying and irrigating (ARDI), were designed. The EnviroSCAN probes and heat pulse sensors were used to monitor soil water dynamics and sap flow respectively. The results shown that the root sap flow of wet side was much larger than that of dry side in PRD and ARDI, also larger than that of the same side in CFI. The root sap flow of dry side in ARDI was restored and improved more quickly than in PRD after rewetting. The trunk sap flow in PRD was smaller than in CFI when one side was drying, and it was larger than in CFI after the dry side rewetting. The trunk sap flow in ARDI was smaller than in CFI, but larger than in PRD during one side drying. The daily water consumption in ARDI and PRD was smaller than that in CFI during the period of only one side irrigated. The compensatory effect for water uptake existed in the roots of wet side for ARDI and PRD, and the ability of root water uptake was enhanced when the dry side rewetting, and it related the duration of root drying. Daily root sap flow was significantly related to reference evapotranspiration, but these relations were markedly different for different surface wetting patterns and different sides. The daily trunk sap flow was also related to reference evapotranspiration, and the ratio of trunk sap flow and reference evapotranspiration was not same for the same soil water content under different surface wetting patterns. Irrigation water use was approximately reduced 1/2 in ARDI and in the drying periods of PRD compared with CFI, but water consumption of trees and trunk sap flow were not reduced the same percentage. The effects of partial rootzone drying on water balance and sap flow were significantly influenced by the shallow ground water table. The capillary contribution from ground water table was significantly increased in ARDI and PRD compared with CFI.