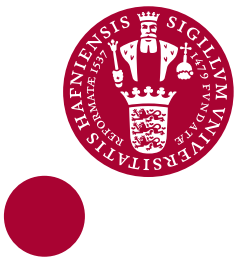

Alternate partial root-zone irrigation enhances nitrogen uptake and optimizes nitrogen distribution in the canopy of tomatoes

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ABSTRACTS

Shanghai Academy of Agricultural Sciences
Shanghai Agrobiological Gene Center

conductance for *P. orientalis* hadn't significant difference in the range of soil water potential -0.041 MPa – -0.648 MPa. *P. orientalis* has a very strong ability in maintaining turgor pressure, dehydration endurance and drought resistance.

P 3.48 - Alternate partial root-zone irrigation enhances nitrogen uptake and optimizes nitrogen distribution in the canopy of tomatoes

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Alternate partial root-zone irrigation (PRI), a novel water-saving irrigation strategy, has been shown to increase water use efficiency (WUE) by 30%-100% with a slight yield reduction as compared to fully-irrigated (FI) controls. However, its advantages in terms of improving WUE, maintaining yield and nitrogen (N) uptake in comparison with its counterpart conventional deficit irrigation (DI) using the same amount of irrigation volume remains largely elusive. In this study, the comparative effects of PRI and DI on WUE, N uptake and partitioning in tomato plants were investigated. The plants were grown in split-root pots and the soil was parallel-labeled with $^{15}NH_4^+$ and $^{15}NO_3^-$. Results showed that both PRI and DI saved 25% water, while led to 10.0% and 17.5% decreases in dry biomass, respectively, as compared with the FI plants. WUE was the greatest for the PRI plants and followed by the DI plants, and was 18.6% and 10.8%, respectively, higher than that of the FI plants. The increases of WUE in the PRI and DI plants was accompanied by an increase of the $\delta^{13}C$ in the plant biomass as compared with the FI plants, suggesting that the improvement of WUE in the PRI and DI plants was a result of long-term optimization of stomatal control over gas exchanges, especially for the PRI plants. During the experimental period, plant's N uptake was the highest in the FI treatment, followed by the PRI, and the lowest in the DI treatment. A similar trend of ^{15}N recovery was observed. Most interestingly, PRI plants consistently allocated more N into the upper leaf layer, particularly compared to the FI plants, and which may indicate a greater assimilation rate in those plants. It is concluded that PRI enhances N uptake and optimizes N distribution in the canopy, both might have contributed to the high WUE in the plants.

P 3.49 - Increasing water use efficiency (WUE) in tomato (*Solanum lycoper- sicum* L.) via abscisic acid overproduction

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Breeding plants that can produce equivalent growth with reduced water input (improved water use efficiency (WUE)) is necessary for sustained future crop production. Water deficit induces redistribution and synthesis of the phytohormone abscisic acid (ABA), thereby restricting stomatal opening and limiting water loss. Using tomato as a model crop, we have shown that it is possible to manipulate stomatal behaviour in order to improve WUE by increasing ABA production under optimal conditions. ABA is synthesised via cleavage of oxygenated carotenoids (xanthophylls). This work involves tomato genes encoding three enzymes in the ABA biosynthesis pathway: 9-cis-epoxycarotenoid dioxygenase (NCED) which can catalyse the oxidative cleavage step; β-carotene hydroxylase (BCH) which can catalyse the conversion of β-carotene to zeaxanthin; and phytoene synthase (PSY) which can produce phytoene from two molecules of geranylgeranyl diphosphate. It has been established that tomato lines over-expressing a LeNCED1 gene construct had increased ABA accumulation and improved WUE (Thompson et al., 2007). ABA production may be limited in some tissues by the supply of precursors; in order to increase xanthophyll precursor pool size, tomato lines over- expressing LeNCED1 and LeBCH2 have been combined. These double transgenics produce more ABA and have higher WUE than either of the single transgenic