Effect of alternate partial root-zone irrigation on N uptake and root growth in tomatoes

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S15.224
Response of Bedding Plants to Saline Water Irrigation

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Water shortages and poor water quality are critical issues in many regions of the world. With a rapidly increasing population and diminishing water supplies, the competition for fresh water among agriculture, industry, urban and recreational users has become intense. Use of alternative water sources, such as municipal reclaimed water and other poor-quality, non-potable saline waters, for irrigating urban landscapes may be inevitable in the 21st century. The major concern of using these alternative water sources for landscape irrigation is their elevated salinity, which causes salt injury on sensitive plants, and also causes salt accumulation in root zones if irrigation is not managed properly. This paper presents our latest research results on salt tolerance of bedding plants. The selected bedding plants responded to salt stress differently based on their growth, visual quality and tissue salt accumulation. A number of popular bedding plant species and cultivars can be irrigated with saline water up to 4.0 dS/m without significant growth reduction while others may exhibit salt injury as root zone salinity increased. Therefore, proper plant selection is important for landscapes where low quality water may be used for irrigation.

S15.225
Effect of Alternate Partial Root-Zone Irrigation on N Uptake and Root Growth in Tomatoes

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Comparative effects of partial root-zone irrigation (PRI) and deficit irrigation (DI) on nitrogen (N) accumulation and root growth in tomato (*Lycopersicon esculentum* L.) plants were investigated in two experiments using 15N isotope technique. The plants were grown in split-root pots in a climate-controlled glasshouse and were subjected to full irrigation (FI), DI and PRI. The soil was labeled with inorganic 15N in the first experiment, while in the second experiment 15N-labeled maize residues were used in order to trace the distribution of 15N in the soil-plant system. Results showed that PRI increased water use efficiency (WUE) in both experiments, which was significantly higher than DI and FI. In the experiment with inorganic 15N labeling, plant N uptake was highest in FI, followed by the PRI, and the lowest in DI; and the 15N recovery rate was 80% in FI and PRI, which was significantly higher than in DI. In the experiment with incorporation of 15N-labeled maize residues, plant N uptake was the greatest in PRI, which was enhanced by 14%, as compared with FI and DI treatments. The mineralized 15N from maize residue was 25% in PRI, which was significantly higher than in FI and DI treatments. The root length density (RLD) was slightly higher in DI than in FI and PRI; however, there was no significant difference among treatments. Conclusively, PRI could be a promising field management practice for improving both WUE and nitrogen use efficiency (NUE) for water-limiting environments.

S15.226
Drought Tolerance in Apple Seedlings through Abscisic Acid (ABA) Regulation

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Plants have unique ways to tolerate environmental stress such as drought or low temperatures. For instance, opening and closing action of stomata associated with abscisic acid (ABA) levels regulates water concentrations in plants. In this study, we examined the effect of an inhibitor of ABA 8'-hydroxylase (AHI) on drought tolerance in apple seedlings (*Malus domestica* Borkh.). ABA metabolism, stomatal aperture, water potential, and radical scavenging activity in leaves were all investigated under drought conditions. The result of our observation had shown that the AHI application to seedlings greatly decreased the stomatal aperture in the leaves as in contrast to untreated control samples. However, watering of AHI treated plants re-increased it to the original level. In addition, water potential in AHI-treated leaves remained higher than the one measured in untreated-leaves during the exposure to drought. Drought conditions increased ABA concentrations in both, AHI treated-plants and untreated-plant specimens. Notably, ABA concentrations in AHI-treated leaves were higher than those in untreated-leaves under drought conditions. Although the expression of 9-cis-epoxycarotenoid dioxigenase (MdNCED) genes increased with days of drought stress treatment, in AHI-treated leaves the expression of those genes was significantly lower than in untreated control samples. These results suggest that the prompt stomatal closure through the regulation of ABA 8'-hydroxylase may be required for the plants to survive under relatively long drought conditions.

S15.227
Refining Irrigation Wetting Depth Using the FullStop System to Improve Water Use Efficiency in Citrus

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One of the most promising ways to increase water use efficiency is to improve and modernise current methods of water application. Despite major technological advances in irrigation equipment that provide citrus growers with a capacity to apply the exact water volumes needed by trees where it most accessible for root uptake, plant water use is highly variable. It depends on the stage of plant growth, crop load, atmospheric evaporative demand (ETo) and soil water availability. All these factors combine to determine crop water requirement (transpiration – ETc). Citrus trees exhibit complex physiological responses that allow them to cope with reduced water availability under harsh environmental conditions. Savings in water were not only achieved through reduced volumes of water needed to wet the irrigated fraction of the root zone in drip irrigated orchards using PRD, but plant responses were stimulated to restrict their water use as well. Because PRD deliberately creates discontinuities in soil moisture within the root zone, practical management of irrigation scheduling using soil water measurements becomes more difficult. Since the majority of the active root zone of citrus trees lies in the upper 0.4 m of the soil profile, it is questionable whether supplying the entire root zone with water is necessary. If the irrigated root volume could be reduced by controlling the depth of wetting, additional water savings would be achieved. Therefore, controlled wetting depth using the Full Stop™ wetting front detectors was investigated as a means of deriving additional water saving in PRD irrigated citrus to further improve citrus WUE.

S15.228
Drought Response Traits in 'Tomàtiga de Ramellet' Tomato Cultivars from the Balearic Islands

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'Tomàtiga de Ramellet' (TR) are a population of tomato cultivars similar to other long-shelf-life land-race varieties grown in Southern Europe and around the Mediterranean. These varieties exhibit dramatically delayed softening due to the delayed fruit deterioration (DFD) phenotype. Another important trait of this cultivar is its capacity to grow under non-irrigation conditions during the Mediterranean summer, and