Considerations for Salt Management in Soil and Water for Producing Horticultural Crops: Introduction to the Workshop

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In nonhalophytic plants, saline conditions reduce vegetative growth and yields. Salt stress effects on plants from soil (≥ 4 dS·m⁻¹ EC and <15% exchangeable Na⁺) or from saline (brackish) irrigation water (≥ 4 dS·m⁻¹ EC) may be divided into three broad categories: 1) osmotic effects, 2) specific ion effects, and 3) interference with the uptake of essential nutrient ions (Hausenbuiller, 1972). Generally salts, once introduced, accumulate in the upper soil profile when they are transported by upward capillary movement of water, which evaporates, and when rainfall and irrigation are insufficient to leach salts to lower soil depths (Suarez, 1992). Thus, soil salinity is a particularly severe problem in the arid and semi-arid zones of the world or in areas where only poor-quality water is available for irrigation (Hamdy et al., 1993; Rowley, 1993; Satti et al., 1994). In the coastal areas of the United States, the gradual intrusion of seawater into the fresh-water aquifers threatens water supplies for agricultural, industrial, and municipal users (Cole, 1993).

Crops grown on saline soils or irrigated with saline water require different management and irrigation methods than plants in nonsaline soils or irrigated with good-quality water. For example, in soils that have >15% exchangeable Na⁺, plants require soluble Ca²⁺ fertilizers to remedy ionic imbalances, which adversely affect their growth and development. Selecting crops and cultivars that can tolerate saline conditions and may produce economically acceptable yields is very important. Plants in the same family, or even the same species, react differently to saline conditions. For example, in Cruciferae, the order from highest to lowest tolerance to balanced fertilizer salts was cabbage > cauliflower > broccoli > kohlrabi (Csizinszky, 1979), and, in Leguminosae,

the order was green pea > faba bean > soybean > green bean (Delgado et al., 1994). In Solanaceae, differences to salt stress among tomato cultivars were reported by Perez-Alfocea et al. (1993) and among eggplant cultivars by Zurayk et al. (1993).

Many plants have salt-sensitive stages during their development when irrigation by saline water should be avoided. Germinating seeds and young seedlings are particularly sensitive to salt stress, and irrigation with saline water during these stages is harmful. Hamdy et al. (1993) recommended irrigation with good-quality water during the salt-sensitive stages of growth, followed by saline water during later growth stages, when good-quality water may be scarce for irrigation purposes.

Although consumptive use of water by agriculture and industry has declined since the mid-1980s, the demand for food, water, and land by an ever-growing population has increased (Solley, 1993; Suarez, 1992). Under these conditions, the knowledge of crop management on marginal lands, an understanding of irrigation management with brackish water, and crop selection for saline environmental conditions will increase in importance for horticulturists.

In the following articles, some soil and crop management methods, breeding and selecting plants for salt tolerance, and aspects of water and solute transport in soils are discussed.

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