

Arava Center for Agricultural Water Use Efficiency Research

Substantial land areas used for agriculture are located in arid zones including the Arava Valley where large amounts of irrigation water are required for crop production. Available water sources for agricultural use are often highly saline and may contain levels of toxic substances (*i.e.* boron). Understanding of plant response functions to combinations of water availability, salinity, contaminant content, and nutrient levels is indispensable to the understanding of plant growth and water use and for optimized management. Accurate knowledge is necessary to develop appropriate irrigation regimes for agriculture.

Today, not enough information is available in order to ensure maximum yields while conserving water resources. The result is often both poor economic returns and detrimental environmental effects resulting from over or under irrigation with low quality water. Over-irrigation leads to economic waste and contamination of groundwater with salts, boron and nutrients. Under-irrigation leads to contamination of the root zone of the soil. Proper development of irrigation management schemes based on specific crop and water quality information, can lead to maximum returns, minimum waste and reduction of negative environmental consequences. Groundwater quality (chloride content) in the Southern Arava is deteriorating at a rate of 10 ppm Cl per year. At the same time, nitrate concentrations are quickly approaching toxic levels.

Developments in irrigation technology can lead to breakthroughs in the efficiency of water use. One major avenue for advancement is the adjustment of water applications to water requirements over small time scales. Similar adjustments can be appropriate for nutrient applications and under saline conditions. To address this approach and to properly evaluate plant yield responses, a sophisticated laboratory for precise water, nutrient and solute measurements in soil and plants is required.

Researchers at Arava R&D have been involved with water use efficiency development for more than 40 years, beginning with design and field trials of the first modern drip irrigation systems. Today, research at the "Arava" station at Yotvata includes technical developments in micro-irrigation, advances in irrigation scheduling, and investigations of plant response to environmental stresses. Recently, a new design for lysimeter systems was developed by researchers at the station that allows for exact water and solute monitoring and

balance under conditions that mimic those in agricultural fields. Using the lysimeters, precise data are obtained concerning crop water requirements and yield response to a multitude of environmental and management parameters and crops. Through cooperation with regional extension services and growers' organizations, appropriate application regimes and water management parameters are being developed for irrigation of economic crops using marginal (saline and recycled wastewater) water sources.

The center will be a place where contributions to economic needs of the Southern Arava go hand in hand with contributions to basic science having global importance. The vision for the center for agricultural water use efficiency research includes:

- ⊗ To study and understand water-soil-plant-atmosphere relationships.
- ⊗ To develop and evaluate irrigation technologies and techniques.
- ⊗ To Increase water use efficiency in (desert) agriculture.
- ⊗ To efficiently utilize marginal (saline and effluent) water supplies.
- ⊗ To Increase fertilizer efficiency.
- ⊗ To decrease environmental contamination from agricultural sources.
- ⊗ To model plant response to agricultural conditions including water quality and stress considerations and promote use of such models for agricultural management.
- ⊗ To promote successful agriculture in Israel's arid south.
- ⊗ To advance regional development through sharing of knowledge and technology with Israel's neighbors.
- ⊗ To contribute to science through publication in professional journals involving topics of soil physics, soil chemistry, irrigation, plant growth and response to stress conditions, water management.
- ⊗ To build and promote international scientific cooperation.
- ⊗ To provide a platform for academic advancement and achievement of the local population.

Some of the established research systems for the Arava Center for Agricultural Water Use Efficiency Research



Date Palms in lysimeters. Study of the combined effects of salinity and high boron in irrigation water on water requirements. 20 independently controlled and monitored trees in 2.5 cubic meter containers. Automation of irrigation supply and drainage collection. Constant weighing of each lysimeter.



“Carousel” for water balance research of greenhouse crops. Determination of effect of salinity and water content on greenhouse peppers. 24 fully automated lysimeters.



Analysis of irrigation water salinity and frequency of irrigation scheduling on grafted watermelons. Field includes 50 fully automated lysimeters for water use determination and for determination of soil and groundwater contamination for field crops.