

#### **4. Benefits of wireless sensor networks for irrigation management**

*Provide growers with real-time information:* Sensor networks provide growers soil moisture and environmental conditions for their own production areas. Since the data can be seen on-line, access to this information is easy. This provides growers with information they trust and can act upon. We have learned that most growers make much better irrigation/environmental management decisions once they have access to data collected in their own operation. Seeing the impact that your irrigation/environmental management decisions makes it easy to improve on standard practices.

*Precision Control of Irrigation:* We have shown through our research that we can achieve between a 40 and 70% reduction in irrigation water applications with soil moisture sensor-based irrigation control. Although reductions vary from operation to operation, because all growers manage irrigation differently, we have consistently seen large reductions in irrigation water use. For one of our nursery growers, a 50% reduction in irrigation saved over 43 million gallons of water, and \$6,500 in pumping costs in 2012. In the central valley of California, where water costs are typically \$750 / acre foot, the net cost of this 43 million gallons of water would have been at least \$100,000, without accounting for additional pumping, plant growth or other economic benefits. In this case, the return on investment for the \$48,000 sensor network would have been achieved in less than 4 months.

*Impact on Water Availability:* For most growers, the cost of water is low compared to other variable costs, such as labor. However, some operations are limited by the capacity of their well or pump, or by the time it takes to irrigate all crops. Water availability and irrigation time can limit the amount of plants that can be grown. One nursery grower was able to install an additional 30-acre tree production area, simply based on the amount of water he saved elsewhere using sensor-based irrigation.

*Increased Yields and Quality:* Growers can use these sensors as a tool to refine their growing practices for increases in yield and quality. For example, a snapdragon cut flower grower was able to make more timely irrigation decisions through the use of sensor networks in his greenhouse production. Since these plants were grown in a recycling hydroponics system, water savings were not much of a concern. But better irrigation management increased the yield and quality of snapdragon cut-flowers by 30% depending on season and cultivar. This clearly shows that the benefits of precision irrigation go well beyond just water savings.

