

IRRIGATION FOR THE 21ST CENTURY

New Technology adds precision and makes grower's jobs easier

By Owrang Kashef

Irrigation boils down to supplying water to crops at the right time in the right quantities. New technology is making it easier to achieve this, and with less work.

Equipment is now on the market that allows for more precision irrigation, which can improve quality and speed crop times. It also allows growers to monitor these systems remotely, which breaks the leash of having to be at or near the nursery at all times.

Automated irrigation has been around for about 40 years. Controllers introduced at that time were basically simple clocks and switches. At a predefined time, the valves opened, irrigation water was supplied and when the cycle time ended, the valves closed.

As controllers became more sophisticated, it was possible to take flow pulse input and inject fertilizers and other chemicals into the irrigation lines. Rain and freeze sensors were introduced into the market to stop or start irrigation cycles.

Today's controllers are much more sophisticated than their predecessors. Growers want to know how environmental factors affect crop growth. Analog input signals are becoming popular with newer controllers. With analog input, it's possible to measure a certain gradient condition, such as the moisture level in the soil or pressure in the water lines. Also with these inputs, real-time monitoring of the system is viable.

SOIL SENSORS

Many soil-moisture sensors are on the market. Some require calibration based on the soil type and conditions.

Higher-end models are "plug and play", requiring no calibration. These sensors give continuous soil moisture readings within a given range at specified depth. They can identify critical conditions such as saturation, field capacity or wilting point.

Collection of soil moisture data provides the user with a trend-analysis tool that can establish the frequency and length of irrigation cycles. Data from these sensors can also tell us about plant behavior, such as when the plant consumes water and at what depth.

When installed in tandem at different depths, sensors can chart a wetting profile. Sensors can be set to monitor moisture levels at 4, 12, and 20 inches deep, for example.

There are different options for collecting data from soil sensors. Data loggers can be placed on the ground next to the sensors, and a data shuttle is normally used to transfer collected information to a personal computer. This is the least expensive option.

Irrigation For the 21st Century

Wireless communication systems are available to transmit data via spread spectrum or a licensed radio to a PC.

Soil moisture sensors, which can be used for container or field production, can also be connected directly to controllers. This approach provides the benefit of controlling the irrigation cycles based on soil moisture content.

Preset points are defined in the program by the grower and the controller can automatically activate the irrigation cycle. This is an example of an integrated irrigation control system where one controller (usually a central controller) analyzes the incoming data and sends commands out to the field controllers.

CENTRAL CONTROLLERS

In recent years, a central controller with a desk top interface has become a popular tool in programming, monitoring and analyzing data from field controllers. Depending on the system, it's possible to have many field controllers communicate with a central controller.

Field controllers usually operate as stand-alone units and are capable of uploading and downloading data to and from a central controller via wire or a radio communication link.

Field controllers are normally installed next to a water source, such as a pumping station. This approach allows the controller to activate pumps, backwash filters, take flow meter readings and inject fertilizers and other chemicals.

Water quality control has become an important factor in nursery production, and many growers inject acid and chlorine to lower pH and control bacteria. Data related to water quality can be stored in the central controller.

Pressure transducers can be installed at the pumping station to monitor line pressure or act as a protective measure in case of extreme pressure conditions. Electrical conductivity and pH sensors may also be installed downstream from a pumping station to detect and adjust chemical injection into the irrigation lines.

All this information can be readily accessible at the central controller for monitoring and analysis.

Controllers are now able to detect liquid levels inside chemical tanks and communicate this information when a predefined low level is reached. The central controller is then able to send an e-mail to the grower and/or chemical supplier, alerting them of this condition. Coordinating chemical refill with the supplier can become an automatic procedure.

VALVES AND FLOW METERS

Valve operation has become the simplest aspect of a controller's operation in the automation market. But is it possible to know if a valve actually opened?

A flow meter can tell you how much volume is going through a water main. However, at nurseries where multiple valves have to be activated simultaneously, a flow meter reading will not tell the controller which valve actually went on.

Irrigation For the 21st Century

To make this scenario even more complex, if there's a leak in one of the lines, the basic flow meter reading will not help the grower identify the problem.

A solution is to install pressure switches, which act as contacts when a predefined pressure is reached down stream of a given valve. A contact closure is recognized by the controller, indicating valve closure actually took place. A smart controller is able to detect a failed closure and send an e-mail to the grower informing him of this problem.

WEATHER STATIONS

Installing local weather stations is becoming popular with many larger growers. Air temperature, humidity, solar radiation, wind speed and direction, rain, soil temperature and leaf wetness can be detected by the sensors.

The information is then transferred to the central controller that is able to calculate evapotranspiration (ET), gust and dew point. A smart controller is also capable of monitoring data from a weather station and, after analysis, take actions based on predefined parameters.

Examples are shutting down irrigation when wind speed is greater than 30 mph, adjusting irrigation to supplement rainwater that has fallen in the past 24 hours, or irrigating based on daily calculated ET.

REMOTE ACCESS

It's possible to access central controllers over the Internet. They can be monitored, modified and updated remotely. Wireless communication, albeit slow, will enable users to have similar accessibility. Pocket PC and smart phone technologies, united with wireless communications in a Wide Area Network, will let you access your desktop computer at a higher speed. Field controllers of the future may actually interface with your smart phones for program accessibility and modification.

WHY IS IT NECESSARY

Why do we need all this technology? We were able to get along without it for so many years.

The answer is that water resources are becoming increasingly limited, the cost of fuel and energy is on the rise, labor costs and availability fluctuate and competition continues to introduce products at lower costs with better quality. Unless we have tools to better control our operations, it will be very difficult to beat the odds.

If a problem arises at your nursery while you're away, it's possible to connect via wireless access to your central controller, monitor and define the obstacle and direct staff to address the problem.

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