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anaging water and nutrients in vegetable crops

Evaluation tools for growers

By Joanne Littlefield and Susan McGinley

Vegetable crop production in the arid Southwest requires continual irrigation and fertilizing. By managing water and nutrient applications correctly growers can not only save water but also reduce environmental impact. Nitrogen in particular is essential to productive plant growth, but applying more than crops will use can cause leaching from the soil profile and potential groundwater pollution. Growers need to manage nitrogen carefully because just as too much of it can leach into the groundwater, too little can decrease marketable yields. Drip irrigation is one way to put the nitrogen exactly where it is needed, without applying it in excess.

Tom Thompson, an associate professor and soils specialist in the College of



Shaping planting beds prior to drip installation

Thomas Thompson

tubing periodically, a practice called “fertigation.” Applying nutrients through the water enables growers to manage water and nitrogen simultaneously, a clear advantage for drip irrigation, according to Thompson. Since nitrogen requirements for drip-irrigated plants are usually less than for crops grown on traditional, furrow-irrigated beds, he is determining how often growers need to fertigate, and is establishing guidelines that can help growers determine the best inputs for their crop.

“A broccoli crop, for example, needs about 350 pounds per acre of actual nitrogen over the growing season,” Thompson says. That’s the optimum amount, but periodic plant tissue tests during the growing season can help producers determine exactly how much nitrogen is needed (see sidebar). In addition to these tests, and to the grower’s own experience, Thompson suggests using soil-water tension readings to schedule irrigations. “By developing all of these guidelines for water management and nitrogen fertilizer management, we can add to the diagnostic tools growers need to maintain plant health,” he says.

The bottom line is whether or not drip irrigation and fertigation result in a high-yield, high quality crop. According to Thompson, his research results confirm that high-yield agriculture is not incompatible with good environmental stewardship.

“Our analysis of the data over a ten-year period has shown that excellent yields and economic returns can consistently be achieved



Thomas Thompson

Growers attend a field day at the agricultural center.

Agriculture and Life Sciences at the University of Arizona, has been studying drip irrigation and nutrient management in winter vegetables for the last ten years. He has conducted his research on broccoli, cauliflower and leaf lettuce on plots of one to four acres at the UA’s Maricopa Agricultural Center in central Arizona.

The ongoing studies have focused on irrigating daily through a buried drip system, and putting nitrogen into the drip

CONTACT

Thomas Thompson
(520) 621-3670
thompson@ag.arizona.edu

with drip irrigation systems, without polluting losses of nitrogen to the environment,” he says. Drip systems also use approximately 20-50 percent less water than conventional furrow irrigation.

Drip irrigation has not fully caught on among Arizona vegetable growers because start-up costs are greater for drip than for furrow irrigation. Yet Thompson’s findings, and the experience of several pioneering Arizona growers such as Howard Wuertz in central Arizona, who have installed drip systems in their vegetable crops, indicate that drip irrigation eventually pays off. Wuertz has been using drip irrigation successfully on several vegetable crops for more than 20 years.

“Although adoption of drip irrigation has been delayed by the adverse farm economy of recent years, among other factors, I believe that drip will play an important role in Arizona’s agricultural future,” Thompson says. “While it requires more maintenance, with drip it’s possible to use water and fertilizer inputs more efficiently than in conventional production systems now in use. Furthermore, our experiments and grower experience has shown consistently high crop yield and quality with drip.”



Thomas Thompson

In the future, Thompson would like to put a permanent drip irrigation installation into a large experimental block at MAC that could be studied for perhaps ten years or more. It would be used not only for research, but also for demonstration purposes, to show how drip and nitrogen fertigation perform long-term in vegetable production. W

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PLANT TISSUE TESTING

Since nitrogen applications are based on how much nitrogen the crop has already taken up, petiole tests can help growers determine the nitrogen status of plants. Several years ago, Tom Thompson, UA Department of Soil, Water and Environmental Science, studied two plant tissue tests on broccoli and cauliflower, and found that although both worked well, sap testing was a faster method.

Dry tissue testing, the conventional method, involves sampling the petioles, or short stems that connect leaves to the main plant stem. Petioles are gathered from 15 to 20 plants at the 4-6 leaf stage, from the youngest fully-expanded leaf, and analyzed in

a laboratory for their nitrate content. One drawback is that this method can take two to three days from sampling time to the completed analysis, according to Thompson. Still, for most crops it’s a valuable nitrogen management tool if implemented before mid-season.

Sap testing is a newer technique that offers instantaneous measurement of plant N status. In this case the petiole sampling technique is the same, except that instead of drying the samples, sap is extracted from petioles for analysis. Sap nitrate is then measured on a hand-held, calibrated nitrate ion meter. This quick test takes only a few minutes to perform in the field.