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Drip irrigation can save fertilizer costs in lettuce

By Bob Johnson

Lettuce growers may discover that a well-managed drip irrigation system could open the door to substantial reductions in fertilizer costs.

Most vegetable growers invest in drip systems because the more precise control of irrigation makes it possible to conserve water and save on pumping costs while growing a better crop.

But University of California researchers have found that drip may also make it possible to reduce costs by more precisely applying fertilizer.

In two trials in Salinas Valley commercial lettuce fields, researchers found that nitrogen fertilizer applications could be cut back to less than 100 pounds of nitrogen per acre on drip irrigation systems without hurting lettuce yields.

That meant one of the two growers could have saved 77 pounds of nitrogen fertilizer per acre from his standard practice with no loss in yield. The other grower could have saved well over 100 pounds of nitrogen fertilizer per acre.

"In both fields the reduced nitrogen fertigation treatment had statistically equivalent lettuce yields compared to the grower treatment," said Tim Hartz, UC Cooperative Extension vegetable crops specialist. Hartz conducted the trials in the summer of 2007 in conjunction with UCCE Monterey County farm advisors Richard Smith and Michael Cahn.

A third lettuce trial in the spring of this year also showed that at least one of the fertigations could have been eliminated with no loss in yield.

These results remain preliminary, and the researchers intend to conduct four or five additional trials later this year.

But the reductions in nitrogen applications were impressive in light of the skyrocketing costs of fertilizer and the growing regulatory pressures to reduce chemical runoff.

One reason that fertilizer could be cut back so much was a well-managed drip system makes it possible to control water well enough minimize the amount of nitrate lost through leaching, Hartz said.

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"If a drip system is well managed, you will have less loss of water as runoff or deep percolation," Hartz said. "And that means you have less nitrogen leaving the root zone."

Another important factor is that there was already a substantial amount of nitrate nitrogen in the soil and available to the crop, he said, noting that nearly all of the vegetable ground in the Central Coast Region already has enough nitrogen to justify the modest effort required to measure that nitrogen and include it in fertilizer contributions.

"As a rough approximation, each part per million of nitrate nitrogen in a soil sample representing the top foot of soil represents approximately 4 pounds of nitrogen per acre," Hartz said.

The residual nitrate nitrogen already in the soil in the two Salinas Valley fields for the recent trials was the equivalent of 80 to 100 pounds of nitrogen per acre. The grower standard in both of these fields was to apply a total of around 170 pounds of nitrogen with a preplant application, followed by three sidedress applications during the season.

The researchers dramatically reduced the fertilizer in their test plots by skipping the first two sidedress applications in one of the fields and skipping the last two applications in the other field. In both cases reducing total nitrogen applications by 40 to 60 percent had no significant affect on the lettuce yield.

Salinas Valley lettuce growers have adopted drip irrigation on a wide scale over the last decade or so.

"All of the major growers have experimented with drip and most of them are heavy users," Hartz said. He said he believes that at least half the lettuce ground in the Salinas Valley is already on drip irrigation and that share is increasing. But there is still no standard practice on how to adjust fertilizer programs when switching to drip irrigation.

"If you were to ask a dozen different growers, you would find they have wildly different practices when it comes to fertilizer inputs," Hartz said. "You will find that some have cut back on their nitrogen when they go to drip; but you will also find some who have kept the same fertilizer plans they had on sprinklers."

While the researchers work toward guidelines to allow growers to safely cut back on nitrogen fertilizer without hurting their crop, they are finding that savings could also be possible in phosphorous fertilizer applications.

The 2007 trials indicated that many Central Coast growers could also go a few seasons without using any phosphorous fertilizer on their lettuce because more than enough phosphorous has already built up in the soil.

One of the growers in the trial did not add any phosphorous to his field because residual phosphorous was already pretty high. The researchers applied phosphorous to a few plots in that field to see if it made any difference. The other grower did apply some preplant phosphorous, and the researchers set aside a few plots without phosphorous.

In both cases, the additional phosphorous did not increase crop yield.

Hartz said he believes that additional phosphorous is not needed to grow lettuce on either drip or sprinkler irrigation as long as soil phosphorous is at 50 parts per million in cool weather or 60 parts per million in warm weather.

"Soil test phosphorous levels in fields not receiving phosphorous fertilization will decline slowly, but highly enriched fields may not require phosphorous fertilization for several years," Hartz said.

The advantages of monitoring the soil and applying phosphorous only after it becomes needed are both the savings in fertilizer costs and the reduction of phosphorous in the runoff water, he said.

The trials were done on a fairly substantial scale—four plots 200 feet long and four beds wide on each of the farms.

But these trials are not the final word on fertilizer requirements for lettuce. The researchers plan future trials to fine-tune their fertilizer recommendations for lettuce grown on drip irrigation.

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