A Newsletter for Pest Control Advisers August 2000



*A year later, Pest Control Advisers understand the control methods for the lettuce aphid, which includes an application of ADMIRE Insecticide and steady scouting.*

# Aggressive Management Approach Gives Growers Upper Hand on Lettuce Aphids

What a difference a year makes.

Last summer, entomologists from Salinas to Yuma were scrambling to find solutions for a new pest, the lettuce aphid. This summer, they may be hard-pressed to find one to study.

"The only place I'm seeing lettuce aphid is at farmers' markets where organic lettuce is sold," says Franklin Laemmlen, University of California farm adviser in Santa Barbara and San Luis Obispo Counties.

Why has the lettuce aphid become a manageable pest? First, intense research has given entomologists much greater insight into its behavior, which makes it easier to predict an infestation. Second, most growers in vulnerable areas are protecting their crops at planting with ADMIRE® 2 Flowable Insecticide from Bayer Corporation.

"Right now, the growers who are religiously applying ADMIRE at planting time or over the seed line with transplants are not having problems," Laemmlen says. "ADMIRE is doing a fantastic job."

However, entomologists caution growers about becoming complacent in their scouting regimens. A late-season infestation can flare up quickly, and populations can explode from one to 125 in only three weeks.

Michel Hardoy, a pest control adviser (PCA) with Wilbur-Ellis in the King City, Calif., area, recalls how populations built steadily throughout the 1999 season and isn't taking anything for granted.

"The lettuce aphid is a problem pest that we will have to deal with from year to year," he says. "Sometimes we have tremendous pressure, and sometimes we don't."

Growers in coastal counties should be especially alert this time of year, because lettuce aphids thrive in temperatures from 60 to 75 degrees. Growers should check fields at least twice a week after aphid activity is detected, sampling 10 to 15 plants in each quadrant.

"I monitor the crop two to three times a week to make application decisions for

*cont'd on page 3*

WESTERN ADVISER

A Newsletter for Pest Control Advisers Sept. 2000



WESTERN AGRI DEVISE

# Markets Remain Strong for Western Vegetables

If an investor knew for certain which and when stock prices would go up, it would be easy to make money in the market. And, if growers could predict which crops would be in demand, it would be much easier to make a profit in vegetable production.

No one has a crystal ball to predict the future, but recent trends give a good indication of which vegetables are hot – and which are not.

One thing is certain – California remains the nation's salad bowl. The Golden State grows one-half of all vegetables produced in the United States. California growers produced vegetables and melons valued at $5.89 billion in 1998, the latest year for which figures are available, according to the California Department of Food and Agriculture.

"After two years that were not so profitable, I think we are going to see a period of profitability," says Dave Moore, president of the Western Growers Association. "I'm bullish on Western vegetables."

One vegetable that Moore is bullish on is lettuce. It remains the billion-dollar crop, with 1998 sales of $1.11 billion.

"Iceberg lettuce is still popular, but red and green 'designer' lettuce has come on strong recently," Moore says.

Several fresh-market crops registered significant increases in per capita consumption in 1999, according to the USDA: cauliflower (40 percent), head lettuce (15 percent), broccoli (15 percent), cantaloupe (9 percent) and watermelon (8 percent).

"Broccoli sales continue to grow because of its health benefits and its popularity with many ethnic groups," Moore says.

On the downside, Americans ate less cabbage (down 9 percent), leaf and romaine lettuce (7 percent), and tomatoes (1 percent). Americans purchased fewer canned vegetables last year (down 1 percent), but more frozen vegetables (up 4 percent).

The good news from the USDA is that per capita vegetable and melon consumption in 1999 was 454 pounds – up about 9 pounds from the previous year. Large supplies and low prices contributed to a 5 percent increase in fresh vegetable use. The USDA expected consumption figures to remain steady in 2000.

"I believe there is increased consumption because of the Five-a-Day program and a general interest in healthy diets," Moore says.

*(continued on page 3)*

A Newsletter for Pest Control Advisers November 2000



WESTERN ADVISER

# Achieving even coverage through drip tape

Ever wonder how long it takes for solution to run through a drip-tape system? Knowing can improve uniformity of chemigation and cut down on wasted chemicals. For less than five bucks, you can have both.

"The answers are found using a simple pool-spa test kit," reveals Larry Schwankl, an irrigation specialist with the University of California Cooperative Extension. He recommends this: Inject chlorine at 10 to 20 ppm into your drip system, and determine how long it takes the chlorine to pass through the entire system. Injecting chlorine is preventive maintenance against biological clogging problems, too. Begin injecting chlorine, and note the time you start. Go to the end of the drip-tape run. If the tape is buried, dig around the tape until the pinhole emitter is visible. Begin collecting water samples here, and test them with the chlorine kit. When chlorine shows up in the water sample, take note of the time. Figure the difference between when the chlorine was injected and when the first positive sample was taken. That is the travel time for chemicals and liquid nutrients.

This test establishes a minimum injection time for soluble inputs or washing out the system after an injection. "A common mistake when chemigating with drip is to halt an injection too soon," Schwankl and his U.C. Davis colleague Terry Prichard found. "Some of the field ends up getting more chemical than others," Schwankl says. "Another thing we've seen is people shutting off the system right after the injection. Parts of the field a long way from the source may not get any chemical, or certainly less than what is applied at the head of the system."


*This $4.99 testing kit for swimming pools is an inexpensive tool for improving chemigation efficiency.*

"Solution moves more slowly through drip tape, especially at the tail end of the lateral drip runs," Schwankl says. This characteristic has led to some misunderstanding. "The idea frequently was that as soon as I start injecting, chemical starts coming out all over my drip system. That isn't the case," he says. "It has to move through pipelines and the drip tape until it's coming out all emission points."

As for fears of applying too much water or chemicals to plants nearest the source point, he explains: "It all evens out. When you start injecting, the chemical appears at the closest emitter and moves all the way to the end, with a delay. When you shut it off, the closest emitter clears first. There is a similar delay out to the far point."

*cont'd on page 3*

A Newsletter for Pest Control Advisers May 2001



WESTERN ADVISER

# Citrus Industry Watches for CVC

A bacterial citrus disease from South America is a much bigger concern now that the Glassy-winged Sharpshooter has fanned out across Southern California. Phil Phillips, who first reported the Glassy-winged Sharpshooter in the early 1990s in Ventura County, Calif., thinks it is likely that the wide-ranging sharpshooter could spread Citrus Variegated Chlorosis (CVC), should the disease be carried here from South America. So far CVC has not been detected in the United States, although it may be moving north into Central America and toward U.S. borders.

Both Pierce's disease and CVC occur when *Xyella fastidiosa* infects the host plant and eventually blocks water from moving through the plant's system. The blockage in citrus first causes spotting on leaf surfaces and leaf die-back, followed by collapse of the plant. A five-year-old citrus tree will likely succumb to CVC.

"A closely related sharpshooter species, along with several other species of sharpshooter and spittle bugs, has a 12-year history of vectoring the CVC strain of *X. fastidiosa* to citrus in Brazil, causing considerable damage and production loss," reports Phillips, an integrated pest management adviser with the University of California Cooperative Extension. Uruguay, Argentina and Paraguay also battle with CVC.

Phillips believes it's possible that the Glassy-winged Sharpshooter could vector CVC in the event that the disease leapfrogged from South America to the United States. The possibility that someone unknowingly might sneak in a rogue plant is a real concern, he says.

*Male and female Glassy-winged Sharpshooters*

"It could move all the way from South America in a year very easily," Phillips says. "All it takes is one grower bringing back an infected plant because he likes the budwood, and he thinks by propagating it, he can get ahead of the competition."

There is a growing awareness that CVC could arrive soon in the United States, and advisers and growers should be ready. An informal network of scientists in the U.S., Central and South America are tracking the movement of CVC. There has been an unconfirmed report of CVC in Costa Rica, which would indicate the disease may be moving northward toward the United States. With the Glassy-winged Sharpshooter established in

*cont'd on page 3*

A Newsletter for Pest Control Advisers June 2001



WESTERN IPM ADVISER

# Birds and Bees Fly.

## But, which direction? And, why should I care?

While a bird's flight path is rarely a concern to growers and PCAs, the flight pattern of pollinating honeybees is causing a buzz in the watermelon industry.

For years, watermelon growers have planted pollinators in separate rows, thinking honeybees traverse the field from right-to-left and left-to-right, like a crab.

But some watermelon growers, particularly those growing seedless watermelon or triploids, are planting the pollinators within the row, betting the pollinating bees will travel up and down the row, as the crow flies.

Watermelon grower Bob Dyer is a believer. "I haven't done any scientific studies tracking the bees but I've watched the bees and have talked with beekeepers, and they go up and down the row," says Dyer, who grows triploids in the West, in Mexico and all over the U.S. "They work in a straight line."

Planting pollinators in the row, coupled with the bee's straight flight path, has advantages. It brings bees closer to the flower. By working the row, honeybees don't have to jump the row to alight on blossoms in separate rows. They just follow the row's plant spacing, which is less than half the distance between rows.

For example, using the traditional method, a row of seedless watermelon stands next to a row of pollinators. When the young plant starts to bloom, the bees are still 80 inches from the rows. With in-row pollinators, the bees are only 30 inches away.

Doesn't sound like a big deal. But, it is. The bee with the straight flight path is more likely to jump from one plant to the next instead of back and forth. Depending on the growing area, Dyer plants a pollinator every second plant in the row.

The results for Dyer have been positive. He has seen earlier pollination and an earlier fruit set. And, like any crop, the earlier the fruit set, the earlier the harvest, and the earlier you have something to sell in the market.

Beekeeper Clyde Frings, who works with many triploid watermelon growers, backs up Dyer's premise. Bees travel up and down the row, he said. Maximum speed: 10 mph. Range: 2 miles a day.

There is one drawback to in-row pollinators with harvesting. The pollinator usually produces low-quality fruit. Harvesters need to be trained to distinguish the pollinator fruit from marketable fruit.

Typically, triploids produce round to slightly blocky fruit. Pollinators in North America usually produce longer fruit.

One way to minimize the harvesting problem is by producing a pollinator that produces little or no fruit, yet produces an enormous amount of pollen. Not only would harvesting complications be minimized, but less pollinators would be needed in the row and in the field.

Along these lines, growers are asking the industry for an all-male plant that produces no fruit. That way, they could plant one pollinator every five plants. They're also asking for a tall plant, one that doesn't get choked out by the seedless plant and is more accessible to bees.

Until researchers fill that order, in-row pollinators may be the way to go.

WESTERN ADVISER

A Newsletter for Pest Control Advisers July 2001



# America Has Spoken: Bring on the Lettuce

The lettuce head count is in. More Americans are eating lettuce than ever before, according to the U.S.D.A. Cobb salad at Denny's. Caesar salad at Ruth's Chris. Bagged fresh cut salad for lunch. And, an exotic Oriental salad at the dinner table.

The lettuce love fest increased so much that Americans chowed down an average of 33 pounds of lettuce in 2000 — an all-time high. And, it's not just your mainstay iceberg. It's all varieties. For example, to satisfy this hunger for lettuce, Romaine production alone jumped a whopping 162 percent this past decade.

With demand up, the industry has responded — delivering greater variety, more freshness and more convenience. At the supermarket, consumers choose from head lettuce to bagged lettuce to an upper-shelf Italian salad.

The leafy trend is likely to continue. Consider this: The U.S. produces more lettuce than any other country, except China. More than 99 percent of lettuce is grown in California and Arizona, with 96 percent of the iceberg and Romaine production and 98 percent of the leaf lettuce production.

Overall, U.S. lettuce production increased 16 percent since 1992, with leaf lettuce up 37 percent. Iceberg lettuce fell out of favor — it increased only 2 percent. But, there's a good reason. As the popularity of other varieties increased, iceberg sales decreased from 84 percent in 1992 to 73 percent in 2000.

Iceberg is still the most widely used. Americans ate 25 pounds per person per year of the stuff, second only to potatoes at 51 pounds. While Americans used nearly 7 billion pounds of iceberg in 2000, per capita use of iceberg declined 13 percent since its 1989 peak.

That slump has been offset by other varieties. For example, per capita use of leaf and Romaine lettuce has more than doubled since 1990, culminating in a consumption record of more than 8 pounds for those varieties in 2000.

Spurred by this rampant growth, the fresh-cut industry has grown quickly. In 1993, about 55 companies sold 197 fresh-cut salad types in American supermarkets with sales totaling $197 million. By 1999, these same firms were selling 459 items, and sales skyrocketed to $1.3 billion.

Momentum doesn't seem to be slowing. But changes are afoot within the industry, out of sight of supermarket shelves.

The U.S.D.A. predicts sales and marketing arrangements in the lettuce industry will continue to change as markets for lettuce and fresh-cut produce evolve. For example, analysts note the relationship between shippers and their customers is becoming more formalized.

*cont'd on page 3*

A Newsletter for Pest Control Advisers August 2001



WESTERN AGRI VISE

# Fertilization Management Vital to Desert Crops

Plant it. Water it. Fertilize it. Harvest it. Sell it. Yeah, right.

Among those oversimplified tasks lurk thousands of variables that stand in the way of a successful crop.

One of those tasks is fertilization... particularly nitrogen.

Fertilization in desert crops is a delicate art: Under-fertilization can lead to crop loss of plant vigor, an open door to pests and small, unmarketable fruit.

On the other hand, over-fertilization can raise production costs and, in the case of nitrogen, pollute groundwater.

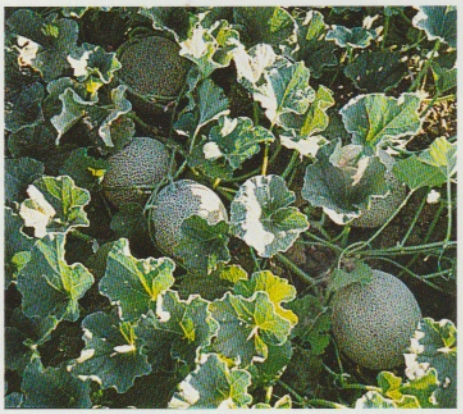
Good nitrogen management is a key ingredient for successful desert crops like lettuce and melons.

According to University of Arizona research with melons, nitrogen (N) and phosphorus (P) are the nutrients with the greatest influence on yields. Without fertilization, desert soils can rarely supply enough of these major nutrients.

However, desert soils do supply adequate potassium (K). Under some conditions, potassium shortfalls may occur. This occurs with melons following alfalfa, very sandy soils or early planted fall melons.

A well-fertilized melon crop yielding 20 to 30 tons per acre will take up about 90 lb N/acre, 25 lb P/acre and 150 lb K/acre. A watermelon crop yielding 30 to 40 tons per acre will take up 100 lb N/acre, 30 lb P/acre and 160 lb K/acre.

Keep in mind nitrogen is easily lost from soils because of nitrate leaching and volatilization of



*Fertilization management is key to successful crop production in the desert, particularly melons.*

gases. Therefore, the University of Arizona recommends that nitrogen be split into two or more applications during the season.

These applications should be guided by feedback from leaf petiole samples collected at various growth stages, beginning at the 3 to 4 leaf stage. The leaf sample should be the youngest leaf.

Lettuce crops are even hungrier for nutrients. Lettuce produced on low desert soils requires from 150 to 300 lb N/acre for the best yields, according to the University of Arizona.

Actual rate will vary depending upon residual soil nitrogen, soil texture, irrigation and rainfall.

As with melons, split applications of nitrogen are usually more efficient than a single preplant application. Why? Because nitrogen in the soil is subject to leaching, de-nitrification and other mechanisms of loss during the growing season.

About 50 lb N/acre is a good preplant

*cont'd on page 3*

A Newsletter for Pest Control Advisers March 2002



WESTERN IPM ADVISER

# Curly Top Virus Under Investigation

The tomato industry is puzzled by a severe outbreak of curly top virus that struck crops in the San Joaquin Valley in 2001. The virus is vectored by the beet leafhopper and attacks peppers, beans, melons and sugar beets. Outbreaks of the disease may vary in strength, but typically do not inflict major losses.

Last year, however, curly top caused widespread damage in tomato crops over a broad area on the west side of the Valley. Fresno County was hit the hardest, but Kern, Stanislaus and Monterey Counties were also affected. Many fields experienced six to eight percent losses; but, in a few cases in Fresno County, yields were as low as 14 tons, rather than the typical 40 tons per acre. The worst damage occurred in processing tomatoes, but some fresh market tomatoes also were damaged.

A large population of leafhoppers, which overwinter in the foothills, caused the problem, says Bob Peterson, an entomologist with the California Department of Food and Agriculture (CDFA). A buildup of weeds and an abnormally dry, warm winter led to a high number of insects. However, other aspects of the outbreak have piqued the interest of researchers. Why were tomatoes affected more than other crops? Why did the outbreak persist throughout the season, rather than peaking at a particular time as it normally does?

One possibility is that there was a genetic change in the virus that caused a change in behavior. There are at least three strains of curly top virus, each distinguished by the plants it prefers. Bob Gilbertson, a UC-Davis plant pathologist, is studying virus DNA from samples of infected plants to determine whether a known strain or a new strain is responsible.

*The damaging effects of curly top virus on tomatoes.*

In the long term, the curly top virus DNA could be useful in an early warning system to predict where outbreaks might occur. Using a molecular technique, the polymerase chain reaction (PCR), the viral DNA can be detected inside leafhoppers. By identifying virus-carrying leafhoppers, growers could alter planting schemes and/or spray programs to target potential hot spots, says Gilbertson.

Cultural practices also may have played

*cont'd on page 4*

A Newsletter for Pest Control Advisers April 2002



WESTERN AGRI-VISE

# Air-injected Water Increases Yields

Injecting air into subsurface drip lines in some row crops may increase yields, according to research conducted at the Center for Irrigation Technology (CIT) at California State University (CSU), Fresno. Bell pepper plants produced 33 percent more peppers with 39 percent greater weight when air was injected into the drip line.

The research was done on quarter-acre plots with drip lines buried 5 to 6 inches in plant rows that were 190 feet long. The water had a volume of about 12 percent air. The crop was irrigated using California Irrigation Management Information System (CIMIS) evapotranspiration data.

The study was based on the hypothesis that aerating the irrigation water would facilitate air to move with water into the root zone, thereby enhancing root zone aeration. Well-aerated soil is known to improve growing conditions for the roots. The results of the study found that plants that received aerated water developed larger root mass.

"Roots seek out areas of aeration," says Dave Goorahoo, a research soil scientist at CIT. "Air-injected water may be creating a better environment for root growth and a healthy root system leads to a healthy plant, which leads to less overall stress and the plant's ability to produce more."

The next phase of the research is to conduct the same experiment on commercial size plots. One question researchers have is how the length of the drip lines might affect results. Will the air reach the entire length of subsurface drip?

*Air bubbles are delivered to plant roots via subsurface drip irrigation water. Photo courtesy of Mazzei Injector Corporation.*

As the length of the drip tape increases, does the efficiency of the air distribution decline? The additional research will measure water pressure and velocity along the drip tape.

In the summers of 1999, 2000 and 2001, the process was tested on a commercial farm by Angelo Mazzei, of Mazzei Injector Corp., Bakersfield, Calif. Mazzei used equipment he had invented to inject air into subsurface drip irrigation systems (Mazzei Airjection® Irrigation). The process was tested on 80 acres of bell pepper plants in rows 640 feet in length. The results produced increased yields of up to 12 percent.

*cont'd on page 4*

WESTERN IPM ADVISER

A Newsletter for Pest Control Advisers June 2002



# Solar Power Inhibits Melon Disease

A novel approach under investigation this year could give growers more control over a major melon disease. Mike Stanghellini, plant pathologist at UC-Riverside, has been experimenting with "solar power" to reduce the population of *Monosporascus cannonballus*, a fungus that attacks vine roots. The disease, called melon vine decline, is a widespread, potentially devastating problem in California's Imperial Valley.

The unique symptom of melon vine decline is a grower's worst nightmare: One or two weeks before harvest, the crop looks fine. Then, one morning, the grower discovers the entire canopy has collapsed from lack of water, leaving an unmarketable crop of sunburnt melons.

Research in Stanghellini's laboratory has found that the fungus reproduces on infected melon roots primarily at the end of the growing season. High temperatures trigger a high rate of reproduction. Destroying roots as soon as possible after canopy collapse should reduce pathogen reproduction.

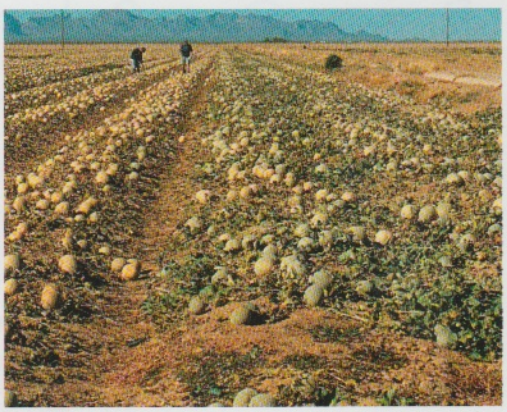
However, research has shown that destroying only the vine and leaving roots in the ground actually makes the fungus grow faster, says Stanghellini. Applying a herbicide to kill the tops of plants also spurs the fungus to reproduce at a higher rate.

A new tactic to inhibit reproduction on roots uses the heat of the desert sun to destroy the fungus. Stanghellini is experimenting with killing the fungus by exposing the roots to sunlight. Right after canopy collapse or harvest, he uses cultivating equipment, such as a carrot lifter, to lift the roots to the surface.

Stanghellini has found that exposing roots to the sun for seven days will kill 80 percent of the fungus. The time for implementing this practice is brief, however. The grower only has a three-week window from the time of collapse to stop reproduction of the fungus. "It is the same concept as killing weeds before they go to seed," says Stanghellini.

Last June (2001), Stanghellini used this tactic in an Imperial Valley field. After "cooking" the exposed roots, he plowed them back into the soil. This year's crop was planted in the same beds. Did the solar cooking destroy the fungus sufficiently? The answer lies in the current crop.

"Cooking them on the surface killed 80 percent, but the fungus persisted on 20 percent of the roots," he says. "We want to see if we stopped enough so the fungus can't reproduce."



*A field of collapsed melon vines, due to melon vine decline. Image courtesy of Michael Stanghellini, UC-Riverside.*

*cont'd on page 4*

A Newsletter for Pest Control Advisers July 2002

# Western Ag Advisor

ADMIRE® BAYTHROID® PROVADO® FLINT®

## Chemical Control Still Viable

Just as the old saying goes, "Make new friends, but keep the old," farmers are finding that while "soft" pesticides may have their place in the fields, conventional chemical control is still essential in keeping down most pests in vegetable row crops.

In a recently completed integrated pest management (IPM) study, researchers found that "soft" pesticides, in fact, cost three to nine cents more than standard control practices to produce a carton of row crops.

Growers, pest control advisers (PCAs), pesticide manufacturers and the University of California Cooperative Extension (UCCE) conducted the three-year $450,000 Central Coast Vegetable IPM Project, funded by Pew Charitable Trust. The study was designed to test the efficacy of "soft" pesticides compared to conventional chemicals.

The project was carried out at 46 field demonstrations on 667 acres along the central California coast. "In a nutshell, what we found was that we were successful in not losing any crop quality or quantity due to alternative approaches, but alternative approaches turned out to be more expensive," says Bill Chaney, the Monterey County farm adviser, who coordinated the project.

Researchers also found that there were "holes" in the softer insecticide programs in test fields that had to be augmented by conventional chemicals. "One of the things that complicated our study was that while we were aiming our efforts at leafminer, a new lettuce aphid arrived," Chaney explains. Because the chemistries being tested were not providing solutions to the problem, Chaney turned to traditional control methods to fight the pest.

*A recently completed IPM study focused on leafminer control. Adult leafminer image courtesy of Bill Chaney.*

Ed Mora, pest control adviser for D'Arrigo Brothers, Co., a 12,000-acre vegetable company that participated in the IPM project, says that the introduction of new pests in IPM fields is a general cause for concern among growers.

"When this new aphid came in, it was a huge problem. It threw everything we'd been doing out the window. IPM was risky – a gamble – with this new aphid. You have to really watch the fields closely," says Mora.

In test fields where growers planned on solely using "soft" pesticides, 38 percent of head lettuce fields, 29 percent of romaine fields and 100 percent of celery fields had to fall back on conventional chemicals, according to Chaney.

"One of the things the study showed is that it is important for regulators and the public to know that we have a need for conventional chemicals, which are critical for maintaining the current production and economics of our current farming system," Chaney says.

In some farming situations such as lygus, which is a serious pest in celery, farmers have no alternative but to use broad-spectrum pesticides, says Chaney. Other pests, such as root maggots, which live and breed in the soil are best treated by broad-spectrum pesticides

*cont'd on page 4*

A Newsletter for Pest Control Advisers August 2002

WESTERN IPM ADVISER

ADMIRE® BAYTHROID® PROVADO® FLINT®

# Technology Aids in Lygus Bug Control

In the same way that the military uses geographic information systems (GIS) and satellite photography to help detect the position of enemy camps, growers and pest control advisers (PCAs) may soon be able to use this technology to pinpoint the exact location and migration of pests.

In the long run, this technology might save time and money fighting certain pests, especially lygus. Lygus, also known as Western tarnished plant bug, is a native pest in California that attacks beans, lettuce, strawberries, cotton, alfalfa, broccoli, cauliflower and tree fruit.

*Satellite technology may help pinpoint when and where lygus bugs will attack. Image courtesy of Bill Chaney, UC-Davis.*

"Because lygus has such a wide variety of hosts, it is often difficult to predict when and where the pest will strike," says Pete Goodell, a pest management scientist at the University of California-Kearney Agricultural Research Center in Parlier, Calif.

Unlike pests such as scale, which originate within given fields at predictable times, it is hard to predict when lygus might strike. "Lygus builds up in various crops and, as one crop is harvested, the pest moves from one host plant to the next one that is available. In order to understand what lygus might do, you have to understand what crops are surrounding a particular area," Goodell explains.

Using satellite and GIS technology, PCAs can get a better idea of what type of crops surround their growers' fields. They can also track the movement of vegetation in the nearby foothills from where the lygus is likely to spread.

As plants dry in the foothills when the warm weather starts and the rain stops, lygus begins looking for new homes in Valley agriculture. Lygus can be a serious problem for fall lettuce growers in the San Joaquin Valley when the last of the cotton is harvested and lygus, searching for new host plants, moves into lettuce fields.

"However, in areas where alfalfa — a preferred lygus host plant — is available year-round, lygus is less likely to inflict damage on surrounding vegetable fields," says Goodell. Knowing this, growers might take into account the proximity of alfalfa fields when planning their vegetable row crops.

"Being aware of surrounding vegetation and using tools such as satellite and GIS systems are an important part in protecting vegetable crops from lygus, because, by the time the pest strikes, it is often too late to do anything about it," says Bill Chaney, University of California Cooperative Extension entomology farm adviser in Salinas, Calif.

In the Salinas area, lygus tends to be a serious problem in celery, as well as in broccoli and cauliflower fields shortly after transplanting. "If lygus feed on the cauliflower and broccoli plants shortly after transplanting, it causes them to not form a marketable head," Chaney says. In celery, lygus can cause

*cont'd on page 4*

A Newsletter for Pest Control Advisers October 2002

WESTERN IPM ADVISER

ADMIRE® BAYTHROID® PROVADO® FLINT®

# Altering Pre-irrigation and Bed-shaping Practices May Reduce Weeds and Input Costs

Sometimes, it seems, the smallest changes can make the biggest differences. Recently, scientists have discovered that by slightly altering their pre-irrigation and bed-shaping practices, vegetable farmers can reduce their weeds by 25 percent and cut herbicide costs by as much as 50 percent.

While most farmers pre-irrigate their fields one to two weeks before planting in order to soften up their beds, pre-irrigation, applied at the right time, can also significantly reduce the proliferation of such weeds as burning nettle, sow thistle, shepherd's purse and nightshade, says Steve Fenimore, a University of California Extension specialist at Salinas, Calif.

"The idea is that if you stimulate the growth of the weeds to emerge prior to planting, when you till your soil and plant your crops, you're also clearing out the weeds at the same time. Basically it's free weed control, since you have to do the tillage and pre-irrigation anyway," Fenimore explains.

In his weed study, Fenimore compared pre-irrigated fields to fields that had not been pre-irrigated before planting.

"What we found was that in some test fields we needed to use 1.2 pounds of herbicides in fields that weren't pre-irrigated vs. 6/10 of a pound of herbicides in fields that were pre-irrigated. This showed very clearly that pre-irrigation has a very large benefit in weed control," says Fenimore.

Fenimore also tested the effects of furrow vs. sprinkler pre-irrigation.

While sprinkler pre-irrigation worked best for most shallow-rooted weeds, furrow pre-irrigation did a better job in reducing the population of deeper-seeded burning nettle weeds.

Burning nettle, which is a very common weed in Salinas, prefers germinating in the dark as opposed to the light. As a result, this weed tends to germinate deeper in the soil, adds Fenimore.

"If you wet the soil more deeply through furrow irrigation instead of sprinkler irrigation, you do a better job of stimulating the weeds deeper down, and you get more of a thorough kill," Fenimore says.

*Timing of pre-irrigation is important when using furrow irrigation, and it can help reduce the proliferation of weeds. Image courtesy of Shachar Shem-Tov, postgraduate student at Salinas Extension Center, Salinas, Calif.*

*cont'd on page 4*

A Newsletter for Pest Control Advisers March 2003



WESTERN ADVISER

# Curly Top Virus Makes Its Way Through Fields

## *Implications of transplanting versus direct seeding*

Many tomato growers in the Central San Joaquin Valley in California have recently switched over from direct seeding their fields to using transplants. Although an effective means of increasing field productivity, transplanting also creates a higher degree of susceptibility for plants to get hit by a dangerous viral plant disease: curly top.

Curly top is a virus that is vectored by the sugar beet leafhopper, stunting tomato plants and drastically decreasing yields. "There's curling of the leaf and a graying of the plant," says Charles Rivara, director of the California Tomato Research Institute.

Approximately 95 percent of processing tomato growers now use transplants in their fields. Researchers believe this vast majority has caused an upsurge of the virus in today's fields.

When growers redistribute their transplants, they generally place 6,000 to 7,000 plants per acre. When growers utilize a direct-seeding program, they plant 50,000 to 80,000 seeds per acre, according to Rivara. A majority of these seeds, when they germinate, get thinned out of the fields.

But before they're thinned, they offer the field a certain amount of protection against curly top virus.

*The damaging effects of curly top virus on tomatoes.*

"If we have a virus that's going through these plants and killing them off, unlike a lot of other crops, tomato plants will compensate for missing plants," says Rivara.

This means that the plants on each side of an infected plant will take over and compensate for the missing plant. Since there are fewer transplants than seeded plants in the field, there are fewer plants to compensate when curly top strikes.

*cont'd on page 4*

# Growers Consider Benefits of Drip Irrigation

*Broccoli growers reap benefits from drip irrigation option.*

As water continues to become a more precious and expensive commodity in the West, more farmers are considering the benefits of drip irrigation.

In the more arid parts of California and in Yuma, Arizona, only a relatively small minority of broccoli growers are using drip, according to Tom Thompson, associate professor of soil science at the University of Arizona-Yuma.

Over the past several years, researchers such as Thompson have been studying the benefits of drip vs. sprinkler or flood irrigation.

"In general, what we found is that water savings of up to 20 percent can be achieved with drip irrigation, and you can apply less nitrogen – maybe 10 to 20 percent less," says Thompson.

Growers need to use less fertilizer, since less nitrogen is leached into the fields when drip irrigation is used. This is important not only in terms of saving money on fertilizer, but also in meeting federal and state regulations to keep groundwater clean.

"Nitrate is the most widespread of all groundwater contaminants," says Thompson, "and much of it comes from leaching of nitrates into agricultural fields."

This is the first year that researchers are doing side-by-side tests comparing drip-irrigated broccoli fields to furrow-irrigated fields. Preliminary findings show that broccoli in the drip-irrigated fields out yielded broccoli in furrow-irrigated fields. Another advantage of drip irrigation is that it produces consistent quality and yields in row crops.

The benefits of drip irrigation, though, are more than just higher yields and lower water requirements. Growers who use drip irrigation have the upper hand, since they achieve great choice and decision-making ability with their vegetable irrigation. Also, with drip systems, farmers can run fertilizers through their lines every time they irrigate.

"The beauty of drip irrigation is the great flexibility it gives you with water and fertilizer applications," says Thompson. "If you have to sidedress the fields, you go through the extra cost and trouble of running equipment through the field."

There are two different ways to set up fertigation systems in the field. The first option is to have a system permanently installed in the field. The lower cost alternative is a mobile filter and pump station which travels around to different fields.

According to recent studies, it makes no difference to the outcome of the crop whether it is fertilized in small doses every day or in large doses every month. Thompson believes this is good news for growers who don't have the ability to fertigate every day.

Since drip-irrigated fields have a tendency to build up fewer salts in the soil than furrow-irrigated fields, growers also have greater flexibility in using saltier, lower quality water when irrigating their fields.

"You can run pretty salty water through the lines," says Thompson. "But sometimes it may be necessary to flush out some of the salts (by flooding the field). My sense, though, is that this is only necessary in fairly extreme situations."

In choosing a drip irrigation system, growers can opt for subsurface or surface drip systems. Subsurface drip is more expensive than surface systems. However, well-installed and maintained subsurface systems last much longer than surface systems. In either case, drip irrigation as a whole seems to be an up and coming trend among growers today. Its effectiveness and increased level of control provide growers with a new facet of irrigation options.

WESTERN ADVISER

A Newsletter for Pest Control Advisers May 2003

# Investigating Lettuce Cultivars for Resistance to Fusarium Wilt

## *Identifying Fusarium wilt can be difficult to distinguish from Verticillium wilt.*

Since there is no known cure for Fusarium wilt, a soilborne disease that invades lettuce fields, researchers have been screening possible lettuce cultivars that might have resistance or at least tolerance to the disease.

Fusarium wilt was discovered in Yuma, Ariz., in the 2001 growing season. "The next year the proliferation of Fusarium wilt doubled," says Michael Matheron, extension plant pathologist at the University of Arizona's Yuma Agricultural Center.

"If left unchecked, lettuce fields can lose up to 100 percent of their yields," Matheron says.

Fusarium wilt is most destructive in the early planted lettuces in September, during the warmer parts of the growing season. "We find that the disease goes from very severe in the fall to moderate in the winter to much less of a problem in spring," Matheron says. "The disease also seems to prefer head lettuce varieties compared to romaine cultivars."

In completed field trials, Matheron discovered that the disease killed 95 percent of head lettuce plants, 75 percent of butterhead type lettuces, 60 percent of greenleaf lettuces and 18 percent of romaine cultivars.

"Growers usually don't detect evidence of Fusarium wilt until November or December, but the disease can strike anywhere between germination through maturity," Matheron advises.

Some symptoms of the disease include stunting of the plant; wilting of the leaves and having an appearance of water deficiency. The initial symptoms of the disease resemble Verticillium wilt, a soilborne disease that has become a problem in lettuce fields in Salinas County, Calif.

One distinguishing characteristic between the two diseases is that Fusarium wilt has a distinctive reddish brown discoloration at its taproot, which can extend into the core of the lettuce.

It's important to note that while there are fungicides that can control Verticillium, once Fusarium wilt infects a field, it's there to stay.

*Fusarium wilt has a distinctive reddish brown discoloration at its taproot, which can extend into the core of the lettuce. Image courtesy of Michael Matheron.*

"We don't know how long Fusarium lasts in the soil, but it could easily be 10 or 20 years," says Matheron.

One thing farmers can do to prevent the Fusarium wilt from spreading is to take extra care that soils from good fields don't become cross-contaminated with infected fields.

"Anything can spread contaminated soil. Workers going from one field to another could get soil on their shoes and carry the disease. Any type of implement, such as a tractor that moves from field to field, can contaminate new fields," Matheron said. Surface running water and laser leveling can spread the disease from one end of the field to the other.

"Growers who discover Fusarium wilt in their fields should probably let them go fallow, and plant somewhere else," Matheron says. However, if this isn't a possibility, the best alternative is for the grower to plant the fields with romaine in the springtime when Fusarium wilt is least likely to be a problem.

WESTERN IPM ADVISER

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# Researchers working towards new nematode controls in carrots

Root knot nematodes, including *Meloidogyne javinca*, afflict almost every carrot field in California. An outbreak can cause disfiguring in the carrots, including forking, galling and stubbing.

"Carrots become unmarketable if the roots are damaged. They must have perfect or near perfect roots to be marketable," said Joe Nunez, vegetable plant pathology farm adviser in Kern County.

While growers have been accustomed to fumigating their fields every season, fumigations can cost $200 to $300 per acre, according to Phillip Simon, a U.S. Department of Agriculture plant geneticist. Growers might be able to save money with nematode-resistant carrot varieties, which are likely to be on the market within the next few years, Simon said.

Simon, who is well known for his work in enhancing beta carotene in carrots, has recently discovered that a Brazilian carrot, "Brasilia," appears to be resistant to *M. javinca* as well as *M. incognita*, a related nematode.

Although the Brasilia is not suited for California soil, Simon said that researchers are currently working on breeding traits from the Brasilia with traits from California carrot varieties.

"There is one gene in the Brasilia that seems to be (nematode resistant). We're in the process of incorporating that gene into a wide range of carrots and working with seed companies to bring the gene into carrots for California production," Simon said.

Finding alternative methods to fight soil-borne diseases, such as using resistant varieties, is important, since fumigants like methyl bromide are becoming less available to growers, Nunez said.

One of the interesting discoveries about the Brasilia is that it contains a gene that is very similar to a gene found in nematode-resistant tomato varieties. If researchers can isolate these individual genes in tomatoes and carrots, it could have far reaching implications for other row crops that are afflicted with nematodes, Simon said.

Meanwhile, University of California researchers are studying the relationship between nematode resistance in carrots and high temperatures, Nunez said.

"Nematodes are very temperature dependent. If you plant carrots in cool weather in December and harvest in the spring before the weather warms up, you can pretty much avoid nematodes," Nunez said.

Although many Kern County growers plant carrots in the spring, knowing how nematodes and warm temperatures are related may help farmers pinpoint the best times of the year to fumigate their fields.

Scientists also are doing additional research with "trap crops". The idea is that growers would plant a nematode-susceptible crop, let it get infected by the soil-borne disease, and then kill the plant with an herbicide.

"If the young plants are killed, the nematodes aren't able to finish their life cycles. Therefore it reduces the nematode population in the soil before farmers plant their carrot crops," Nunez said.

Bayer Chemical corp

A NEWSLETTER FOR PEST CONTROL ADVISERS JUNE 2003

WESTERN IPM ADVISER

# Researchers working towards new nematode controls in carrots

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# Mustard cropping offers many advantages

As the government imposes increasingly tougher rules and regulations on California agriculture, farmers will need to become more creative to survive economically.

Farmers have become more concerned about talks in the state legislature that could lead to a ban on hand weeding, as well as regulations requiring farmers to get permits on the days they want to disc their fields to keep dust down.

No such regulations have yet been made, but with a state legislature whose membership with agricultural backgrounds consists of less than two percent, farmers increasingly are worried that it's only a matter of time before the government starts affecting more of their day-to-day operations.

One recent discovery that may help farmers is the finding that growing mustard plants on farmland could help improve soil conditions and suppress dust on windy days.

Dust suppression especially is important in the California desert, where high winds and encroaching urban development make it tougher for farmers to disc their land without their neighbors complaining.

*Some Kern County vegetable growers are experimenting with mustard cropping to reduce dust, add biomass, and possibly serve as a bio-fumigant.*

The advantage of mustard is that it is a quick-growing crop with a high biomass that may help improve soil fertility. Mustard also suppresses weeds and soil-borne diseases, especially in carrot and potato fields, said Joe Nunez, vegetable plant pathology farm adviser in Kern County.

"We're looking to see if this will solve some soil problems with nematodes and various soil fungi. This is an alternative method (to fumigants), and it's cheaper and more applicable in some situations," Nunez said. In addition to its large biomass, mustard contains a chemical, glucosinolate, within its cells that gets released when mustard plants are disked into the ground. The glucosinolate acts as a natural fumigant which helps cleanse the soil, Nunez said.

The bio-fumigation works for three to four days, whereas chemical fumigants, such as methyl bromide last from 7 to 10 days, Nunez said.

Although the glucosinolate doesn't work as long as chemical fumigants, the mustard may be a good alternative as a soil cleanser to methyl bromide, which is scheduled to be phased out by 2005. Mustard also adds organic green matter to the soil and may reduce soil borne disease pressures over time, Nunez said.

"When you add organic green matter, you provide a source for all microbes in the soil that can inhibit plant pathogens," Nunez said. Adding organic matter also makes it easier to till the soil, reduce erosion and compaction, and increase water penetration and the soil's ability to retain water.

Since mustard is fast growing, it doesn't use up any space that would normally be allocated to other crops, Nunez said.

"We have a perfect window of opportunity for planting mustard in Kern County in the fall, during a time when the fields are generally fallow," Nunez said.

Vegetable growers in Washington state have already had good success in using mustard as a bio-fumigant, Nunez said, but this is the first year Kern county growers are trying mustard plants.

"Right now, it's a matter of waiting to find out what kind of effect the various soil microorganisms (from the mustard) are going to have on the crop," Nunez said.

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# Salt-tolerant vegetables research gains steam

Most California vegetable growers have to contend with the buildup of excessive salt deposits in their fields caused by salty underground water sources.

While vegetable growers on the California coast experience problems with saltwater intrusion from the ocean, vegetable growers inland, in the San Joaquin Valley, experience problems because they have no nearby water sources to discard the salt deposits.

According to Stephan Grattan, a UC Cooperative Extension plant-water relations specialist, University of California, researchers have published comprehensive guidelines about which crops are more salt sensitive and which ones are more likely to fare better in salty soils.

"We're trying to find potential crops that can be used in salty water," he explained. "Generally, vegetable crops are fairly sensitive to salt, but some vegetables are more tolerant than others. Broccoli and cauliflower are more tolerant than lettuce; artichokes are more tolerant than broccoli; and asparagus is the most tolerant."

In some cases, salty water will reduce plant size. In other cases salinity can actually improve quality, as in the case of tomatoes and cantaloupes, where salt helps increase solids in the fruits. While few growers would choose to farm land high in salinity, there are some things growers can do to mitigate the negative affects of salty water.

"Growers with salinity problems find their crops suffer much more damage if they water their fields with sprinklers rather than using furrow or drip irrigation. Sprinklers will cause some of the salt to go directly onto the leaves of the plants which can cause more injury," Grattan said.

One of the few advantages of salty groundwater is it increases the amount of nitrates in the soil. "While nitrates can be problematic from a drinking standpoint, it can be used as a resource for growers who may want to scale back on their fertilizers," Grattan said.

Generally growers avoid using salty water on crops even though there can be problems if the irrigation water isn't salty enough. "If the water is too pure, it has a hard time penetrating the soil. It's a phenomenon that causes water to pond up on the soil surface. If you get water logging like this, you could have problems with root disease," Grattan said.

Growers who use Sierra Nevada water in the eastern San Joaquin Valley, which has very little salt, can alleviate some of these problems by adding gypsum into their irrigation water.

Since more growers have problems with water that is too salty versus water that isn't salty enough, researchers are looking into which crops "love" salt. "So far, researchers have discovered that salicornia, a pickle weed plant, grows particularly well in salty soil," Grattan said.

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>
> Stephan Grattan
> UC Cooperative Extension plant-water relations specialist
> University of California

"It's a strange plant; however, it can be used as a vegetable crop. Some gourmet restaurants use the pickle weed shoots instead of salt," Grattan said.

"The plant also produces a seed that can be made into an oil of very high quality comparable to safflower oil," Grattan said. "The plant hasn't been domesticated yet, and there's a lot of genetic variability to it, but there is still some genetic work being done on it."