The Vegetable and Small Fruit Gazette

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Horticulture Department
The Pennsylvania State University
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In this Issue:

Tip for the Month: : "Life isn't a matter of milestones but of moments"-Rose Kennedy

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Comments from the Editor

Bill Lamont, Department of Horticulture

This is a month when activity in the fields really begins to speed up. We are starting to lay plastic and have transplanted onions on plastic in the field. In the high tunnels things have been active for some time, with planting of early red potatoes, peppers, eggplant and tomatoes and also harvesting beautiful lettuce, kale and an assortment of other greens. We continue to collect excellent environmental data inside the high tunnels compared to the outside that we will share in this publication, on the Center for Plasticulture website: http://plasticulture.cas.psu.edu and at upcoming workshops and in the High Tunnel Manual to be published in June. I want to thank Tom Butzler for his excellent article **"The Evolving Pesticide Industry"** in this issue of the Vegetable and Small Fruit Gazette. We have Laura McNutt on deck for an article for the June issue. I

am adding meetings, field days and twilight meetings to the Upcoming Meetings List. If you have an event that you would like to advertise, please send it to me. As always, the Vegetable and Small Fruit Gazette Team encourages your feedback so that we can better serve your needs and address your concerns.

Schedule for Agent Articles

Bill Lamont, Department of Horticulture

June	Laura McNutt
July	Steve Bogash
August	Mary Conklin
September	Eric Oesterling
October	Cheryl Bjornson
November	John Esslinger
December	Andy Muza

The Evolving Pesticide Industry

Tom Butzler, Extension Agent, Horticulture/Integrated Pest Management, Clinton County

Many of you are aware of the pesticide history during the 20th century. Synthetic pesticides did not play a major role in agriculture during that century until the aftermath of the two great world wars, especially World War II. Worldwide industries that focused research and production on the war efforts now had to reconfigure themselves for peaceful purposes. The chemical industry in particular needed to find new uses for its products and facilities.

The most common example of this transformation, and one many are familiar with, was DDT. DDT was discovered by a Swiss scientist while trying to find a chemical that could be used on war refugees to eliminate typhus spreading vectors. Because of this discovery, DDT was used in many war theaters to eliminate disease-carrying insects. After the war, DDT was introduced to the farms as a way to control plant pests.

Many of the pesticides introduced in the decades following WW II were very effective in controlling pests but presented some troubling challenges and problems. Some

products persisted in the environment for long periods of time, accumulated in living organisms, presented worker safety concerns, or was so broad spectrum that they affected many non-target organisms. The Environmental Protection Agency and pesticide companies knew these issues had to be addressed and started a quest to find safer products. As a result, the 1996 Food Quality Protection Act was passed which created incentives to agricultural chemical manufacturers to register new products, "reduced risk pesticides", that have environmental and human safety advantages over older products.

Two recent examples of reduced risk pesticides are the strobilurins and callistemone. Strobilurins, a novel class of fungicides was inspired by naturally occurring chemicals produced by wood-rotting mushrooms. Strobilurins are variants of the naturally occurring strobilurin A which is the substance the pine cone fungus (*Strobilurus tenacellus*) uses to fight off other fungi which compete for its food, the pine cone. These naturally occurring chemicals are not themselves suitable for use in agriculture because they are fairly unstable molecules in the environment. However, knowledge of their chemical structure allowed pesticide companies to design and synthesize similar molecules. Strobilurin products have been in use the past couples years for control of various plant pathogens; Quadris for use on many vegetables and Heritage for use in the green industry.

A more recent "reduced-risk" product to hit the market is a novel class of herbicides, callistemone. According to Syngenta, a company scientist noticed that very few weeds grew underneath a *Callistemon citrinus* plant in his garden. He concluded that the plant must have an allelopathic effect on surrounding vegetation. Tests were conducted and the allelopathic substance was isolated. Further lab work synthesized related compounds to improve its efficacy. This all led to the release of the herbicide Callisto (common name, mesotrione). At this time, mesotione is labeled for use as a post-emergence on field corn for broadleaf control.

It is pretty interesting to see how scientists are observing organisms interacting in our surrounding ecosystems and using some of nature's innovations for agriculture. I planted my tomato plants a little too close to a walnut tree last year and they did very poorly. That makes me wonder if anyone has looked at walnut wilt as a herbicide.

Crop Yields for Vegetables and Small Fruits Grown on Raised Beds with Plastic Mulch and Drip Irrigation

Mike Orzolek and Bill Lamont, Department of Horticulture

Use of raised beds with plastic mulch and drip irrigation for the production of vegetable and small fruit crops will result in higher crop yields and quality compared to bare ground culture. Yield as determined by variety, production system, environment, soil type and location will vary; the reason why a range of marketable yields are presented in the Table below.

Crop	Marketable Yield
Cantaloupe, eastern type	5,000 - 7,000 fruit/A or 10 to 15T/a
Cantaloupe, western type	12,000 - 16,000 fruit/A
Cucumber, slicing (32 lb bu)	1,000 - 1,400 bu/A or 16 to 22 T/A
Bell pepper (32 lb bu)	1,200 - 1,800 bu/A or 18 to 28 T/A
Tomato, fresh market (25 lb carton)	2,200 - 2,800 box/A or 32 to 40 T/A
Summer squash (24 lb 5/9 bushel)	600 - 1,000 bu/A or 8 to 12T/A
Watermelon	2,500 - 5,500 fruit/A or 10 to 12T/A
Acorn squash (20 lb carton)	800 - 1,000 carton/A or 8 to 10 T/A
Butternut squash (40 lb carton)	900 - 1,200 carton/A or 18 to 24 T/A
Eggplant (22 lb carton)	900 - 1,300 carton/A or 10 to 14 T/A
Sweet Spanish onions (40 lb carton)	1,000 -1,400 cartons/A or 22 to 28 T/A
Pumpkin	28 - 32 T/A
Early sweet corn	1,200 - 1,600 doz./A
Strawberry	15,000 - 20,000 lbs/A

New Herbicide for 2002

M.D. Orzolek, Department of Horticulture

The herbicide Sandea from Gowan Co. has been granted a 24C (special local needs) label for the state of Pennsylvania. Sandea is labeled for use in cantaloupe, cucumber, pumpkins and winter squash. Sandea is not labeled for use in watermelon. For use in cucumber and cantaloupes, Sandea will control several broadleaf weeds, but will not control grasses; therefore, be sure to include a grass herbicide in your weed control program with this material. Sandea can be applied either as a pre-emergence or post-emergence application. For pre-emergence application the rate is 0.50 to 0.66 oz/A in a minimum of 15 gallons water per acre. For best results, tank-mix with either Prefar (especially if irrigation is available) or Command for grass control. Optimum weed control is achieved if 0.25-0.50 inches of water from rainfall or irrigation is received within 3 days of the application. For post-emergence application, the rate is 0.5 to 0.66

oz/A in a minimum of 15 gallons of water and a nonionic surfactant. Treat when plants are in the 2-5 true leaf stage. Sandea is rainfast within 4 hours of application. Suggest waiting 2-3 days after application to irrigate or 7 days for cultivation. Weeds controlled pre-emergence include: yellow nutsedge, pigweeds, wild radish and mustard, common lambsquarters, ragweed, Pennsylvania smartweed, velvetleaf, galinsoga and purslane (suppression). Weeds controlled with post-emergence applications include: yellow nutsedge, pigweeds, wild radish and mustard, ragweed, Pennsylvania smartweed, velvetleaf, and galinsoga. **Note** the lack of lambsquarters and purslane control with Sandea post-emergence application.

For use in pumpkin and winter squash, Sandea is only recommended as a post-emergence application at the rate of 0.5 oz/A. The pumpkin and winter squash must be in the 2-5 leaf stage of growth prior to Sandea application. (Applications after the 5 leaf stage may cause temporary blossom drop.) A minimum of 15 gallons of water and a nonionic surfactant is recommended. Do not use a Crop Oil Concentrate. Suggest waiting 2-3 days after application to irrigate or 7 days for cultivation. Weeds controlled with post-emergence applications include: yellow nutsedge, pigweeds, wild radish and mustard, ragweed, Pennsylvania smartweed, velvetleaf, galinsoga and common cocklebur. **Note** the lack of lambsquarters and purslane control with Sandea post-emergence application On pumpkin and winter squash, Sandea may cause treated plants to appear yellow for 14 or more days after application. In addition, younger leaves may exhibit a crinkled appearance.

USE PRECAUTIONS

- Do not apply Sandea by air.
- Do not apply Sandea using air assisted (air blast) field crop sprayers.
- Do not apply this product through any type of irrigation system.
- Heavy rainfall and/or excessive irrigation soon after application may cause crop injury. This potential injury can be enhanced if seeding depth is too shallow.
- Under cool temperature conditions that can delay early seedling emergence or growth, Sandea can cause injury or crop failure. Be especially cautious during first planting of season when this condition is likely to occur.
- To avoid subsequent injury to desirable crops, read and follow sprayer tank cleanout instructions.
- Follow all recommended crop rotation intervals as listed in this label.
- Sandea should not be applied if the crop or target weeds are under stress due to drought, water saturated soils, low fertility (especially low nitrogen levels) or other poor growing conditions.
- Do not apply Sandea to crops treated with soil applied organophosphate insecticides.
- Do not apply an organophosphate insecticide within 7 days before or 3 days after any Sandea application.
- In the event of crop failure, cucumbers may be planted back into the treated area at the user's risk for potential phytotoxicity to the subsequent crop.

When purchasing this material, signing a Waiver of Liability is required at the point of purchase.

Report on High Tunnel Workshop and Dates of Future Workshops

Bill Lamont, Department of Horticulture

A successful workshop was held this past Saturday, April 27th at the Penn State High Tunnel Research and Education Facility located at the Horticulture Farm, Rock Springs, Pa. I would like to especially thank Eric Burkhart, my graduate student, for organizing this excellent workshop and for conducting the program. Also a thank you is due to Lisa White, Manger of the High Tunnel Facility and the rest of the crew for their assistance in preparing for this program. I have included a copy of the topics discussed below.

11:00	INTRODUCTION
11:15	GARLIC RESEARCH PLOTS Mulching options: compost and straw
11:30	SPRING POTATO RESEARCH PLOT Mulching options: black plastic Low tunnel research
11:45	COVER CROP DEMONSTRATION (PART I) Irrigation options for cover crop establishment Determining nutrient contributions Options for mowing and management
12:30	EGGPLANT-PEPPER RESEARCH PLOTS Cover crop research update Low tunnel research Permanent versus annual beds
1:00	BREAK Snacks, refreshments, restrooms
1:30	LEAFY GREENS, HERBS, SUGAR & SNOW PEA RESEARCH Scheduling and spacing Low tunnel research Use of compost with supplemental fertilizer
2:00	COVER CROP DEMONSTRATION (PART II) Residue management
2:30	COMPOST UTILIZATION IN HIGH TUNNELS Overview of research Application methods
3:00	ADJOURN

Other workshops/field days will be conducted during the year and are listed below. Put them on your calendar now and plan on attending. There will be an agent in-service training program on the high tunnels on September 6, 2002.

SUMMER workshop/field day (all day) (Co-Sponsored with PASA)	Fri., July 19
AGENT INSERVICE TRAINING	Fri. Sept. 6th
AUTUMN workshop	Sat., October 26
WINTER workshop	Sat., December 13

Early Season Pests

S.J. Fleischer, Department of Entomology

I expect the warm winter to result high rates of survival of overwintering pests, giving us a fairly high rate of pest pressure early in the season. Here's a review of some early season pests. Chemical control options for seed treatments have been improving, and have been incorporated into the 2002 Commercial Vegetable Production Recommendations.

Corn flea beetle. The corn flea beetle is 2 mm long, has an oval-shaped black body tinged with bronze or bluish-green, and yellow markings on its legs. Adults overwinter in dead vegetation and litter at the base of plants. They are active on weeds in the spring, then move to corn and feed during May and June. Infestations are more severe during a mild winter followed by a cool spring. Adult beetles leave small circular feeding holes and spots or long stripes along the leaves. Because the beetles develop on weeds, keeping fields free of weeds helps in their control. Delayed planting may also reduce populations. The economic importance of this insect is that it transmits the bacterium that causes Stewart's wilt (also known as bacterial wilt). Resistant varieties are effective in preventing disease. This pest is typically more of a problem in earlier plantings - if at all possible, we recommend planting resistant cultivars for the early plantings. Seed commercially treated with imidacloprid is also effective in both controlling the beetle populations, typically until the 4 to 5 leaf stage, and in controlling disease. Soil-applied insecticides can be used, but are less effective during cooler temperatures; foliar materials may be necessary during this period. Treatments can also be based on scouting after plant emergence. Begin checking plants at the spike stage, especially during sunny calm days when the beetles are more likely to be active. Examine 10 plants at each of 10 sites and determine the number of plants infested. Record the percent plants infested. If varieties susceptible to Stewart's wilt are grown, apply foliar treatments when 6% or more of the plants are infested with beetles, and repeat if beetle activity remains high.

Seedcorn maggot. The adult seedcorn maggot is a fly similar to a housefly, but you are unlikely to see it. The adult is only 5 mm (~ 1/4 inch) long, and is more gray in color than a housefly. The damaging larvae or "maggots" are the immature larval stage. They grow from a newly hatch larva up to 1/4 inch long, they are yellowish white, legless, cylindrical, and tapered at one end. This tapered end contains a single hook-like appendage that is part of the mouth. There are no other readily visible mouthparts. Pupa are inside a puparium (a hardened skin) which starts as an ivory color and hardens into a reddish brown color. Pupae are also ~ 1/4 inch long.

These insects overwinter as a pupa in our soils (farther south all life stages can be found during the winter). Adults emerge in early spring and lay an average of 270 eggs per female in moist soil. Soil containing abundant decaying vegetation is also attractive to the ovipositing female. Exposed peat or potting soil mix of transplants can also serve as attractive sites for females looking for a place to lay eggs. Larvae hatch and crawl to germinating seeds or plants roots, and complete their development within 2-3 weeks. Several generations per year may occur. The maggots burrow into the seed, causing seed death or poor germination. Damage tends to be spread throughout the field. The larvae feed on peas, beans, corn, cabbage, turnip, radish, onion, beet, spinach and sprouting potato.

Damage can sometimes be avoided by delaying planting until the first generation larvae have pupated. This date varies with locality, but is approximately June 10 for New York State. It takes about 450 degree-days to complete a generation, which is a bit fast for an insect species. In field corn, if you have passed 450 degree-days, you are typically past the 1st generation, and after that soil conditions make it unlikely that seedcorn maggot would be a serious problem. However, in vegetable crops the later plantings of multiple crops can be attacked. Cultural controls include:

- thorough incorporation of organic matter into the soil,
- preparation of seedbeds for rapid germination,
- shallow planting (encourage rapid plant growth and minimize the time the germinating seed is sitting in the soil)
- covering rootball of transplants when transplanting
- planting when soil temperature are warm

This last recommendation is especially effective for transplants. Studies in Indiana with melon transplants have shown that root damage is directly related to soil temperature.

Seed treatments applied at planting should give effective chemical control with minimal amount of pesticide. There are many new options and formulations. Current options are on page B54 of the 2002 Commercial Vegetable Production Recommendations. For some crops, we have the option of transplant application of Admire. For example, transplant application of Admire can be applied which also effectively controls seedcorn maggot. There are also several materials available for pre-plant incorporation that control can be applied. Post-applications, soil drenches after the damage is present, are not effective. See the Commercial Vegetable Production Recommendations for specific materials. We try and provide specific recommendations for each

crop, but for all crops we review soil pest issues in the introductory material (called Soil pests - their detection and control, which is on B51-B54 in the 2002 Production Guide).

Wireworms. Wireworms are long, slender, hard-bodied, wirelike larvae of "click beetles". They are about 1.25 inches long by 1/8 inches in diameter. The larvae are the damaging stage, not the adults. The adults are called click beetles because of their habit of snapping and flipping their bodies when turned upside down. Wireworms have variable life cycles, depending on the species. Most species take 2 to 5 years to complete their development, so there is considerable overlap of larval sizes; the larger larvae do more damage. One species that is troublesome in potato (*Melanotus communis*; there is no common name) takes 6 years to complete it's life cycle. Wireworms overwinter as eggs, larvae, or adults.

Wireworms do more damage during cool wet springs, especially in fields following sod or other grasses. They damage crops by devouring seeds in the soil, cutting underground stems and roots, and by boring into the larger stems and roots. Often the seed is hollowed out, leaving only the hull. All crops are susceptible to attack to one degree or another, and particularly susceptible are potatoes, carrots, peas, onions, corn, sweet potatoes, lettuce, melons, beans, cowpeas, and sugar beets.

Plowing or cultivating infested soils in the late summer or fall exposes wireworms to natural enemies. Crop rotation helps reduce wireworm populations; continuous planting of vegetables and field crops, especially potatoes and wheat, tend to increase wireworm abundance. No-till fields may allow wireworm populations to increase.

A number of materials are available for wireworm control (see the Commercial Vegetable Production Recommendations). Insecticides can be applied either in the spring or fall when the soil temperature at 6 inches deep is at least 50 F. In general, seed treatments with only lindane or permethrin protect only the germinating seed from wireworms; commercially treated seed with imidacloprid provides longer control.

White grubs. White grubs are the immature stages (larvae) of June beetles, May beetles, and Japanese beetles. There are over 100 species of white grubs. They have a C-shaped body, a brown head, three pairs of legs, and a slightly enlarged abdomen. Full grown grubs range from 0.75 to 1.75 inches long.

Adults feed on leaves of trees, whereas the larvae feed on roots, particularly bluegrass, other lawn grasses, timothy, corn, soybeans, tubers of potatoes, and other crops. Grubs feeding on roots of corn cause wilting and stunting, and death of the plant if enough feeding occurs. Similar to wireworms, cool, wet springs and areas previously in sod may have heavier infestations.

The life cycles of the more abundant and injurious species may extend over three years. Eggs are laid 1 to 8 inches deep in the soil, especially near woodlands; after 3 weeks the larvae hatch and begin feeding on roots. During the winter the larvae migrate to deeper portions of the soil.

Crop rotation helps reduce populations. It is best to plant deep-rooted legumes (alfalfa, clover) in rotation with susceptible crops. In some regions a rotation of oats, barley or wheat with clover and corn has been satisfactory. Corn or potatoes may follow clovers but they should not follow grasses in the year of a heavy beetle flight. The most severe damage occurs on crops that follow grass sod. Late summer or early fall plowing destroys many larvae, pupae, and adults in the soil and exposes these stages to predators, which includes many vertebrates, as well as parasitic wasps. Soil insecticides applied for wireworm control may also effectively reduce grubs.

Black cutworms. As opposed to early-season pests like seedcorn maggot and wireworms, which may be found on many crops, black cutworms are primarily pests of corn, but they can also attack tomato, pepper and eggplant. The adult moths of this species become active in April and May in Pennsylvania. Females lay eggs in dead vegetation on the soil surface and in weeds, where moisture is high. The larva is greasy gray to black with a light stripe down its back. Full grown larvae are about 1.75 inches in length. Young larvae feed on the leaves of emerging corn, whereas the older larvae cut the plant off at the base (hence the name "cutworm") or bore into the plant. After four or five weeks of feeding in May and June, the larvae pupate in the soil. Two more generations may occur, but no damage occurs from these.

A number of cultural controls may help control cutworm populations: good weed control, fall plowing, spring cultivation after weeds have started some growth (height of 2"). Also avoid planting hill or row crops after grassy sod. No-tillage or reduced tillage may increase the amount of damage. Pre-planting or at-planting treatments for black cutworm can be used, but post-planting treatments based on scouting during the leaf stages are also effective. Blacklight traps can be used to monitor moths, but it is as effective to monitor for feeding damage.

In sweet corn, check each planting weekly during the spike through the 5-leaf stage. Check for small irregular holes in the leaves, as well as missing or cut plants. If cutworms are present, examine 10 sets of 20 plants throughout the field and record the percent of cut or damaged plants. Look under clods of dirt and vegetation and the bases of plants for the larvae; if you see the larvae, record the average size of the cutworms and the number per 100 plants. In sweet corn during the two-leaf stages, apply a treatment if more than 10% of the plants show fresh signs of feeding. At the three to four-leaf stages apply treatment at a 5% level. Also, use your judgement based on stand count: if you are at the minimum stand count, you may need immediate treatment, whereas more feeding can be tolerated if the stand is heavier than needed. During drier conditions, treatments may be less effective because cutworms may be feeding below the soil surface; in these cases, rotary hoeing or cultivation, as well as using higher spray volumes, may help increase the chances of contacting the insects with the pesticide.

Asparagus beetles. There are two species of asparagus beetles: asparagus beetle, and spotted asparagus beetle. The life cycles are essentially identical, except that the spotted asparagus beetle feeds on or in the berries, and thus does not cause economic damage. The adult asparagus beetle is about 0.25 long, with a blue-black underside and a reddish-brown prothorax

(the area immediately behind the head). The wings have a blue-black base color, are bordered with reddish-brown, and have four creamy-yellow circular to rectangular spots. Larvae are about 1/16" long, with dark gray bodies and black heads. Eggs are slate black in color, elongate oval in shape, and attached by one end to the stems of the host. The spotted asparagus beetle has a blue-black underside and a reddish back with 12 small black spots. Larvae are orange. Hibernating adults emerge and feed about the time the spears are cut for market. Asparagus beetles chew the green shoots, causing the tips to scar and turn brown. The presence of the black eggs on the shoots also makes them unfit for market. The eggs hatch in about one week, and the larvae may then cause additional damage. If enough damage occurs, the next year's crop may be affected because of lower root reserves. There are not many reported cultural controls for these beetles. One, which may be useful to homeowners, is to harvest the spears regularly, and to wash the eggs off the spears. Foliar materials are available, and post-harvest treatments are also effective in reducing the number of overwintering beetles.

Bug vs. Bug - Monitoring Insects on Sticky Traps

Cathy Thomas, Integrated Pest Management Program
Pennsylvania Department of Agriculture

Shore flies (Ephydridae) are sometimes confused with the dark winged fungus gnat. Both insects thrive in a moist greenhouse environment, have similar biology and feed on fungi, and decaying matter. Shore fly larvae are not known to feed on plant tissue unlike fungus gnat larvae which can be cause economic damage to plant roots. When they occur in high numbers, the adult stage of both pests can be a nuisance to employees and to customers in retail greenhouses. Additionally, fungus gnat and shore fly adults and larvae can spread spores of fungal pathogens.

It is important to identify which fly is attacking your crops since the control strategy for each pest varies. Shore flies are very difficult to control since control options are limited in edible crops and biological controls that attack fungus gnats may not be effective for shore fly control.

Life Cycle

Adults shore flies (2mm) are more robust than the delicate fungus gnat. The dark shore fly has short bristlelike antennae and each wing has five pale spots. These characters are easy to identify with a 15x hand lens.

Adult shore flies lay oblong, white eggs (up to 300) on algal scum or in very wet areas with decomposing organic matter (potting mix, pots, floors, near water spigots). Eggs hatch in to tiny first stage larvae (maggots) that have two forked, dark-tipped breathing tubes at the rear. Two additional larval stages occur with the mature larva reaching a length of 2.5 mm. The pupae are dark brown, curved and tapered on both ends with a tough skin that provides protection from insecticides. All of these stages are found within the crust of algae and on the top layer of potting mix. The life cycle from egg to

adult requires approximately 4 weeks depending on temperature. Development time decreases as the temperatures rise.

Damage

The primary damage caused by shore flies is "fly specks" or excrement left on foliage of seedlings or mature plants.

Control

Monitoring

Monitor weekly for shore fly and fungus gnat development with yellow sticky cards, especially in propagation areas. Inspect plants and soil surface for adult shore flies.

Cultural methods

- Avoid overwatering and fertilizer run-off.
- Eliminate algae on benches, walls, mats, and on soil under benches with a registered algicide.
- Practice good sanitation and remove all plant debris from greenhouse.

Biological
Hypoaspis miles (predatory mite) - this predatory soil mite provides some control over shore fly larvae if they are not in standing water. Shore fly larvae can survive in standing water, however the soil mite can not. This soil mite is commercially available through most biological control suppliers.

A new biocontrol being researched is *Atheta coriara*,a soil dwelling staphylinid beetle that feeds on fungus gnats, shore flies and thrips pupae. This beetle is not yet commercially available.

Two widely used biological products for fungus gnat control, Steinernema feltiae (*beneficial nematode*) and Gnatrolä (*Bacillus thuringiensis*) are not effective in controlling shore flies.

Drenches with Biorational pesticides

Soil treatments can be used to control the larval stages of shore flies. Treatments are mainly insect growth regulators used to interrupt hormones and prevent maturation of the insect to the adult stage. Many synthetic insect growth regulators are approved for shore flies in ornamental crops, however, they are not approved for greenhouse vegetable production. The following treatments are approved for greenhouse vegetables.

- Azadirachtin (Botanical) - when ingested or absorbed by the insect larva, the molting process is interrupted. Several products containing this active ingredient are commercially available.

- *Beauvaria basianna* (fungus, microbial) - the spores of this beneficial fungus attach to the larva and penetrate the cuticle eventually infecting the body cavity.

Remember when applying these products that they are not "rescue treatments" - use as a preventative when insect populations are at low levels.

Please phone or email me if there are specific issues you would like me address in this column.

Cathy Thomas
Integrated Pest Management Program
Bureau of Plant Industry/Rm. 100
2301 N. Cameron Street
Harrisburg, PA 17110
717/705-5857
c-cthomas@state.pa.us
cet3@psu.edu

That's a Berry Good Question

Kathy Demchak, Department of Horticulture

Q. I'm sending in early-season strawberry leaf samples from my plasticulture fields for a nutrient analysis. I want to use the results to adjust my fertigation, but I'm not sure what to make of the results. What are the levels of nutrients that should be in my strawberries this time of year? (Anon.)

A. Adequate nutrient concentrations (dry weight basis) during this time of year (up until early fruit set) are the following: nitrogen (N) should be at 2.8-3.0%; phosphorus (P) at 0.2-0.4%; potassium (K) at 1.1-2.5%; calcium (Ca) at 0.4-1.5%, magnesium (Mg) at 0.2-0.4%; manganese (Mn) at 25-100 ppm; iron (Fe) at 50-100 ppm; copper (Cu) at 5-10 ppm; boron (B) at 20-40 ppm; and zinc (Zn) at 20-40 ppm. These values are from the "Hill System Plastic Mulched Strawberry Production Guide for Colder Areas" from Virginia Tech.
The most common problems seen, and solutions currently recommended are below. I've first must state that most of this is based on observations, research done in the Southern part of the country, and research done on matted row strawberries - not on research done this far North on plasticulture strawberries. So, if anyone out there has any experiences that would help provide information, please contact me.
If nitrogen levels are too low or high, adjust the nitrogen fertigation amounts up or done accordingly. Nitrogen recommendations in matted row production are to increase the N application rate by 10% for each 0.1% that the sample concentration was below the normal level. That seems to be a sensible approach with plasticulture as well and could be used 'in reverse' to reduce nitrogen rates if levels are too high. I haven't seen problems with phosphorus levels, but if phosphorus is low, growers should go with a soluble fertilizer containing phosphorus in addition to nitrogen. Sometimes potassium, calcium, and magnesium values are deficient or approach the low end of their range.

These 3 elements compete with each other for uptake, and need to be kept in balance. Because these elements can be applied in fertilizers that supply nitrogen (as potassium nitrate, calcium nitrate, or magnesium nitrate) we're recommending that the N source be changed depending on the analysis results. So, of these 3 elements, the one(s) that is/are low, or are getting towards the low end of the normal range, should be used as the nitrogen source, with 2 materials alternated each week if 2 are low. Epsom salts (contains 10% Mg) also can be used for magnesium fertigation, and contains about the same concentration of magnesium as magnesium nitrate (9.5% Mg). If no particular element of these 3 stands out as being low, keep in mind that as fruit enlarges, potassium is pulled into the fruit in fairly large quantities and calcium helps with fruit firmness. Alternating potassium nitrate and calcium nitrate weekly is recommended if all is otherwise normal. Finally, if micronutrients are needed, foliar sprays of the deficient element(s) are recommended.
Some publications with additional information are the NRAES publication "Trickle Irrigation in the Eastern United States" which contains information on planning and operating trickle systems, and the NRAES Strawberry Production Guide, which includes a very helpful table with materials for fertigation and their solubilities. Which brings me to one more note of caution - if you're mixing together materials that may precipitate with each other, be sure to run a test, mixing together the materials in a jar in the same concentration that they'll be mixed in practice. Then let the jar sit for 12 hours, and check for any precipitates.

Got a question? Send it to Kathy Demchak, at 102 Tyson Bldg., University Park, PA 16802. You will be credited with the question, or can remain anonymous, as you wish.

Potato Musings

Bill Lamont, Department of Horticulture

Cut Seed vs. Whole Potato Seed

A question that is frequently asked is- will single drop seed (whole seed) give better performance than cut seed? A five-year study comparing whole seed to cut-and-treated seed was conducted by a group of researchers at the Idaho Falls Research and Extension Center and helps shed light on this issue. Cutting seed tubers creates large wounds, which are vulnerable to disease and must heal before maximum seed performance can be realized. Whole seed is not wounded and does not have this handicap. In spite of this potential advantage untreated, whole seed actually had slightly more seed decay than any of the cut-and-treated treatments. Overall, whole seed did not outperform cut-and-treated seed when the averages for total and marketable yield over five years were compared. Several disease issues, among them Rhizoctonia canker (black scurf) and silver scurf, may mean that applying a fungicide on whole seed should be considered. Cut-and-healed (suberized) seed may perform just as well as whole seed in problem situations. (Taken from Phillip Nolte's article in the Spudvine, March 2002)

Upcoming Meetings

Bill Lamont, Department of Horticulture

Local

June 3, 2002. 6:00-8:00 PM Strawberry Twilight Meeting, Risser's Farm Market, Annville PA Contact: Ginger Pryor, 717-270-4391

July 15, 2002. 6:00-8:00 PM Lebanon County Produce Auction Twilight Meeting Contact: Ginger Pryor, 717-270-4391

September 6, 2002. High Tunnel In-Service Training for County Extension Agents, High Tunnel Research and Education Facility, Rock Springs, Pa. Contact: Bill Lamont 814-865-7118 or email: wlamont@psu.edu

Regional

August 19, 2002. Vegetable, Small Fruit and Tree Fruit Field Day, Horticulture Farm, Rock Springs, Pa. Contact: Mike Orzolek 814-863-2251 or e-mail mdo1@psu.edu

August 20-22, 2002. Ag Progress Days, Rock Springs, PA. Contact: Bob Oberheim 814-865-2081 or e-mail bah4@psu.edu

Februrary 4-6, 2003. Mid-Atlantic Fruit and Vegetable Conference, Hershey, PA. Contact: Bill Troxell 717-694-3596 or e-mail: wt.pvga@tricountyi.net

National

August 11-17, 2002. International Horticultural Congress; Metropolitan Toronto Convention Centre, Toronto: Call (416) 504-4500 or visit www.ihc2002.org

August 11-17, 2002. Potato Association of America Annual Meeting; Metropolitan Toronto Convention Centre, Toronto: Contact Leslie Copp at (519) 824-4120 or icopp@uoguelph.ca

August 11-17, 2002. American Society for Horticultural Science; Metropolitan Toronto Convention Centre, Toronto: www.ihc2002.org or contact ASHS at (703) 836-4606.