The Vegetable and Small Fruit Gazette

Vol. 7, No. 5- May 2003

Horticulture Department
The Pennsylvania State University

In this Issue:

Tip for the Month-- "Argue for your limitations and sure enough they're yours"--Richard Bach

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Comments from the Editor

Bill Lamont, Department of Horticulture

Even though it is still a bit chilly out we have blue and white potato plants 18 inches high in the high tunnels. A Penn State Alumnus contacted me and wanted to make the "Penn State Blue and White Potato Salad" for her wedding this summer, so I saw an opportunity to market the blue and white potato program to a wider audience. We will take pictures of the bride and groom in front of the display or feeding the potato salad to each other and use the photos in future marketing activities and promotion of this project to our local restaurants. Hopefully this will grow into an opportunity for our potato growers in Pennsylvania. I really appreciate the excellent article on **"Blueberry Mulching"** that George Perry from the Schuylkill County Extension Office developed for this issue and I look forward to receiving Tom Butzler's article that will appear in

the June issue and also want to encourage colleagues from other departments to contributed articles throughout the year. 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.

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Schedule for Agent Articles

Bill Lamont, Department of Horticulture

June	Tom Butzler
July	Eric Oesterling
August	Tom Ford
September	Cheryl Bjornson
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December	Andy Muza

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Heads Up on Agent Vegetable and Small Fruit In-Service In July

Bill Lamont, Department of Horticulture

Just a heads-up that the Vegetable and Small Fruit In-service will be held on July 29 and 30th at the Horticulture Research Farm, Rock Springs, PA. There will be a dinner the evening of July 29th for team building, etc. The in-service will cover on-going vegetable and small fruit research both in the field and high tunnels located at the Horticulture Farm. This is the program that we discussed at our November roundtable last year. Just wanted to make sure you had time to put it on your calendars. More particulars to follow in later gazettes.

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Passing of Dr. Steve Johnston, Extenstion Plant Pathologist, Rutgers University

Bill Lamont, Department of Horticulture

I am saddened to report that on Wednesday April 16th, Dr. Steve Johnston died as a result of injuries received while clearing some land. Many will remember Steve as a frequent and always excellent speaker our Mid-Atlantic Fruit and Vegetable Conference in Hershey as well as the Western Pennsylvania Growers Seminar in Butler, and at the Lehigh/Schuylkill County Potato Growers Meeting, Schnecksville Grange in Neffs, PA.

Steve worked at the Rutgers Agricultural Research and Extension Center (RAREC) in Upper Deerfield for the past 26 years. He worked with growers throughout the state of New Jersey and researchers and educators throughout the world.

I had so much respect for Steve as a professional extension plant pathologist and admired his tremendous expertise and his ability to share this knowledge in an informative and interesting way to a wide range of audiences, which was truly a gift that I enjoyed at many meetings.
I admired Steve as person, a man of character, a Christian, and a person passionate about his work and who loved his family. Steve could light up a room with his big smile and the warmth of his outgoing personality. That is the way I will remember Steve with a big smile, laughing and always willing to lend a hand. Steve is survived at the home by his wife Faith and sons Adam and Matthew.

Two scholarship funds have been established in Steve's memory. The scholarship for the Cumberland County Board of Agriculture will support a graduate level assistant at the RAREC. Those interested in making a contribution can do so as follows:

Make checks payable: Cumberland County Board of Agriculture
On check memo line write: Stephen A. Johnston Memorial Fund

Mail to: Cumberland County Board of Agriculture
Extension Education Center
291 Morton Avenue
Millville, NJ 08332

Or

Make check payable to: Howe/Quigley Scholarship Fund
Mail to: Howe/Quigley Scholarship Fund
c/o St. Paul's United Methodist Church
17 Franklin St.
Penns Grove, NJ 08069-1316

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Certified Organic Crop Production

Elsa Sánchez and Mike Orzolek, Department of Horticulture

In October 2002 the USDA implemented the National Organic Standards (NOS). The intent of the NOS is to provide uniform production and handling standards for crops labeled as organic. A summary of the NOS and additional considerations for organic production follows.

Production Practices

Plant Selection

National Organic Standard Summary

The use of genetically modified organisms is prohibited in certified organic production. Certified seed, annual seedlings and other planting stock used must be organically produced. Exceptions can be made when no commercial organic seed or planting stock is available. In this case, non-treated non-organic seeds and planting stock can be used except for the production of edible sprouts. In addition, when non-treated non-organic seed or planting stock is not commercially available, materials treated with substances allowable according to the National List can be used. The National List is a list of allowable and prohibited substances in certified organic production provided for in the Organic Foods Production Act of 1990. A temporary variance can be obtained for non-organic annual seedlings when an unavoidable event such as a fire, flood or frost has occurred which destroys organically produced seedlings. In addition, planting stock that is used to produce perennial crops can be sold as organic after it has been managed using certified organic practices for a minimum of 1 year. Seeds, annual seedlings and planting stock that have been treated with prohibited substances can be used to produce an organic crop when the application of the substance is a requirement of Federal or State phytosanitary regulations. It is best to work closely with the certifying agency to ensure that exceptions can be made without compromising organic certification. Additionally, growers cannot use lumber treated with arsenate or other prohibited substances for new installations or as replacement lumber for lumber in contact with soil or livestock.

Additional Considerations

In addition to the above criteria from the NOS, select cultivars with good market characteristics. Also, seed and plant selection can be used as a preventative tool for pest management. Select seed and plant cultivars with resistance or tolerance to insect and disease pests common in your area or field. In addition, when using transplants and other planting stock buy certified stock when possible and only purchase from reputable suppliers.

Soil Fertility

National Organic Standard Summary

The goal of soil fertility management, for organic growers, is to maintain or improve the soil condition and minimize erosion. Practices used include sound crop rotations, the use of green manures and cover crops, the application of plant and animal matter and the application of nutrients or soil amendments allowable according to the National List.

Additional Considerations

Soil testing should be used to determine the amount of nutrients needed for optimal growth of a particular crop. Soil test kits can be obtained through local Extension offices. The nutrient levels in the soil will determine the amount of nutrients needed through green manures, cover-cropping, the application of composted and uncomposted (raw) manures and allowable fertilizer.

Plant and Animal Materials

National Organic Standard Summary

Plant and animal materials not treated with a prohibited substance can be applied composted or uncomposted. Composted plant or animal materials can be incorporated into the soil as necessary provided the compost meets carbon to nitrogen (C:N) and temperature requirements. The compost used must have a C:N ratio between 25:1 and 40:1. In addition, when using an in-vessel or static aerated pile system for composting the pile must reach a temperature between 131 ºF and 170 ºF for a minimum of 3 days. If using a windrow system for generating compost, the pile temperature must be maintained between 131 °F and 170 °F for a minimum of 15 days and turned a minimum of 5 times during that time. Uncomposted plant materials can also be used in certified organic production. Uncomposted animal manure must be used on fields with crops not to be consumed by humans or integrated into the soil a minimum of 90 days before harvesting a product to be consumed by humans provided that the edible portion of the crop does not contact the soil or integrated into the soil a minimum of 120 days before harvesting a product to be consumed by humans that does come into contact with the soil. Using human sources of sewage sludge is prohibited in certified organic production.

Additional Considerations

Composted materials can be tested to determine the amount of nutrients supplied (kits are available through local Extension offices). It is also useful to determine the pH of the compost because, depending on the source material, the compost may have an unsuitably high pH for crop production. The amount of nitrogen (N), phosphate (P_2O_5) and potash (K_2O) in several uncomposted manures and green manures can be found in the Pennsylvania Commercial Vegetable Production Recommendations guide.

Fertilizers and Soil Amendments

National Organic Standard Summary

Fertilizers and soil amendments that meet the NOS are available to complement other fertility practices. In addition, mined substances of low solubility can be used to supply plant nutrients. Plant or animal ashes can also be used to improve soil fertility as long as they have not been combined or treated with a prohibited substance and are not themselves a prohibited substance.

Additional Considerations

Note that a fertilizer or soil amendment labeled as 'natural' or 'organic' may not meet the NOS. It is best to check allowed and prohibited materials for certified organic production through a certifying agency. There are some limitations to using organic fertilizers growers should be

aware of, such as, some allowable fertilizers are difficult to find commercially. In addition, allowable fertilizers frequently cost more relative to synthetic fertilizers. They tend to be low in the amount of nutrients and therefore may need to be applied in large amounts. As a result, it can be difficult to supply enough of the product. Lastly, organic fertilizers can also be difficult to blend.

Pest Management

National Organic Standard Summary

Pests must be managed primarily through the use of preventative practices. Preventative options include cultural techniques, the use of physical barriers and the use of biological management strategies. Several cultural techniques are available for pest management including good site and cultivar selection, proper moisture and nutrient management, sanitation, rouging, vector management, manipulating harvest schedules, crop rotation, using cover crops and green manures, mechanical cultivation, hand weeding, using trap crops, creating habitats for beneficials, mulching, livestock grazing etc. Physical barriers include plastic or organic mulches and row covers. Note that when using plastic mulches they must be removed at the end of harvest. Burning of crop resides is prohibited except when used for disease management or to promote seed germination. When preventative practices are not sufficient to prevent a pest, biological, botanical or synthetic substances can be used, providing they are allowable substances.

Additional Considerations

Pests commonly associated with particular crops should be determined prior to planting. Cultural techniques and physical barriers can then be selected specific to potential pests. This form of pest management can require increased time commitment and labor in monitoring pests and practicing preventative methods of management, than a primarily pesticide based approach. If preventative strategies fail allowable pesticides can be used. Growers should expect to have more pest damage that anticipated in some years.

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Early Season Soil Pests

Shelby J. Fleischer, Department of Entomology

The cold winter will result should slow the start of insect population development. But when the insects do become active, will there be significantly lower densities caused by mortality to the overwintering life stage? Species that are adapted to overwinter in cold climates, as far north as Canada, or those that have the ability to burrow deep in the soil (assuming you have land with deep soil) may well have survived the winter well, especially if you had no-till or good snow cover conditions. Here's a review of some early season soil pests. Chemical control options

have been incorporated into the 2003 Commercial Vegetable Production Recommendations - but please note one error: Furadan 4F is not labeled on peppers, and on cucurbits and sweet corn the target pests are not wireworms.

Wireworms. Wireworms are becoming an increasing problem in the mid-Atlantic area. 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 and freezing temperatures. 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.

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. Imidicloprid (Admire or Platinum) applied through drip-irrigation is not labeled for wireworms, but when applied to labeled crops for pests on the label, it can also help with wireworm suppression. When using diazinon, try to work it gently in to the soil immediately before transplanting so it is in the root zone.

A monitoring technique is to set up bait stations using 1 cup untreated wheat plus 1 cup untreated shelled corn, about 4 inches deep, covered with black plastic. Uncover the bait 10-14 days later. The germinating seed gives off volatiles (CO_2 and others) that attract the wireworms. A threshold for insecticide application is 1 wireworm per bait station. One guess for why we are seeing increased wireworm problems, and on more crops, is that we are putting in transplants into plastic mulch on recently prepared ground earlier in the season. The ground preparation may remove other food resources, and the transplants then act similar to the bait station.

If you are having wireworm problems, collect some (about 20-30) in alcohol and send them in for identification. Management for a species with a short (1-year) life cycle will be different for

species with a long (5-6 year) life cycle.

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. Root-feeding causes wilting, 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.

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 grayer 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. Pupae are inside a puparium (a hardened skin) which starts as an ivory color and hardens into a reddish brown color. Pupae are ~ 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. For some crops, we have the option of transplant application of Admire. 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.

Black cutworms. As opposed to early-season pests 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 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 damage does not tend to occur from later generations.

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 judgment 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.

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Bug vs. Bug - Managing Plant Diseases with Biofungicides

Cathy Thomas, Integrated Pest Management Program
Pennsylvania Department of Agriculture

Nematodes are simple roundworms lacking segments or appendages and may be parasitic, free-living or predaceous. An entomopathogenic (insect-parasitic) nematode has a symbiotic association with bacteria that is lethal to many soil dwelling insects, but are very safe for animals and plants. The two genera of insect-parasitic nematodes used for pest control include *Steinernema* and *Heterorhabditis*. Insect parasitic nematodes have been used successfully to control soil dwelling pests in many industries such as greenhouse, nursery, strawberry, mushroom and turf industries, replacing drenches with synthetic pesticides. Because of the high degree of safety, nematode applications are exempt from re-entry intervals, worker protection standards and do not require a mask or other safety equipment. Nematodes can be applied like most conventional pesticides using a pull behind sprayer, fertigation system, or backpack sprayer.

Entomopathogenic Nematode Life Cycle

Nematodes are shipped to the grower in the infective juvenile stage. When applied to the soil, the infective juvenile surrounds the pest insect and enters it through natural body openings such as the mouth, anus, or spiracles, penetrating through to the body cavity. Once inside the body, a symbiotic bacteria is released from the nematode gut which multiplies rapidly and causes insect death within 24 - 48 hours. The nematodes feed on broken down tissue in the insect cadaver and develop into adults. A new generation of nematodes is produced within two weeks with thousands of new infective juveniles emerging from the insect cadaver in search of fresh hosts. Insects killed by steinernematid nematodes appear brownish-yellow, and insects killed heterorhabditids become red and the tissue has a gummy consistency.

A Partial list of Key species of Insect-parasitic nematodes

Nematodes are host specific, therefore it is important to purchase the correct nematode for your pest situation. The nematodes mentioned below are commercially available.

Steinernema carpocapsae - the most studied, available and versatile of all entomopathogenic nematodes. They are easily mass produced and are formulated into a partially desiccated state that provides a long shelf life. Especially effective against lepidopterous larvae, including webworms, cutworms, armyworms, and wood borers. This species is an "ambusher", standing on its tail in an upright position near the soil and attaches to passing hosts. Trade name: Exhibit SCO®

Target Pests: Cutworms, armyworms, billbugs, root weevils, vine weevils, stem borers, fleas, fungus gnats, webworms
Crop/habitat: Vegetables, small fruits, turf, ornamentals, greenhouse

Steinernema feltiae - used to control dipterous (flies) insects, including fungus gnats, and mushroom flies. Offers greater effectiveness at lower soil temperatures. Trade names include: Scanmask® , Exhibit SF® , Entonem®

Heterorhabditis bacteriophora: the most important entomopathogenic nematodes. It attacks lepidopterous and coleopteroous insect larvae among other hosts. The nematode is used most in controlling root weevils, especially black vine weevil in containerized soil. Target Pests: Black Vine weevil, sciarids, grubs (Japanese Beetles)
Crop/habitat: Home/garden, lawns, strawberries, ornamentals, tree nurseries, greenhouses

For more information, consult these websites:

www.biologicco.com
www.biobest.be
www.bugsandbees.com
www2.oardc.ohio-state.edu/nematodes
www.koppert.nl www.nysaes.cornell.edu/ent/biocontrol/

Partial List of Nematode Suppliers
•Griffin Greenhouse and Nursery Supply - 800-732-3509
• IPM Labs, Locke, NY - 315-497-2063
• International Technology, Bio Best Products, CO - 800-375-1684
• Koppert Biological Systems - 800-928-8827
• Syngenta Bioline - Oxnard, CA - 805-986-8265

For another comprehensive listing of biocontrol suppliers and information visit this website: http://www.anbp.org. This is the site of The Association of Natural Biocontrol Producers (ANBP), a professional association representing the biological pest management industry. ANBP membership includes producers, distributors, and in addition, users of natural enemies and researchers.

Advantages for using entomopathogenic nematodes

•Compatible with many insect growth regulators and other insecticides. Consult your supplier for specific information or check these compatibility charts.
• Resistance management tool.
• No worker reentry intervals

Disadvantages for using entomopathogenic nematodes

• Inactivated by desiccation or ultra-violet light, apply nematodes during early morning or late evening when sunlight is minimal.
• Require special storage and handling, store nematodes in a cool, dry place out of direct sunlight. Refrigeration is sometimes required.

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That's a Berry Good Question!!

Kathy Demchak, Department of Horticulture

Q. Since there are new fungicides available, what is the current recommended gray mold control program for strawberries? (Tim Elkner, PSU Cooperative Extension in Lancaster County, asks this question "on behalf of strawberry growers across Pennsylvania".)

A. First, much credit must go to Mike Ellis from Ohio State, as many of the statements below are based on his work and recommendations, though some are also based on PA experiences. Second, now that anthracnose fruit rot has been showing up in a number of growers' fields, it makes sense to consider control of anthracnose along with control of gray mold, as Mike suggests doing. Especially for operations where anthracnose is likely to be a problem (those in warmer locations in PA, or those using strawberry plasticulture) we'd like to weight our control program towards using materials that have effectiveness against both gray mold and anthracnose. This would decrease the amounts of inoculum of both diseases prior to and during harvest.

As a review, in the past few years, labels have been obtained for use of Elevate, Switch, Nova, Quadris and Cabrio on strawberries. Elevate is a great material for gray mold, similar to Rovral or Ronilan, but has little effectiveness against other diseases. Switch is a mixture of two active ingredients, and is labeled only for gray mold control, but also has some effectiveness against other diseases including anthracnose and leaf spots. Nova is good for powdery mildew and leaf spots, but doesn't enter into the picture for gray mold control. Quadris is for control of anthracnose and powdery mildew, but not gray mold, as it has a relatively small effect against gray mold and isn't labeled for it anyway. Cabrio is labeled for anthracnose, powdery mildew, common leaf spot, and "gray mold suppression", which means that it does decrease the amount of gray mold present, like Quadris, but not to the extent that you would want to rely on it as a substantial part of your program. Quadris and Cabrio are in the same fungicide class, and so cannot be rotated with each other for resistance management purposes. All other fungicides listed above are in different fungicide classes, and so can be alternated with each other. Also, remember that Quadris is extremely phytotoxic to McIntosh apples trees and related cultivars. Captan or Thiram, materials which have been available for a long time, have value especially to delay the buildup of resistant strains of fungi. Both have decent efficacy (but not stellar performance) against gray mold and anthracnose.

The main idea with gray mold control is, as in the past, to control the infections that take place during bloom. If you do a good job of preventing infection of blossoms by gray mold, it is much less likely that you will have a problem with gray mold during harvest. So, for growers who are interested primarily in controlling gray mold, use Elevate or Switch in combination with or alternated with Captan or Thiram at early bloom, full bloom, and late bloom. If anthracnose is of concern on your farm, concentrate on using Switch and Captan for gray mold control (together or alternated) to also reduce anthracnose inoculum build-up. Since the critical time to prevent gray mold inoculation is during bloom, I'd make sure to use a good gray mold material (Elevate or Switch) during the one or two sprays when the most blossoms are open, and not Captan or Thiram alone at this time. If anthracnose is of concern, Quadris or Cabrio should be used as the fruit develops. If you're in matted-row production, haven't seen anthracnose symptoms in the previous year, and need a material for additional gray mold control at harvest, either Elevate or Switch are good choices. Make sure not to overuse any of the newer materials, following the directions the packaging for rotating with other fungicides. If you don't, resistant strains of fungi will develop, and these materials will lose their effectiveness.

Got a question? Chances are that someone else has the same question, but isn't asking! Send your question to Kathy Demchak, at 102 Tyson Bldg., University Park, PA 16802, or via email to kdemchak@psu.edu. You will be credited with the question, or can remain anonymous, as you wish.

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New Developments in Small Fruit Fungicides

Reprinted from Ohio Fruit ICM News, Vol.7, Issue 14, April 17, 2003.
Source: Mike Ellis, OSU Plant Pathologist.

Switch 62.5% WDG fungicide was recently registered for use on several berry crops and caneberries. Berry crops include blueberries, currants, gooseberries, elderberries, and huckleberries, as well as other cultivars and hybrids of these crops. Caneberries include blackberries and raspberries and/or cultivars and/or hybrids of these crops. On blueberry it is registered for control of Mummy Berry, Anthracnose (Colletotrichum spp.), Alternaria fruit rot, and Phomopsis twig blight. On brambles it is registered for control of Botrytis fruit rot. Switch is an excellent material for control of Botrytis fruit rot (gray mold). It is also registered for control of Botrytis fruit rot on strawberry, and has been reported to provide some level of control for anthracnose fruit rot on strawberry.

The following information was taken from the label:
Rate: 11 to 14 oz per acre
Application timing: Make the first application during early bloom. A second application should be made 7 to 10 days later. Additional applications can be made at 7-10 day intervals if conditions remain favorable for disease development. Make no more than two (2) sequential applications before using another registered fungicide. Switch 62.5WG may be applied in an alternating or blocking program.
Notes: Pre-harvest interval is 0 days. Do not apply more than 56 ounces of product per acre per year.
Rotational Crop Restrictions: Do not plant any other crop for a period of 12 months unless Switch 62.5WG is registered for that use.
Please note that for purposes of fungicide resistance management, no more than two sequential applications may be made before using another registered fungicide with different chemistry. For Botrytis control on brambles, Switch can be used in alternating programs with Elevate, Rovral, or Captan. No more than four applications of Switch may be made per growing season.

Captan 80 WDG: Several changes and additions have occurred on the Captan 80 WDG label. These changes have not been made on any other formulations of Captan to date (Captan 80W, Captan 50W, and Captec 4L). However, these changes are in the registration process and should be made soon on other formulations.
Significant changes:
The Re-entry Interval (REI) has been reduced from 4 days to 24 hours on strawberries, apples, apricots, cherries, nectarines, plums/fresh prunes, and peaches. This is a significant change for growers wishing to use Captan, but having problems with the 4 day REI. The REI for blueberries, grapes, raspberries, blackberries, and dewberries is 72 hours.
Blackberries, raspberries and dewberries have been added to the label. Previously, Ohio had a 24-C registration for the use of Captan 50W and Captan 80W. The 24-C registration is no longer needed for use of the Captan 80 WDG formulation.

The following is from the Captan 80 WDG label:

Blackberries, raspberries, dewberries:
Anthracnose, Botrytis, Spur blight: Apply 2 pounds Captan 80 WDG per acre when blossoms are in bud (young canes are 8-10 inches long). Make a second application two weeks later. Apply a fall spray after old canes are removed.
Fruit rot: Apply pounds of Captan 80 WDG per acre at early bloom (5-10% bloom) and again at full bloom. Additional applications may be made at 10-14 day intervals as needed. Apply Captan 80 WDG as indicated above in 45-100 gallons of water per acre per season. Do not apply within 3 days of harvest. The REI is 72 hours.
Note: During early bloom and preharvest sprays, Captan is an excellent material to use in combination (tank mix) with Switch, Elevate, or Rovral.

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Straw Removal Tidbit

Kathy Demchak, Department of Horticulture

Growers often ask when the best time is to remove the straw from their strawberries in the spring. The usual answer is when the plants resume growing, but before the new growth has "yellowed too much". Research studies done in Illinois have shown that the highest yields are obtained if straw is removed when the bare soil temperature averages between 40 and 43 degrees at a 4" depth. Here's a little cue that might help to remind you that you should be checking the soil temperature and plants. Over the last few years, I've noticed that our research plot soil temperatures are in this 40-43 degree range at about the same time that red maple tree buds first start to expand, before the trees start blooming. You probably know this stage. It's that day when you notice a faint reddish blush to the hills, and realize that spring must finally be arriving. That is my cue to check the soil temperature, and sure enough, every year it's been between 40 and 43 degrees at that time. The strawberry plants also look like they're just thinking of sending out new leaves, too. Nifty little brain-jogger, aye? At that point I check the weather forecast for temperature trends, and figure out whether I want to take the straw off pronto, or wait a few days if there's a cold spell forecast.

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Blueberry Mulching

George Perry, Penn State Cooperative Extension, Schuykill County

Mulch plays a very important role in blueberry production in Pennsylvania. The highbush blueberry plant is grown on upland soils in most locations of Pennsylvania. Highbush blueberry is naturally adapted to a lowland, acid soil so amendments must be

made to the soil for a successful planting on upland locations. Highbush blueberry roots thrive in an open, porous soil which is high in organic matter, well drained and supplied with adequate moisture. Blueberry roots are in the upper 18 inches of the soil. Upland soils are generally drier, higher pH and lower organic content than lowland soils. It is important to maintain a constant moisture content near the surface of the soil and optimum soil acidity, one of the most successful ways is using mulch. Annual mulching has been found to reduce weed growth, lower soil temperatures in summer, help maintain uniform soil moisture and develop a better soil structure, prevent heaving and subsequent root injury, control soil erosion and reduce the costs of cultivation.

The following research material is from Blueberry Science by Paul Eck. The favored mulching material is sawdust, preferably a well composted softwood sawdust (Moore and Pavlis,1979). Pinebark is also excellent and compacts less than sawdust. Four to six inches of mulch are needed initially, with annual additions of one inch of sawdust to maintain the depth. If fresh sawdust is used, an additional 50 to 100 percent N may be necessary for the first few years to compensate for increased microbial activity. Well composted sawdust requires less supplemental nitrogen. Other organic materials that have been used, not as effective as sawdust, include corn cobs, straw and leaves. Manure and stable bedding must be well composted before they are safe to use and even than are not as desirable as sawdust since they may increase soil pH.

In a long term experiment on a commercial highbush blueberry planting in Arkansas, (Moore and Pavlis,1979) found that plants continuously mulched with sawdust outyielded plants mulched only for the first year, first two years, or first three years after planting. They also observed that straw mulch was effective, but deteriorated more rapidly than sawdust. The incorporation of peat moss in the soil at planting also resulted in higher yields in following years.

In addition to its use as a mulch, composted sawdust has been found beneficial when applied in the planting hole, particularly in conjunction with the mulch (Brooks, 1972). In these studies fertilizer applications had to be increased threefold to produce vigorous growth. (Cummings,1981) was able to overcome the harmful effects of high pH by incorporating sawdust into the soil in which rabbiteye blueberries were grown. Black plastic has been successfully used as a mulching material in establishing plantings (Bell and Kroon,1979). Care must be taken when fertilizing under black plastic since fertilizer placed close to the plant crown can cause severe burning. It is probably preferable to work the required fertilizer into the soil before laying the plastic. (Mainland and Lilly,1984) concluded that black plastic mulch offers a practical method for controlling weeds and encouraging fruiting at an earlier age. They found that a single application of 925 Kg/ha of a 10-10-10 fertilizer incorporated into the soil before laying the plastic provided adequate nutrition for two years, the effective life of the plastic. A blueberry mulch research plot was conducted over five years by the Extension agent in Southeast Pennsylvania. The plot was replicated three times with three mulches, corn cobs, wood chips and sawdust. The plot had four cultivars, Bluejay, Bluecrop, Patriot and Spartan. After five years it was determined there was no significant yield difference. The best mulch of the three is the one you can obtain at the lowest cost. Remember sawdust or

wood chips from red maple and beech should not be used. Sawdust or wood chips from those two trees may injure or retard blueberry plant growth.

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Transition to Organic Highbush Blueberry Production

Bill Sciarappa, Gary Pavlis, Nicholi Vorsa, Rutgers University

Four significant developments have occurred that amplify opportunity for growers to successfully grow organic highbush blueberry and to increase or transition acreage. First, there is the recent USDA national organic standardization that defines organic production practices and crop labels that creates clarity and evens competition. Second, we have the continued increase of small fruit and vegetable sales related to nutritional and human health reasons that strongly contribute in creating today's $40,000,000 highbush blueberry market in NJ. Future agribusiness gains are promising through the "organic certification" market segment. This organic designation appeals to today's consumer as an even higher market value and creates a separate market segment above the fresh market mainstream. Third, new tools are becoming available to organic growers that reduce the risk from pest problems such as the recent organic registration of Spinosad - now known as Entrust in the organic market. Finally, the Rutgers Blueberry Research Working group has made considerable progress in refining standard IPM practices and in helping develop new tools and holistic approaches for organic production systems. Our "Work in Progress" is establishing alternative approaches to some current agricultural practices in soil building, fertility, cultural approaches and pest management.

Perhaps 2/3's of what conventional growers do horticulturally is directly applicable to organic production. Some examples include selection for resistant varieties, pruning for canopy ventilation to reduce disease incidence, adding organic amendments in building soil such as peat and humus, mulching for weed control and water conservation, raised mounds, rogueing of infected plants and the use of natural plant protection products like Bt, Pyrethrum and Spinosad which are safe to natural enemies. In contrast to other fruits that have been introduced from other countries, the blueberry is one of the few native American fruits that has relatively good natural resistance to diseases and insects as well as an inherent vigor because it has been domesticated for less than 100 years. Thus, there is this strong historic baseline for succeeding in the return to organic production although some key risk factors remain to be solved. To achieve this comprehensive vision of an integrated organic production system, specific obstacles are being addressed by a team of collaborating specialists supported by RCE administrators Dr. Nick Vorsa of the Phil Marucci Blueberry and Cranberry Research Center and Jack Rabin of the NJ Agricultural Experiment Station as follows

Varietal Selection - Dr. Mark Ehlenfeldt comparative work for the USDA breeding program suggests using early maturing varieties to escape later season blueberry maggot attack like Weymouth, Bluetta and Earlyblue. Mark continues research with new and better varieties resistant to pathogens that are essential in initiating any organic enterprise.

Fertility - Dr. Gary Pavlis has demonstrated the importance of pH in maximizing plant health through the enhanced availability and uptake of nutrients as the ammonium nitrogen form. Gary has also demonstrated the water conservation benefits of trickle irrigation. Dr. Joe Heckman points to a listing of organic based fertilizers to include nitrogen, phosphorus and potassium sources such as rock phosphate, greensand, bone meal, fish meal, and composted manures to restore depleted soils. Check out recent and previous editions of the Rutgers Extension newsletter - Blueberry Bulletin.

Mulching - Dr. Barbara Rogers is researching the impacts of organically approved mulches for soil benefits and weed control. Barbara's investigations with Dr. Uta Krogmann include the recycling of composted cranberry fruit and leaves, municipal leaf blends with available manures, wood chips and plastic mulch.

IPM Scouting - Our state fruit IPM specialist Dean Polk has provided timely pest population data that is GIS positioned within a blueberry field to allow spot spraying as needed based upon economic thresholds. Dean's extensive scouting program utilizes direct pest assessment, pheromone trapping systems and colored sticky boards for decision making.

Entomological Research - Dr. Sridhar Polavarapu has emphasized pruning of old cane to reduce scale infestation, clean cultivation to suppress cranberry weevil and plum curculio and using OMRI approved insecticides as *Bacillus thuringiensis* (Bt), azadirachtin (neem plant extract), rotenone, pyrethrum and spinosad. Spinosad should handle the difficult to control caterpillar complex and other economically important insect pests. Sridhar's research on baited toxicant sphere attractant traps for blueberry maggot and pheromone trapping approaches for oriental beetle are quite promising for commercialization.

Phytopathology Research - Dr. Peter Oudemans has stressed the importance of sanitation in the field to minimize pathogen entry and spread, use of certified free nursery stock, rogueing of virally diseased plants, pruning of bacterial or fungal infected stems and the promotion of rapid drying of leaf and fruit surfaces. OMRI certified fungicides as oxidate are part of his efficacy evaluation program as have been the natural minerals sulfur, lime and copper and bordeau mixture, kaolin clay and urea. Mechanical cultivation and new biological controls appear promising for Mummyberry suppression in the soil.

Weed Control - Dr. Brad Majek provides weed species identification and essential information as to the life cycle of these annual, biennial or perennial grass and broadleaf weeds. Brad's advice helps plan for a weed control program, which includes trying various mulching practices and treatments.

Commercial Organic Grower - John Marchese, Emery's Berry Farm. John's progressive approaches to planting, weed control and fertility from an organic underpinning have been extremely helpful in establishing commercial utility. His comparative use of the Weed Badger rotary hoe, flaming, cover cropping, mulching and alleyway establishment and other methods are pointing out some ways for economically solving problems specific to large-scale organic production.

Commercial Conventional Grower - Bobby Galletta, Atlantic Blueberry. Bobby and his family continue to share their legendary experiences and extensive knowledge in blueberry production in efforts to expand the industry and maintain profitability.

Certification & OMRI Information - Karen Anderson - Erich Bremer - NOFA-NJ. The Northeast Organic Farming Association of NJ has been actively involved in certifying acreage for organic

production and in explaining to growers the approved practices and materials that are essential to maintaining compliance. Through NOFA, growers can connect with other growers as to successful farming practices and can gather current information on plant protection materials and fertilizers through OMRI: Organic Materials Resource Inventory. Call 609-737-6848.
Final Comments -Currently, about 7,500 acres of blueberries are grown in NJ with less than 2% (approximately 110 acres) produced organically. Considerable undeveloped potential exists in Pennsylvania as well. The author believes that the agribusiness situation is that of an advanced market ahead of agricultural research; demand ahead of supply. The price of a flat of organic blueberries has ranged from $18 to $28 over the last three years while conventional production prices have generally ranged between $8 to $14 per flat. Any northeastern growers interested in transitioning to organic blueberries may feel free to contact the author for advice and connection to the team of leading experts referred to in this article. 732-431-7260 or e-mail sciarappa@aesop.rutgers.edu

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Potato Musings

Bill Lamont, Department of Horticulture

Seed Cutter Managment Will Result in Higher Yields

Information for this article taken from Ed Plissey's article in the April 2003 issue of the Maine Potato News.
Bill Lamont, Department of Horticulture

Poor potato stands are frequently a major factor in reduced yield, erratic tuber size distribution and lost internal quality. Poor stands are the result of missing hills, seed piece decay, blind seed or improperly size seed. The first step after acquiring quality seed in avoiding low percentage stands, is to assure that the seed cutter is properly maintained, adjusted and operated.

Seed Source

Some round white and red varieties are prone to poor eye distribution and careful seed sizing before cutting is critical to avoid blind seed. The Atlantic has few eyes at the stem and the seed cutter must be adjusted to allow for larger splits to avoid blind (no eye) seed pieces. Select and plant high-quality certified or foundation seed to avoid virus, and fungal or bacterial disease on the seed cutter. Frequently clean up, disinfecting of seed handling equipment is very important to avoid disease transmission on cut seed. Always disinfect between seed lots.

Seed Piece Size

Strive for uniform seed size and a blocky seed piece. Sliver cuts and "pickle-slice " cuts are more difficult for the planter to pick or hold in cups. Generally, a seed piece size range of 1.25 to 2.5 ounces is acceptable depending on the variety being cut, the desired number of eyes and the physiological age of the seed. The ideal cut seed piece

shape is blocky to spherical providing the lowest cut-surface area to the weight of the seed piece. This shape results in the best pick or cup performance in the planter.

Setting the Cutter

The sizing mechanism on the seed cutter is the critical component to adjust to achieve ideal seed piece size. Make sure the whole-drop section of the cutter is long or wide enough to prevent smaller tubers from carrying over onto the single cut or multiple cut sections of the cutter. Note: A run of small whole seed can easily overload the whole drop sizing unit beyond its capacity resulting in carry-over producing a high percentage of under-size seed and sliver cuts. A properly adjusted seed cutter will evenly distribute the tuber flow to the various cutting areas if the seed supply is properly sized and the uniform flow delivery hopper is properly adjusted. To obtain smooth, even cuts, the cutting discs and blades must be kept sharpened and adjusted according to the owner's manual. Torn or shatter cuts are ideal sites for disease pathogens to get established. Smooth cuts promote rapid wound healing and help avoid seed piece decay. To overcome problems of tuber eye distribution, set the mechanical cutter to produce larger blockier seed pieces. For limited eye varieties such as Atlantic, plant whole seed tubers up to two inches in diameter and split (single-cut) tubers up to 2.5 inches. Avoid machine-cutting tubers over 3.25 inches in diameter. Eliminate undersize seed pieces less than one ounce in weight. Usually a set of adjustable rollers is placed ahead of the seed treater on most mechanical cutters to eliminate low-weight slivers.

Closely Monitor the Cutting Operation

When cutting seed, strive for a minimum average seed piece size of 1 3/4 ounces. Use a platform or dairy scale to weigh sample of cut seed frequently. Look for a minimum of 91 seed pieces to a 10 pound sample of cut seed. Make sure sizing spools are adjusted to produce blocky shaped cut seed pieces while holding sliver cuts to a minimum. Keep all drive belts and chains properly tightened to maintain a smooth, even tuber flow through the machine. Lubricate cogs and pulley drives frequently to assure smooth chain flow. Make sure all shields are in place to protect employees from personal injury. Frequently check the uniform flow hopper to assure an even delivery of uncut tubers to the cutter. If there is a change in seed lot size being delivered to the cutter, adjust tuber flow to avoid crowding the primary sizing spools on the cutter.

Avoid Tuber Damage

Recent research reports have indicated a direct relationship between bruising in seed handling and stand and yield performance of the crop. Make every attempt to reduce drops and bruising in all areas of seed handling, cutting, loading and planting. Tarp all seed loads between cutting and planting operation. Excessive dehydration and shriveling of cut seed will lead to poor emergence, lost vigor, lost yield and quality. By providing careful management to seed receiving, sizing, cutting and sanitation, big dividends in crop performance, yield, quality and profitability can be achieved.

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Upcoming Meetings

Bill Lamont, Department of Horticulture

Local

May 16, 2003. High Tunnel Workshop from 9 AM to 4 PM at the Penn State High Tunnel Research and Education Facility, Horticulture Farm, Rock Springs, PA. Registration is $15 and will include a light lunch. For further information and program content contact: Lisa White (814) 692-4635 or e-mail ldw112@psu.edu.

Regional

January 27-29, 2004. Mid-Atlantic Fruit and Vegetable Conference, Hershey, PA. Contact: Bill Troxell (717)-694-3596 or e-mail: wt.pvga@tricountyi.net

National

August 16-19, 2003. 31st American Society for Plasticulture Congress. The Crown Plaza, Grand Rapids, MI. Contact: Pat Heuser (814) 238-7045 or http://www.plasticulture.org

International

August 10-14, 2003. Potato Association of America Annual Meeting, Red Lion Hotel, Spokane, Wash. Contact: (800) 325-4000. Information/Registration: www.paa2003.wsu.edu.

August 16-19, 2003. 31st American Society for Plasticulture Congress. The Crown Plaza, Grand Rapids, MI. Contact: Pat Heuser (814) 238-7045 or http://www.plasticulture.org

October 3-6, 2003. American Society for Horticultural Science Centennial Conference, Providence, RI. Contact: ASHS at http://www.ashs.org/ where all registration info is on-line or call ASHS Headquarters at (703) 836-2024.

December 8-12, 2003. National Potato Council Seed Seminar; Cruise, Los Angeles, Calif., to Baja, Mexico. Contact: Oregon Seed Potato Association, www.oregonseedpotatoes.org or (503) 731-3300.

January 6-10, 2004: National Potato Council 55th Annual Meeting, Cancun, Mexico, Moon Palace Resort. Contact: (202) 682-0333, or www.nationalpotatocouncil.org.