The Vegetable and Small Fruit Gazette

Vol. 6, No. 3- March 2002

Horticulture Department
The Pennsylvania State University
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In this Issue:

Tip for the Month: ""Courage is the art of being the only one who knows you're scared to death"- Earl Wilson

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Comments from the Editor

Bill Lamont, Department of Horticulture

The month of March still has a few educational opportunities and I would refer you the listing of upcoming meetings at the end of the gazette. I want to thank George Perry and Andy Muza for their excellent articles in this issue of the Vegetable and Small Fruit Gazette. We have Greg Burns on deck for an article for the April issue. 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

April	Greg Burns
May	Tom Butzler
June	Laura McNutt
July	Steve Bogash
August	Mary Conklin
September	Eric Oesterling
October	Cheryl Bjornson
November	John Esslinger
December	Andy Muza

Strawberry Frost Protection by Sprinkling

George Perry, Horticulture Extension Agent, Schuylkill County

It is important to refrain from starting the sprinkler system until absolutely necessary. Soils may become water logged before the frost season is over since each 0.1 acre inch of water represents 2,715 gallons. The critical temperature for blossom and fruit loss is suspected to be about 4°F. Below 32°F, it is suggested that sprinkling be withheld until temperatures in the canopy drops to 30°F. Cutting the decision this close, however, demands good temperature data taken from an adequate number of thermometers exposed properly, and using sprinkler nozzles that will continue to rotate in below freezing temperatures. Once the system is started, it is disastrous to stop until melting can be assured. There is incentive to turn off the water as soon as possible, unless soil drainage is good. It may be turned off when the ice is melting and continues to melt after the water has been turned off. Damage from heavy ice accumulations normally is minimal on strawberries because they generally support themselves from the ground through pillars of ice.

Sprinkler heads on the irrigation system should be changed to apply the minimum amount of water but sufficient water to give frost protection. How much water is needed

for protection? This answer remains poorly defined even though it is possible to estimate the amount of water needed for given wind, temperature and humidity conditions. It is the coverage of the particular blossom or fruit that must be maintained at a minimum level. Lack of uniformity of coverage creates problems. If uniformity is poor to start with it can become progressively worse with increasing wind drift. One factor in coverage is rotation rate, a compromise between distance and frequency of wetting. In general, the rotation rate of the sprinkler head should be no less than 1 rpm. A second factor in coverage relates to the uniform distribution of water around the sprinkler. Uniformity at the top of the plant canopy may be improved by increasing the overlap of the patterns. Strawberries have a shallow canopy depth, which means that fairly good distribution will be maintained throughout the depth of the canopy.

What makes this system work? When a blossom or fruit that is coated with liquid water begins to drop below 32° F, the freezing point of water, the water film begins to freeze liberating heat fusion. Sufficient heat is released to maintain 32°F temperature at the interface between the water and the newly forming ice, even though the air temperature in the vicinity continues to fall. One can count on the temperature on the interface between the water and the ice (water vapor being involved also, so that the so called triple point of water is achieved) being 32°F. The secret is to supply water at least as rapidly as it is being frozen to ice.

Freezing is not the only energy transferring process that may take place when ice and liquid water are exposed to unsaturated air. Evaporation, and energy consuming process, also occurs. When equal amounts of water are evaporated as are frozen, 7 1/2 times as much energy is consumed as is liberated. In other words, if as little as 1/7 of the water evaporates as freezes to ice, the process results in cooling and ceases to be a protection method. Water is the only variable the grower is able to control. Increasing the rate of application while radiation, conductivity, and evaporation remain nearly unchanged will result in increased protection.

It is apparent that for sprinkling to be effective, LAYER OF LIQUID WATER MUST BE MAINTAINED ON THE SURFACE OF THE PLANT OR ON THE SURFACE OF THE ICE LAYER which has formed on the plant. The amount of evaporation is controlled by air dryness and wind speed at the plant level. Fortunately, both decrease with decreasing height. Sprinkled low growing crops show less tendency to be harmed by evaporative cooling than taller growing crops.

Table 1 represents a relatively conservative estimate of the amount of water necessary for crop protection when the problem of distribution and other factors are considered.

Table 1. Precipitation rate in inches per hour necessary for frost protection.

Air temperature	Wind speed in miles per hour (measured at crop height)					
at crop ca*/nopy	0-1	2-4	5-8	10-14	18-22	30

27°F	0.10	0.10	0.1	0.1	0.2	0.3
26	0.10	0.10	0.14	0.2	0.4	0.6
24	0.10	0.16	0.3	0.4	0.8	1.6
22	0.12	0.24	0.5	0.6	1.2	
20	0.16	0.3	0.6	0.8		
18	0.2	0.4	0.7	1.0		

Adapted from Gerber and Martsolf (1965)

Compliance Inspections for Worker Protection Standard

Andy Muza, Penn State Cooperative Extension in Erie County

I have been talking with Pennsylvania Department of Agriculture (PDA) representatives about the upcoming compliance inspections for the Worker Protection Standard (WPS). PDA personnel from both Harrisburg and Region I have been extremely helpful in providing information concerning WPS inspections.

Who will be inspected?
Any farm, nursery, greenhouse or forest where pesticides are used in the production of agricultural plants are subject to inspections. So everyone should be prepared and in compliance. However, agricultural operations that have a number of employees, including those with migrant workers, will probably be prime candidates for inspection.

When will compliance inspections begin?
PDA inspectors from across Pennsylvania will be meeting in Harrisburg during the second week in March. One of the topics covered will include WPS Compliance Inspections. Anytime after this meeting inspections could begin.

Who will conduct inspections?
PDA inspectors from the Agriculture Regional Office in which your county is located will be responsible for inspections.

What will inspectors be looking for?
A Worker Protection Standard Basic Compliance Inspection checklist is available which provides an overview of what inspectors will be looking for (see For More Information below). This checklist outlines areas of compliance which include: Central Location Information; Pesticide Safety Training; Decontamination Sites; Application Notification; Personal Protective Equipment; and Monitoring Handlers. Part of the inspection process will also include worker interviews. Questions such as: Were you trained? and How

were you trained? are likely to be asked. For complete information about your responsibilities refer to *The Worker Protection Standard for Agricultural Pesticides - How To Comply, What Employers Need To Know* EPA 735-B-93-001 July 1993.

For More Information
Two other forms that will help you prepare for an inspection include: Worker Protection Standards Acknowledgment of Handler Instruction, and Worker Protection Standards Acknowledgment of Worker Instruction. For more information about any of these forms, *How To Comply* Manual or additional compliance information contact the **National Agriculture Compliance Assistance Center**.
Toll free: 1-888-663-2155
Fax: 1-913-551-7270
Internet: http://www.epa.gov/oppfead1/safety/workers/workers.htm or the nearest Pennsylvania Department of Agriculture Regional Office.

Penn State's Pesticide Education Program website (http://www.pested.psu.edu) also provides valuable resources about the EPA's Worker Protection Standard including the WPS checklist.

Bug vs. Bug - Biological Control of Western Flower Thrips with the Pirate Bug, *Orius insidiosus*

Cathy Thomas, Integrated Pest Management Program
Pennsylvania Department of Agriculture

Western flower thrips have a broad host range and may feed upon tomatoes, peppers, cucumbers, impatiens, fuchsia, chrysanthemum, ivy geraniums, and many other ornamental hosts. This pest is difficult to control since it has widespread resistance to many different classes of insecticides. In addition to damaging plant tissue, this insect transmits Impatiens Necrotic Spot Virus (INSV) and Tomato Spotted Wilt Virus (TSWV) to both vegetable and ornamental plants. Early first instar nymphs acquire the virus as they feed on infected plants. The virus is retained in the thrips until they reach the adult stage that transmits the virus to susceptible hosts.

Early detection and treatment of this pest is critical to minimize virus transmission. Damage symptoms or virus infection may not be visible until many days after plants have been fed upon. Greenhouse vegetable seedlings and transplants should be **isolated** from ornamental plant material from outside sources that could be harboring the virus or virulent thrips.

The minute pirate bug or Orius insidiosus, is effective in attacking both the adult and immature thrips stages and will also feed on other prey such as aphids and spider mites. Remember to use Orius or any other natural enemy as a preventive control. Biological control is not a rescue treatment and should not be used when thrips populations are high.

Life Cycle of Orius insidiosus

Orius is a small bug with a long feeding tube called a rostrum that folds under its body. The adult female is about 3 mm, while the males are slightly smaller.

When introduced into the crop, the adult female will lay 1 - 3 eggs per day embedded in the plant tissue of petioles, or in veins on the underside of the leaf. From these eggs emerge yellow nymphs with conspicuous red eyes. The total development time from egg to adult is approximately 3 weeks at 77°F. The adult bug lives for 3 - 4 weeks and feeds on all thrips stages, while the younger nymphs eat only thrips larvae. Upon finding prey, they insert their rostrum and drain the prey of its body fluids. *Orius* will also eat pollen when there are no thrips.

Points to consider

- Eliminate the use of toxic insecticides 2 months before introducing *Orius*.
- *Orius* can be used in combination with the predatory mite *Neoseilus cucumeris*.
- Introduce *Orius* has soon as thrips are detected.
- Consult biocontrol supplier for rate information.
- Apply in the cool morning or early evening, avoid application in bright sunlight.
- *Orius* lays eggs largely in side shoots. Avoid loss of eggs by introducing after removing side shoots.

Product Information

Orius is commercially available in the United States through biocontrol suppliers. The adult bug is sent to grower in buckwheat husk carrier, packed in a plastic bottle. Turn the bottle and shake lightly before and during introduction to have equal distribution. Sprinkle the material on leaves in groups to encourage mating and do not disturb for several days so that the bugs have sufficient time to spread throughout the crop. Introduce *Orius* near thrips hot spots to increase their effectiveness. Do not introduce near sticky cards.

Product names by major suppliers:
Orius - System - Biobest Biologicals, Belgium
Thripor - Koppert Biologicals, Netherlands
Oriline - Syngenta Bioline, England, California

A list of biocontrol distributors in the US can be found at this web site: www.anbp.org. which is the Association of Natural Bio-control Producers. Most distributors require orders to be placed by Thursday for delivery the following week.

Benefits

- Can be used in a both vegetable and ornamental crops
- Can be introduced preventatively in pollen bearing crops

- Can be combined with other thrips predators
- Attacks other insect pests

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

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Cucumber Beetle Control

Lewis Otjen, Research Support Associate, Department of Horticulture and
Shelby Fleischer, Department of Entomology

Two species of "cucumber beetles" [striped cucumber beetle, and spotted cucumber beetle] feed on cucurbits. Two additional species [northern corn rootworm, and western corn rootworm] invade late in the season. Within this complex, the striped cucumber beetle is present in the highest density and over the longest time span. Adult feeding during early plant growth can cause stand reduction and rind-feeding by adults or larvae later in the season renders crops unmarketable and may serve as routes of entry for pathogens. Larval feeding also impacts root development and has been correlated with fusarium wilt. More importantly, the striped cucumber beetle vectors bacterial and viral pathogens. The major pathogen is *Erwinia tracheiphila*, the causal agent of bacterial wilt. Disease management currently relies on vector management. Even a low beetle density during colonization of young plants can result in significant plant disease and the severity of disease over time correlates to beetle density during early plant growth. Disease development is strongly influenced by inoculum dose. Cultural methods can manage the problem in machine-harvested, short-season processing pickles that have high plant populations, but the vector/disease complex presents very difficult risks for long-season, fresh-market vine crops that are grown at much lower plant populations. Bacterial wilt is most severe on melons and cucumbers. It was rare to see bacterial wilt in squash and pumpkins in the past, but recently this disease seems to be infesting some squash and pumpkin plantings.

Timing and cultural controls. The striped cucumber beetle overwinters as an adult both inside and outside of cucurbit fields. Adults invade fields soon after transplanting, and lay eggs at the base of plants. The hatching larvae feed on the roots of vine crops, pupate, and then emerge as new adults in about 25-30 days. There are at least 2, and probably more, generations per year in Pennsylvania.

Early immigration can be the most serious. Up to 10% of the immigrating adults have

tested positive for carrying the pathogen that causes bacterial wilt using ELISA tests. Where this immigration has traditionally occurred very soon (within 3 days to a week) after transplanting, we recommend an application of Admire to the transplants. Roots of these young plants may not be sufficiently established to take up material applied through drip irrigation. After transplanting, the roots are training to the drip lines, and a single application through the drip irrigation at that time (about 10 days to 2 weeks after transplanting) should control the immigrating adults. We anticipate that no, or only 1 or 2 foliar insecticide applications would be needed if that early immigrating population is prevented from establishing. If this approach is successful for several years, we may no longer see this dramatic invasion of fields soon after transplanting. Should that occur, scout fields and add Admire when immigration starts.
An effective cultural control method is the use of row covers. Put the covers on right at transplanting. The row covers effectively exclude the beetles for as long as you have the crop covered. If you can find a self-pollinating cultivar (there are some good ones now for cucumbers), then you can leave the floating row cover on until harvest. Otherwise, you need to remove the cover to allow bees to pollinate the crop.

Admire 2 F. Imidacloprid, the active ingredient of Admire, is a relatively new systemic neonicotinoid insecticide now labeled for striped cucumber beetle in vine crops. Admire is intended for soil applications and translocates to new leaf tissue when taken up by the roots. *The foliar formulation - Provado - is NOT labeled for cucurbit crops*. In a gallon of formulated product, Admire 2F contains 2 pounds active ingredient Vegetable growers must correct for application rates when using plasticulture and applying materials through drip irrigation since the effective treated area is reduced to that of a "mulched acre". Smaller growers will need low application rates, which require measuring volumes of less than one fluid ounce.
To control cucumber beetles invasion at transplanting with Admire, use a very low rate (0.02 ml/plant) to treat transplants about 1 day prior to planting in the field. To treat a flat of 200 transplants with Admire, dilute 4 ml (0.135 oz) of Admire in a volume of water sufficient to soak to soil mix evenly. This treatment will protect the plants for about 2 weeks, and can be followed by field application if needed. To help make conversions: multiply 0.02 ml per plant times the number of plants in your flat. For example, use 20 ml to treat 1000 transplants. This rate is just a little higher than suggested for tomato transplants, which is - 15 ml - or 0.5 ounce - per 1000 transplants. You can convert ml to oz by dividing by 29.6 (there is 29.6 ml in a fluid oz). Be careful of phytotoxicity (burning the plants) at higher rates. We observed burning of leaf margins at 0.04 ml/melon plant at the 2-leaf stage, although these plants did grow out of this in about 2 weeks.
The best way to apply Admire to the field is through an injector connected to a drip irrigation system. As with all chemical injections, the irrigation system should be primed with water prior to beginning the injection, and the material should be injected slowly to provide even distribution. Remember: the more evenly distributed the material is, the better job of protection, and the chance of phytotoxicity will be reduced (i.e. the more emitters on your drip tubing the better). It is also important that the zone of moisture created by the drip tubing be within the root zone of the crop because it is the roots that will move the material into the plant. Below is a table which shows the number of

ounces (oz) or milliliters (ml) of Admire that need to be applied per 100 row-feet of a cucurbit crop for a application rates of 16-24 oz/A. The amount required to treat a 100 ft row is very small and not easily achieved by commonly available measuring devices. We recommend that growers with small fields use milliliters as a measurement unit, and use syringes if available (without a needle to avoid plugging up the syringe, and to help with safety) for extracting these amounts. A syringe without a needle will provide a very accurate and safe method of measuring these small quantities.

Table 1. Linear rates for Admire in cucurbits for 100 row feet (Remember: do not apply Admire within 21 days of harvest!).

Admire 2 Flowable

Rate Desired oz/A	oz/A Oz/100 row-ft (3 ft bed)*	ml of Admire to apply per 100 row-ft
16	0.110	3.26
17	0.117	3.46
18	0.124	3.67
19	0.131	3.87
20	0.138	4.07
21	0.145	4.28
22	0.152	4.48
23	0.158	4.68
24	0.165	4.89

* These rates were calculated for irrigation systems supplying a 3-foot bed. The amount of material applied should be the same regardless of whether a single or double row occupies a bed of this size.

If a drip irrigation system is not available to deliver the pesticide to the root zone, it can be applied by directing a spray or drench into the soil at the base of the plant. It is important that the material be applied when the soil is moist, or with enough water to soak the soil to the depth of the root zone. If it is applied only to the surface of the soil, the roots will not have good access to it. Apply the material directly to the base of the

plant when the soil is moist and with at least 10 ml of water per plant for young plants (<4 true leaves) and 50 ml of water for larger plants. This can be achieved with a backpack sprayer rather efficiently, but you need to calculate how much time it takes for your backpack sprayer to deliver 10 ml volume of water. To calculate the total volume of water to put in your backpack sprayer, multiply the number of plants you want to treat by the volume of water per plant. For example, let's say you wanted to treat a 100-foot row of cantaloupe with 16 oz/A of Admire. If your plant spacing were 2' then there would be 50 plants in that row. If the plants were young you would only need 10 ml of water per plant (minimum - please feel free to increase this amount if you wish). Multiply 50 plants by 10 ml and you will discover you need 500 ml of water to treat this row. Add 500 ml of water to the backpack sprayer and then add 3.26 ml of Admire (see Table 1), mix well, and apply. The trick with this type of delivery system is to estimate how long it takes to deliver 10 ml (a very small quantity) from your backpack sprayer. Often this is just a quick shot from the trigger. Remember to keep the nozzle close to the soil and direct the spray toward the base of the stem. Please test the output of your sprayer with water prior to performing these calculations, and remember - do not apply Admire within 21 days of harvest.

Read the label. You should always read the label. Information on the label supercedes anything written here, and good information about rates per 1000 linear feet is on the label.

That's a Berry Good Question

Kathy Demchak, Department of Horticulture

Q. I'll ask the question this month, since I get this one quite frequently. Where can I find the cultivar '_____'? (fill in the blank). See below for the answer.

A. If you have Web access, you'll be able to find what you are looking for. This infomation is from Dr. Marvin Pritts of Cornell University:
"All of the berry cultivars offered by 40 of the largest nurseries in North America are now categorized and alphabetized at the following web address:
www.hort.cornell.edu/nursery/
To find a source for a particular cultivar, go to the site, select a crop, find the cultivar of interest, note the nursery codes, then consult the list of nurseries that offer that particular cultivar for addresses, phone numbers, email addresses, web sites and FAX numbers.
Thanks to Mary Jo Kelly for her efforts to update this list."
Note: If you don't have Web access, your county Extension office should be able to get to the Web site above.
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

Compendium of Potato Diseases, Second Edition- A Review

Bill Lamont, Department of Horticulture

Compendium of Potato Diseases, Second Edition, edited by: Walter R. Stevenson, Rosemary Loria, Gary D. Franc, and D.P. Weingartner. 2001. American Phytopathological Society Press, 3340 Pilot Knob Road, St. Paul, MN 55121-2097. 144 p., 193 color photographs, 83 black and white illustrations. $49.00,
8 1/2" x 11" soft-cover. ISBN 0-89054-275-9.

The first edition of the Compendium of Potato Diseases was published in 1981 by the American Phytopathological Society, with Bill Hooker serving as editor. Since then the knowledge base concerning key pathogens of potatoes and management tools to deal with them has greatly expanded. Because of this explosion of new information it was necessary to revise and completely update the original compendium with practical and up-to-date information on diseases affecting potato. The information contained in the new 2nd Edition will be useful to those working with the potato crop nationally and internationally.

The organization of the compendium is excellent and it is divided into two major parts. Part I contains descriptions of diseases caused by infectious pathogens, including fungi, bacteria, nematodes, viruses, and phytoplasmas. Part II contains descriptions of diseases observed in the absence of infectious pathogens, including stresses caused by moisture and temperature extremes, air pollution, herbicide drift and carryover, and nutrient imbalances. At the very beginning of the compendium is a brief but comprehensive introduction covering the origin, history and importance of the potato, its development and anatomy, discussion of tuber periderm and disease resistance, tuber respiration and storage environment and potato disease management strategies.

The individual sections describing individual diseases are organized to include: a review of the importance and distribution of the disease, symptoms useful for diagnosis, the causal organism, the disease cycle and epidemiology, and management practices, with selected references for additional details if the reader is interested in finding more information about a particular disease or disorder. The information on disease management includes a discussion of control principles, so that management tools can be adapted to a wide range of cropping circumstances. There are no specific recommendations for chemical treatment provided in the compendium, since these change frequently and thus would necessitate constant updating and reprinting of this publication. Specific control recommendations are generally available from a wide range of other sources for example; The Commercial Vegetable Production Recommendations published annually in Pennsylvania.

A real plus for this compendium, is the fact that the descriptions of most diseases are illustrated with excellent color photographs of plants and potato tubers showing

symptoms that are extremely useful in diagnosing a field or storage problem. There are also black and white diagrams and photographs with the text to provide additional illustrations of symptoms and causal agents of disease.

The forty-five authors that participated in writing the individual sections of the compendium literally come from around the world and are recognized experts in their field. The result is an authoritative publication on the diseases of potatoes.

The next to last section in the back of the compendium is a glossary of terms, which I found to be extremely helpful. The final section at the end of the compendium is an index listing the subjects covered in compendium allowing one to quickly find any disease or disorder.

The arrival of this 2nd Edition was widely anticipated by those involved in the research, production or marketing of potatoes due to the fact that so many things had changed since the 1st edition was published in 1981. The long wait is over and the resulting 2nd Compendium of Potato Diseases belongs on the bookshelf of any person involved at all with potatoes. It is an excellent reference and resource that will prove to be invaluable in helping to diagnose potato diseases and disorders.

Upcoming Meetings

Bill Lamont, Department of Horticulture

Local

March 5, 2002: Schuylkill County Regional Vegetable Growers Meeting, Extension Office, Pottsville, PA. Contact: George Perry (570) 622-4225

March 6, 2002: Southeastern Vegetable Growers Meeting, Heritage Restaurant, Franconia, PA. Contact: Mary Conklin (610) 489-4315

March 7, 2002: Kutztown Vegetable Auction Growers Meeting, Fleetwood Grange Hall, Kutztown, PA. Contact: John Berry, Lehigh County Extension Office (610) 391-9840 or Laura McNutt, Berks County Extension Office (610) 378-1327

March 12, 2002: North Central Vegetable Meeting, Pleasant Gap, PA. Contact: Tom Butzler, (570) 726-0022

March 13, 2002: North Central Vegetable Producers Conference, Coudersport, PA. Contact: Greg Burns (814) 776-5331

March 14, 2002: Erie County Potato and Vegetable Growers Meeting. Contact: Andy Muza (814) 825-0900

March 15, 2002: Butler County Potato Meeting. Contact: Tom Zundel (412) 662-3141

March 30, 2002: Pond Management for Irrigation, Livestock and Recreational Uses. Biglerville Fruit Lab, Biglerville PA. Contact: Steve Bogash (717) 263-9226

Regional

March 22-23, 2002: Passive Solar Greenhouse-Design, Construction and Year around Production. Contact: Steve Moore (717) 225-2489

National

February 23-26, 2002: 30th American Society for Plasticulture Congress, San Diego, CA. Contact: Pat Heuser Phone: (717) 238-9762 Fax: (717) 238-9985 or website http://www.plasticulture.org