The Vegetable & Small Fruit Gazette

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Schedule for Articles

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Quote for Thought from Pete Ferretti

All journeys have secret destinations of which the traveler is unaware.

~ Martin Buber

Plan for Successful Pest Management

Andy Muza, Penn State Cooperative Extension, Erie County

Spring is here and that means that the potential for pest problems in your berry crops could be just around the corner. Be prepared and have a plan in place to deal with problems as they arise. Some areas to consider as we enter the season:

Cultural Practices – Often the first thought that comes to mind for any pest problem is, "What pesticide can I use for control?" However, the incorporation of cultural practices into your pest management strategy can dramatically reduce the chances for development of problems. Use cultural practices that will aid in the reduction of inocula or the improvement of spray coverage. Practices such as proper pruning, sanitation, renovation, mulching, cultivation, etc. should be an integral part of any pest management strategy where appropriate.

Sprayer maintenance – Now is the time to check the pump, hoses, filters, nozzles, etc. to be sure that everything is in good working order before your first pesticide application. Also practice routine sprayer maintenance during the season such as lubrication of bearings and cleaning and flushing of sprayer after each use.

Sprayer calibration – Pesticides are expensive. Improper calibration can cost you money by either using an excess of material or through lack of control due to inadequate amount of pesticides applied. Calibrate your sprayer at the beginning of the season and at least once during the season. The sprayer should be calibrated in the field under conditions in which the sprayer will be operated.
A useful site for pesticide applicator technology with many links is at
www.nysaes.cornell.edu/ent/faculty/landers/pestapp/.

Review your records – Depending on your crop and problem, a dormant oil spray (for management of scale, or mites) or early lime sulfur spray may be needed (e.g., for phomopsis). Hopefully you have been keeping records of pest problems during the past season(s). This is the first step in developing a management plan for the upcoming season. Review pest problems and outline IPM strategies to address these problems early. If you have not kept records concerning pest problems in your plantings then start this year.

Pest Identification – Before you can properly manage a pest situation you must correctly identify the problem. Know how to identify pests, insect injury and disease symptoms or seek assistance in identification (e.g., Cooperative Extension). A useful web site for identification of problems on small fruit is The Berry Diagnostic Tool www.hort.cornell.edu/diagnostic/ . Many links are also available at Penn State's Small Fruit Website (http://hortweb.cas.psu.edu/extension/smallfruits/index.htm).

Scouting – Routine scouting should begin at bud swell and continue throughout the season on at least a weekly basis. Early detection and correction of problems is key to avoiding major losses.

Pesticide Usage - Consult "The Mid-Atlantic Berry Guide for Commercial Growers" (http://hortweb.cas.psu.edu/extension/smallfruits/index.htm) or similar guide for your state to determine the most effective pesticides and spray timings for your problem.

Use an adequate amount of water for good coverage during spraying and adjust pH of water according to the pesticide label.

Pesticide Resistance Management – To minimize the possibility for development of pesticide resistance **do not** exclusively use the same pesticides or class of pesticides throughout the season. Mix up the use of chemicals for any particular problem by alternating materials and /or tank mixing.

Throughout the season continue to re-examine your IPM practices and adjust where needed. If you are not accomplishing adequate management results for a particular problem then ask yourself, Why not?

A few questions to keep in mind:
- Are cultural practices being used?
- Is the choice of pesticides correct or the best?
- Was spray coverage poor?
- Was spray timing(s) incorrect?
- Were spray intervals too long?
- Were pesticide rates too low?
- Were too few applications used?

Every season presents new challenges and opportunities. Best of luck this season with maximum yields, superb quality, good profits and few problems.

Bacterial Canker on Tomato

Tim Elkner, Regional Horticulture Educator, Lancaster County

Bacterial canker is a disease on tomato that I am seeing more frequently in our fields. This disease, once established in a planting, cannot be eradicated and will usually result in loss of some or a considerable portion of the tomato crop. Wet weather can result in more rapid spread of bacterial canker in the field. This disease also can occur on greenhouse tomato crops although I have not seen or heard of this in our region. Successful management of bacterial canker requires an understanding of the disease cycle and key control measures.

Bacterial canker was observed in Michigan in 1909 although some reports suggest the disease was present in New York in 1892. Canker occurs on all continents and has been reported in most tomato growing areas of the world. There are several natural hosts of the disease (solanaceous weeds) but these are not the likely source of bacterial canker in our tomato fields.

Symptoms of bacterial canker can appear on all parts of tomato plants. Infection can occur at any stage of plant development. The disease can be either a systemic or a secondary infection in a tomato plant; systemic infections are most destructive. Symptoms on systemically infected plants appear first on the oldest leaves. The leaves turn downward and leaflets curl and then shrivel. Other potential symptoms include dull green water-soaked areas on leaves that may later die and wilting of developing leaves. Symptoms of secondary infections are raised white spots on developing fruit or occasionally the leaves and small tan spots on young stems and the calyx. An excellent diagnostic symptom of tomato plants in the later stages of this disease includes open stem and petiole cankers (from which the disease receives its name). Stems from plants with advanced symptoms can be cut open to show a reddish-brown coloration of the pith.

The bacterial canker pathogen can survive in seeds, soil, compost, wooden tomato stakes, dead tomato plant debris and in perennial solanaceous weed hosts. Spread within a field occurs by wind, rain, running water, and insects and by workers during plant handling, cultivation, spraying and harvesting. In my experience the main method of spreading bacterial canker in a field is by workers pruning and tying tomatoes. Hairs on the plants are damaged during these operations and provide openings for infection. Optimum temperatures for development of bacterial canker are 75-90°F.

Specialists agree that bacterial canker is one of the most difficult tomato diseases to control. The key is keeping the disease out of your tomato fields in the first place. The following is a list of methods to help control bacterial canker in tomato crops:

1. Use disease-free seed. The bacterial canker pathogen can survive on both the seed coat and within the seed itself. Therefore, surface decontamination may not insure uninfected seed. Hot-water treatment is the only effective way to kill internal pathogens. Purchase hot-water treated tomato seed (talk with your supplier) or treat the seed yourself. I cannot discuss all the particulars here but tomato seed needs to be treated at 122°F for 25 minutes or 125°F for 20 minutes. If you save your own seed, select tomatoes from uninfected plants and use hot-water treatment before sowing the seeds.
2. Use disease-free transplants. If you grow your own plants, treat seedlings two to four times with streptomycin sulfate while in the greenhouse. (Streptomycin cannot be used in the field). If you purchase plants, check with your supplier to be sure that the plants were treated. Avoid

splashing water between flats of transplants as much as possible during watering and avoid handling plants when they are wet.

3. Use a good rotation schedule in your fields. (2-3 years without tomatoes and related crops.)
4. Treat wooden stakes to prevent carry-over infections.
5. Eradicate solanaceous weeds as much as possible in your fields.
6. Avoid working in your tomato fields when plants are wet.
7. Plow under plant debris after the season. Bacterial canker survives in a field as long as there is any infected debris present. Burying plant debris speeds breakdown.
8. Use preventative sprays if you suspect a canker infection in your field. Avoid airblast sprayers since the high-pressure airstream may result in bacterial spread.
9. Isolated outbreaks (a few plants) may be controlled by removing the obviously infected plants and several nearby plants from the field. However, large-scale outbreaks cannot be effectively controlled using this method.

I suggest that you use as many of these methods as possible to prevent canker in your tomato crop. Prevention is both less expensive and the most effective way to control this disease. Bacterial canker infections in a field or greenhouse require regular copper or copper/maneb sprays and control will be limited at best.

That's a Berry Good Question!!!

Kathy Demchak, Department of Horticulture

Q1. I've got a wet-bulb/dry-bulb thermometer. I know I can use it for calculating relative humidity, but what I really want to know is… What its practical role is in frost protection? I'm trying to take the guesswork out of figuring out when to start the irrigation. (Anon.)

A1. The wet-bulb temperature is very close to what the plant temperature will be once the irrigation has started, and cooling from evaporation has taken place. So, the irrigation should be fully operating when the wet-bulb temperature equals the critical temperature, i.e., start the irrigation when the wet bulb temperature is just a degree or two above the critical temperature. The process of arriving at the wet-bulb temperature will be slower if the water is turning to ice, by the way, and there will be a spell when the temperature reads too high while the water is freezing and giving off heat. If you're protecting strawberry blossoms that are fully open, it's probably just easiest to turn on the irrigation when the wet-bulb temperature reaches 32°F. We frequently recommend looking up starting temperatures from a table of air temperatures, relative humidity and wind speed, or critical temperature and dew point, which I doubt many people do....

Q2. Is a staggered sprinkler spacing really that much better than a square one for frost protection?

A2. The application is definitely more uniform when the pattern of sprinkler heads is staggered, whether for frost protection or for irrigation. When the sprinklers are in a staggered pattern, more of the total area is hit by the water from a similar number of sprinkler heads. For example, if you have 50% overlap in a staggered pattern (i.e., the radius of the water arc would just hit the neighboring line), almost all of the area will be hit by water from 3 sprinkler heads, with only tiny amounts of the area covered by either 2 or 4 sprinkler heads. However, if you have 50% overlap in a square pattern, about equal areas will be covered by 3 or 4 sprinkler heads, and a larger area by only 2 as compared to a staggered pattern. It's easier to see this than to explain it, so if you're really bored someday, draw a bunch of circles on a piece of graph paper, and you'll see what I mean. This is still an oversimplification, as the volume of water is different in different places in the arc. However, it's still better to have the staggered pattern from the standpoint of making sure everything gets covered, especially if a breeze throws the whole pattern off, as you're less likely for certain areas to be dependent on only a sprinkler or two for coverage.

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.

High Tunnel Lettuce Cultivars

Mike Orzolek, Department of Horticulture, Pennsylvania State University

What lettuce types and varieties should I grow in my high tunnel? Below are grower recommendations that I have compiled over the last 2 months off a high tunnel listserv.

1) We live near Lincoln, NE and raise 'Tom Thumb', 'Little Gem', 'Rouge D'Hiver' and 'Magenta' in the spring and fall in our high tunnels. The 'Rouge D'Hiver' lasts well into the winter for us.

2) We like 'Kalura' and 'Winter Density' for green romaine, but 'Kalura' has gotten hard to find. Good old 'Black Seeded Simpson' and 'Waldmann's' for green leaf, 'Red Sails' and 'Merlot' ('Galactica') for red leaf, 'Buttercrunch' and 'Red Cross' for buttercrunch, 'Green Deertongue', but not red, 'Royal Oak' and 'Cocarde' if you can sell oakleafs - we can't. Those are our mainstays for high tunnel winter growing, although we are always trying new ones. We don't grow mache. It is a little too weird for our market and there are too many things that are easy to sell.

3) I have good luck with 'Marvel of Four Seasons', 'Simpson Elite', 'Tango', 'Nancy' and 'Red Sails' in hoop houses in winter/early spring. I don't grow lettuce in hoop houses in spring summer because it is not necessary for lettuce and tends to get too hot for them.

4) I like 'Kalura' best for winter growing in the high tunnels. It makes a fabulous head, much nicer than 'Winter Density'. You can purchase seed for 'Kalura' from Turtle Tree Seed. No website. They accept orders by mail, fax or phone. Their phone number is 1-888-516-7797, fax is 678-202-1351 and address is Camphill Village, Copake, NY 12516. Orders must be placed by May 31st, so you need to order next winter's seed now. Other seed they sell that I really like is cucumber 'Edmonson', 'Pac Choi', 'Dwarf Ching Chang'. We seed into flats and transplant on 6" centers both ways in the high tunnels. Fast crop. Really excellent. Their 'Red Russian' kale is very good. And I love their Swiss chard called 'Rainbow'. It produces fantastic colored stems with shades of red, pink, orange, yellow, white and green and really does well in the high tunnel, from early fall, through winter and on into spring. 'Rainbow' is certified both organic and biodynamic. Other lettuces we grow in the high tunnel are 'Vulcan' (replaced 'Red Sails' a couple of years ago for us). We get 'Vulcan' from Johnny's. And we also grow either 'Galactic' from Johnny's or 'Merlot' from Turtle Tree. Really deep red, so heads are on the small side, and don't grow quite as fast. But customers rave over it. And I love 'Red Tinged Winter' as a late winter/early spring lettuce. I'm really not sure what kind of lettuce it is. It makes a large head, although not tightly wrapped, but it is absolutely drop-dead gorgeous, and tastes really good too! It makes a fabulous display at the farmers' market the middle of April. And my favorite oak leaf varieties are 'Galisse' (green) and 'Oscarde' (red) both from Johnny's. Both good tasting and make a beautiful presentation.
We start our lettuce in flats in the greenhouse, and transplant them at about 4 weeks of age into the high tunnels. In our growing system, they are placed on 12" by 10" centers. Our main growing beds are 42" wide, with 4 rows of drip tape going down each row. Each row of drip tape is about 10-1/2 inches apart, with emitters every 12". When we're ready to transplant, we turn on the irrigation, wait for a wet spot to show, and shove the transplant into the wet spot. You don't need to pull soil up around the transplant and it doesn't need to be planted deep. If your soil is contaminated with fungal diseases, you're better off having the root ball above the soil level.

5) Lettuce is one crop I am interested in (also peas, onions, cucurbits). I am located in upstate NY (20 miles south of Lake Ontario and 90 miles west of Buffalo) in USDA hardiness zone 6a. I am curious to know how early and late those you in a similar zone grow lettuce and other crops, successfully. We grew 'Mikola', green and red 'Grand Rapids', 'Michele' Batavian (best tasting, in our opinion), 'Buttercrunch' and 'Oscarde' (among others) outside last year. It was simply too hot in the warmest part of the growing season (later June, July and August) for good lettuce growth, without bolting or stunting.

6) You said that you charge $1.75 each for lettuce by the head. About what size are your heads? We charged $1 for leaf lettuce "heads" that weighed 4-8 ounces and $2 for "heads" weighing about 12-16+ ounces. I haven't sold any bagged lettuce mixes (mesclun, etc.). We also sold 'Tat Soi', mustard greens and kale for $1 per approximately half-pound bunch at the market. Maybe not enough, since we were the only ones selling those greens?

7) I really hate talking about prices, because what seems high to me seems low to others, and then some one will say my prices are so high, only the rich can afford to buy from me. So... please keep in mind that we live in rural, south central Kentucky, where most people still have roots to the farming community. We sell everything retail, maintaining an email distribution list, where we email our customers with what we have during the winter, and deliver to their door on Saturday morning. From mid-April through the end of October, we sell at a producer-only farmers' market.
Our top selling item is mesclun, $4.50 per half pound, or $8.00 per pound. Next comes spinach, leaf only, washed and spun dried $4.50 per half pound, only comes that way. Lettuce by the "head" sells for $1.75 each. Arugula about a 1-1/2 to 2 ounce bunch is $1.75. All greens, such as kale, chard, collards are $1.75 per bunch - bunch is about 14 to 17 leaves, depends upon how many orders and how much I have to harvest. Minimum order is $5.00 and delivery fee is $2.50 per stop. Round trip takes us about 4 hours, covers about 85 to 100 miles. We make about 20 to 30+ stops, average order is about $16.50 When we're done with our delivery, we're usually only a couple of miles away from our bank and shopping district, so it pays for our trip into town.

Frost Protection: Tips and Techniques

Kathy Demchak, Department of Horticulture

Damage from freezes and frost is of concern from budbreak in the spring through flowering and fruit set. The blossoms are tender and are the plant part most commonly damaged by low temperatures. Since loss of the blossoms means a loss of fruit for the year, frost protection is of great concern.

Critical Temperatures for Frost Damage

Damage occurs when water in the plants' cells freezes, thus causing the cells or cell parts to rupture. The temperature at which this occurs depends on the water content and concentration of water vs. solutes in the plant tissue. Therefore, the temperature at which damage occurs varies with the crop and growth stage. Table 1 lists commonly-accepted critical temperatures for strawberry and blueberry blossoms at different stages of bud development. These values are not absolute, and within reason, it is better to err on the side of safety when protecting crops from frost damage.

Table 1. Critical temperatures (degrees F) for cold damage of flower buds based on stage of development. Note with blueberries, there is considerable variability in temperatures at which damage was reported for these growth stages.

Strawberries	Critical temp.		Blueberries	Critical temp.
Bud emergence	10		Bud swell	15-20
Tight bud	22		Tight cluster	18-23
"Popcorn"	26		Separate flowers visible	22-25
Open blossom	30		Late closed blossom	25-26
Green fruit	28		Open blossom	27
			Petal fall	28

Sources: Strawberry Critical Temperatures - K. Perry and B.C. Poling, North Carolina State Univ.; and Richard Funt, Ohio State Univ.; Blueberry Critical Temperatures - Fruit Crop Advisory Team Alert, Vol. 18, No. 3. "Protecting Blueberries from Frost", E. Hanson and M. Longstroth, Michigan State Univ.

Types of Frosts and Freezes

Radiant frosts and freezes occur on calm, clear nights with no cloud cover. Heat is lost from the soil and plants, and radiates back to the sky. *Advective freezes*, sometimes called windborne freezes, are caused when a cold air mass moves into the region accompanied by with a lot of wind. It is difficult to protect against this type of freeze.

Environmental Factors Affecting Frost Occurrence and Protection

Air temperature is the measurement used for initiating or stopping frost control practices, and can be taken with either a dry-bulb or wet-bulb thermometer. *Dry-bulb temperatures* are the type commonly referenced in literature and in weather forecasts. *Wet-bulb temperatures* are obtained from a thermometer that is covered with a wet wick. Air is moved over the bulb causing evaporative cooling to occur. The wet-bulb temperature is useful because it essentially is what the plant temperature will be once the irrigation is started and evaporative cooling has taken place.

Wind speeds of more than a few miles per hour can make frost protection difficult, especially in an advective freeze. Light breezes, however, tend to mix the air and can increase temperatures at ground

level in the case of radiational frosts. Temperatures tend to be more uniform even across a distance of miles when windy conditions exist.

The *dew point* is the temperature at which the relative humidity reaches 100% as the air cools. At this point, water vapor in the air condenses into fog or dew, which gives off heat, slowing the temperature drop. The risk of having a frost becomes greater as the dew point becomes lower. If the dew point is below freezing, so that condensation and heat release does not take place until below freezing, temperatures can drop to damaging levels extremely rapidly. In this case, the white crystals typically seen in a frost or freeze may not form, a condition sometimes referred to as a "black frost".

Relative humidity is the amount of moisture contained in the air relative to the maximum amount that could be held. It changes with temperature and can change quickly with the air mass.

Site-Specific Effects on Frosts/Freeze Occurrence

Site selection is the most important step for frost or freeze protection of a small fruit crop. The best site is one downwind from or closely surrounded by a large body of water. Topography also affects frost occurrence. Cold air is heavier than warm air, and therefore flows downhill. Temperatures are often higher at the tops of slopes, while cold air which collects in the lower areas (frost pockets) is often 4° to 5°F lower. Southern slopes are generally warmer than those facing north, but plants on Southern slopes will also come out of dormancy earlier, possibly negating this benefit in many instances.

Soil moisture has an effect. Moist soil holds more heat and radiates heat back to the environment for a longer time than dry soil. If the soil is dry, plantings should be irrigated a day or two ahead of an expected cold snap to allow time for heat to be captured.

Soil texture and compaction are also factors, as heavier soils with more clay retain heat better than sandy soils. Sandy soils are also often lighter in color and hence tend to reflect more sunlight, rather than absorbing it in the form of heat.

Ground cover affects the amount of heat absorbed by and released from the soil. A bare, undisturbed moist soil with no ground cover can release enough heat to raise the temperature 2 to 3 degrees in the plant canopy as compared to a sod-, grass-, or straw mulch-covered soil.

Methods for Protecting Plants from Frosts and Freezes

Floating row covers are useful especially for small acreages of low-growing crops or when water for overhead irrigation is not available. The amount of frost protection obtained varies with the weight and fiber arrangement of the row cover. Usually the amount of protection increases with the weight, though differences in texture make this correlation less than perfect. Row covers weighing 0.6 ounces per square yard typically can give 2° or 3°F protection during a radiational frost, while nursery foam covers or a double layer of row covers can give more than 10°F of protection. Weather conditions prior to the frost affect the amount of protection obtained from row covers, since little or no heat may accumulate under the row cover on cloudy windy days. When row covers are used for frost protection, they should be pulled over the crop during mid-afternoon to allow heating to take place. Row covers can also be used in conjunction with sprinkler irrigation on top of the row cover. Row covers used in this way typically cut the amount of overhead irrigation needed for frost protection by about 50% on average.

Heating or burning is an old method of frost protection, but is not practical for low-growing small fruit crops like strawberries, and is infrequently used. However, if fires or heaters are used, several small ones are better than one large one.

Wind machines work if a temperature inversion occurs (warm air present above a cold layer) and if there is no wind as with radiant-type freezes. They mix the air by pulling down the warm air from above to replace the colder air trapped near the soil surface. They only provide a few degrees of protection, and therefore are sufficient protection primarily for crops that bloom relatively late when frosts are usually less severe.

Sprinkler irrigation works well on all small fruit crops, but needs to be used carefully. Because sprinkler irrigation use can result in the application of large volumes of water to the crop, use should be delayed until greater than 10% of the blossoms are in danger of being damaged. This does not necessarily mean that 10% of the blossoms are open. Sprinkler irrigation for frost protection works because water gives off heat when it changes from a liquid to a solid (i.e., freezes). Frost protection using irrigation works only if the system is fully functional prior to the frost event, so test it to ensure it works.

A common recommendation is to start the system when the temperature at plant level falls to 4°F above the critical temperature (for example, 34°F for open strawberry blossoms). If the dew point is below freezing, irrigation must be started at a higher temperature. Under conditions with wind or low humidity, damage can occur when the air temperature is several degrees above the freezing point because of evaporative cooling. Because of this, the wet bulb temperature is often a better indication of when the irrigation system should be used rather than dry bulb (standard) temperature. Irrigation should be operating by the time the wet bulb temperature equals the critical temperature.

Most overhead sprinkler systems are designed to deliver 0.1 to 0.2 acre-inches of water per hour and are useful for radiant freeze or frost protection when wind speeds are light and temperatures are not below the mid-twenties. Microsprinklers provide more uniform distribution than those having larger droplets and/or those covering a larger area. However, the rate at which water freezes depends on several environmental factors, including air temperature, humidity, and wind speed. When breezy conditions (5 mph) are forecast overnight, water supply lines should be moved closer together. At 5-10 mph, protection will be spotty. When wind speeds exceed 10 mph, the risks for crop damage from evaporative cooling may outweigh the potential benefits.

Overhead irrigation pipes and sprinklers can be set up on row covers, and irrigation started after the temperature under the row covers drops near the critical temperature. This is the safest way to protect crops in the case of advective freezes, and greatly reduces the amount of water used regardless of the type of frost event. Because of the necessity of and time required for removing and re-applying the row covers (they can just be gathered into the row middles in which the irrigation pipes are located), this method is best suited for small acreage plantings. Be sure to uncover the plants as early in the day as possible so that drying of the foliage and pollination can take place.

Taking Temperature Measurements: Accurately Depicting Crop Conditions

Temperature sensors must be calibrated to be sure the temperature you are reading is correct. Calibrate them by immersing the sensor in a water and crushed ice slurry, gently stirred, which will be at 32°F.

Note that with liquid-in-glass min-max thermometers, the top of the thermometer needs to be immersed. Adjust subsequent readings accordingly.

With low-growing plants such as strawberries, the coldest temperature in a field is often near the surface where the strawberry plants grow. Readings should be made at the plant canopy level. In blueberry plantings, several measurements should be taken at different places in the field at the various heights of the plant canopy.

Liquid-in-glass thermometers, usually relatively inexpensive in price, can vary in their readings. However, they usually vary less than dial thermometers, and are a good value. *Thermocouple thermometers* are generally capable of measuring a wide range of temperatures, and have a very good percentage accuracy, such as being within plus or minus 0.05% of the temperatures in their ranges. Because the range can be huge, the accuracy may still only be one or two degrees. The thermocouple probes themselves are quite cheap, but the device to which they connect that produces the readable output can be pricey. *Thermistor thermometers* are probably the best option for accuracy, as they are designed to read a relatively narrow temperature range, and have a good percentage accuracy. There are models that will be accurate to within plus or minus 0.5 degrees F with prices in the moderate range. Calibration is still recommended.

Digital readouts give the impression that, because the reading can be noted to the closest tenth or hundredth of a degree, the device must be accurate. This is not necessarily the case. The reading may be very exact, but also very wrong. Accuracy is how correct the device is. For example, a certain digital thermometer may be advertised as having a resolution of 0.1 degrees, but an accuracy of + or - 2 degrees. Accuracy is the important figure. Sometimes you'll see a notation that a thermometer is accurate to a certain percentage within its range. As an example, if the device is listed as being accurate to within 0.5% in its range, and its range is -60° to 140°F, it would be accurate to within 0.5% of this 200 degree range, or, to within plus or minus 1 degree of any temperature read between -60° and 140°F. This does not mean that it is accurate to within 0.5% of any given temperature.

Electronic devices and plug-in probes offer some useful advantages over standard thermometers. For example, if a probe is positioned under a row cover with connecting wires outside of the row cover, the temperature under the row cover can be measured easily. Also, even once irrigation is turned on, the temperature in the field can be monitored. Note that with some electronic devices, the number display is not meant to withstand temperatures below freezing, so the display could "black out" when you need it the most! So, use the display portion in the field only when obtaining the reading.

Frost alarms and alerts are especially valuable if your field is further than walking distance away from where you live. Once the temperature drops to a certain point, the alarm either sounds a buzzer, calls you on the phone, or flashes a light, depending on the model. If you get a model that calls you, it will likely need to be located where there is access to a phone line. A recent addition to frost protection gadgetry is a device that flashes a light that is color-coded to the temperature. This means that it is possible to track the temperature in your field from indoors, or monitor fields in several locations at one time.

Updated Small Fruit Pesticide Tables

Kathy Demchak, Department of Horticulture

Pesticide labels and allowable uses are always changing. There are revised versions of some of the pesticide tables in Mid-Atlantic Berry Guide that incorporate changes that have occurred since the hard copy was published. Tables with changes are posted at http://hortweb.cas.psu.edu/extension/smallfruits/berry_guide_updates.html. Changes to the tables appear in red.

You can also download the entire copy of the Mid-Atlantic Berry guide from http://pubs.cas.psu.edu/FreePubs/pdfs/agrs97.pdf . If you prefer a hard copy of the whole thing, you can purchase a copy from your county office (call first, as not every county has it), or by calling the main Publications Distribution office at 814-865-6713. Cost is $15 plus tax, and from University Park there will be a $5 handling and shipping fee.

Sprayer Application Technology Training for Agricultural Professionals

Submitted by Mike Orzolek

Rutgers University Cooperative Extension in cooperation with Penn State University is hosting a USDA-SARE Train the Trainer Program. The program is: Sprayer Application Technology Training for Agricultural Professionals Only – Not a grower meeting. *Attendees will receive training material for farmer programs.*

When: Wednesday, June 6, 2007
Where: Penn State Research Farm at Landisville Manheim, PA
What's On Tap:

- Extensive hands-on evaluation of various backpack sprayers, including electric, gas, hand and misting designs
- Learn to use an array of accessories such as nozzles, regulators, filters, etc. for various crops
- Learn about drift control, calibration and ease of use
- Lunch provided, and limited mileage expenses if required
- Attendees will receive a training CD-ROM when it's available, as well as a training kit with various nozzles, filters, regulators, etc.
- Pesticide & CEU Certified Crop Advisor credits to be issued
- Program presented by John Grande, Rutgers Cooperative Extension and Michael Orzolek, Penn State University

Time: 10 am to 2 pm
Registration: Please call – 908-730-9419 ext. 0 or email lobb@aesop.rutgers.edu by noon, June 5, 2007
Location: Penn State Research Farm at Landisville, 1446 Auction Road, Manheim, PA 17545-9140

Newspaper and Straw Mulches for Suppressing Weeds in an Organic Cucumber Crop Grown in High Tunnels

Elsa Sánchez, Department of Horticulture

In 2005 and 2006 we conducted a trial to evaluate newspaper and straw mulches for suppressing weeds in a cucumber crop grown in high tunnels under organic management. The trial was conducted at the Russell E. Larson Research and Education Center, Rock Springs, PA in four 17-by-36 ft^2 high tunnels constructed based on the Penn State design.

Cucumber cultivars grown were 'Sweet Marketmore', 'Diva', 'Prolific' and 'Lemon'. Transplants were planted in late June using 18 inch in row spacing with four rows per tunnel. Mulch treatments were 1) wheat straw, 2) shredded newspaper (0.5 inch strips of varying lengths from the Center County Municipal Waste Facility, State College, PA) and 3) sheets of newspaper (obtained free from a local recycling drop-off center). Each mulch treatment was applied to a single row in each high tunnel about 10 days after transplanting. Straw and shredded newspaper mulches were applied by hand in a two foot band four to six inches thick over each row. Sheets of newspaper were applied in a two foot band five sheets thick. Water was applied to both newspaper-based treatments and small amounts of soil were placed on the edges of the sheets of newspaper to anchor the mulches. One row in each tunnel was left bare to serve as a control. The no mulch control treatment was hand weeded once, approximately one month after transplanting. Yields, weed suppression by the mulches and degradation of the mulches were evaluated.

Yields

Over 99% of cucumbers were marketable. In 2005, yield did not differ by cultivar (Table 1). In 2006, marketable yields were higher from 'Sweet Marketmore' than 'Lemon'. In both years, cucumbers were largest from 'Sweet Marketmore' followed by 'Diva' and 'Prolific' and smallest from 'Lemon'.

Table 1. Total marketable yield.

		Marketable Yield (lbs/5 plants)[y]	
Cultivar	**Seed Source**	**2005**	**2006**
Sweet Marketmore	Seeds of Change (Santa Fe, NM)	46.2	26.0 a[z]
Diva	Johnny's Selected Seeds (Winslow, ME)	35.5	18.2 b
Prolific	Seeds of Change (Santa Fe, NM)	37.7	22.5 ab
Lemon	Seeds of Change (Santa Fe, NM)	28.0	12.7 c
	P	0.1142	< 0.0001

[y]Values the mean of four replications.

[z]Values followed by different letters within years are significantly different using Duncan's least significant difference test at the 5% level.

Mulch did not affect yield in either year of the trial. Research has shown that the influence of mulches on yield is dependent on the crop grown. In some research it has resulted in higher yields than not using mulch. In other cases, mulches have been inconsistent for increasing yields or shown to decrease yields compared to not using mulch. In general organic mulches result in cooler and moister soil compared to bare ground. The extent that this change affects crop growth has been linked with water availability where water stress increases the effectiveness of mulches. In this trial, adequate

water was supplied to plants which may have limited the effectiveness of the mulches in increasing yield over the no mulch – control.

Weeds

Predominant weeds present were pigweed, hairy galinsoga and grass species. In both years, weed populations were highest in no mulch – control plots and lowest when shredded newspaper was used (Table 2). Sheets of newspaper and straw mulch provided intermediate weed suppression. Weed levels were similar regardless of cucumber cultivar grown. Additionally, marketable yield and average cucumber weight were not affected by mulch treatments. High weed populations can decrease cucumber yields but, research has shown that if managed at critical times, weed populations can be limited and not decrease yields. In this study mulches were applied 10-11 days after planting when weeds were just beginning to emerge. Additionally, no mulch treatment plots were hand weeded one month after transplanting the cucumbers. All of the mulches were effective at suppressing weeds but, did not result in yields higher than the no mulch control. This indicates that weed populations were maintained below levels that decrease yields. It also indicates that weeds were managed at a critical time for all treatments; in the early season and within the first month after planting. Also, applying shredded newspaper and straw at a depth of four to six inches and sheets of newspaper five sheets thick was adequate for managing weeds.

Table 2. Effect of mulches on weed populations.

	Weed Rating[y]	
Mulch	**2005**	**2006**
No mulch (control)	6.9 a[z]	3.7 a
Newspaper sheets	6.3 b	2.5 b
Straw	4.9 c	2.6 b
Shredded newspaper	1.9 d	1.2 c
P	< 0.0001	< 0.0001

[y]Ratings are the mean of four replications and are based on a visual rating of a 30 ft by 2 ft area and using a scale of 0 – 10; 0 = no weeds present and 10 = severe infestation.
[z]Values followed by different letters within years are significantly different using Duncan's least significant difference test at the 5% level.

Mulch Degradation

By the end of the growing season in each year, sheets of newspaper suffered the most degradation followed by shredded newspaper and straw. Just as observed with weed populations, the cucumber cultivar grown did not influence mulch degradation. Shredded newspaper was more effective for suppressing weeds despite being more susceptible to degradation than straw. Both of these mulches were applied at the same depth indicating that for the shredded newspaper this depth was adequate to compensate for degradation.

All mulch treatments used in this study, including the no mulch control, suppressed weeds to below levels affecting yields. The cost of the mulch favors the use of sheets of newspaper (free) over shredded newspaper ($40.00 a ton or about $1.00/treatment row) and straw ($100.00-150.00 a ton or about $1.80/treatment row). Mulching material was not a factor with the control; however, these plots were hand weeded once generating additional labor costs not associated with the other mulch treatments. Full economic analysis should be preformed to account for transportation, handling, application and weeding costs associated with these treatments.

Upcoming Meetings

If you have a meeting you would like to announce, please send the meeting title, date, location and contact information to esanchez@psu.edu.

Local

- ✓ July 25, 2007. **Kutztown Produce Auction Meeting**, Fleetwood, PA. For more information contact John Berry at (610) 391-9840 or jberry@psu.edu or Mena Hautau at (610) 378-1327 or mmh10@psu.edu.

Regional

- ✓ August 14-16, 2007. **Ag Progress Days**, Rock Springs, PA. For more information call (814) 865-2071 or visit http://apd.cas.psu.edu.

National

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