UMASS EXTENSION

Vegetable Notes

For Vegetable Farmers in Massachusetts

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In this issue:

Crop conditions

Growers and crops are adjusting to midsummer conditions. Temperatures were running about 7 degrees above normal, with daily highs in the high 80's or 90's most of the past 10 days. Rainfall ranged from 0.6 in. to nearly four inches for the past week, with four-week accumulation over 10 inches in many places (NASS Crop Weather, July 1). Lighter soils have done all right, but crops have needed more side dressed or top dressed fertilizers than usual to keep the crops healthy. In fields with heavy soils or poor drainage, waterlogged soils continued to cause crop losses or poor growth after more heavy rains hit again this week. Some flood plain soils were under water and some fields have been replanted. Growers are running out of viable options for crops to plant on fields that have been inaccessible. Fall crops are on their way: growers are planting storage carrots, and fall broccoli and kale has been started in the greenhouse. Summer squash and zucchini are producing heavily and markets are reported to be good. Spring cabbage is sizing up and early carrots are coming in. Eggplants and peppers are setting fruit. Nutrient management may be tricky given losses to leaching and trying to avoid excess nitrogen too late in crop growth, while also providing enough.

Pest alerts

Squash vine borer flights began last week and numbers are going up. Weekly captures in MA traps were: 5 in Deerfield, 14 in Sandwich, and 17 in Barnstable (bucket traps). Traps in NH caught from 6 to 38 moths per week (net traps). Growers of giant pumpkins (C. maxima types), summer squash and zucchini should be check stems for signs of eggs or feeding, and target stems with preventative sprays. Monitor flight with SVB lures in Heliothis net trap or yellow/white bucket trap placed above or in canopy of summer squash or zucchini. See last week's issue for more details.

Ruth discussing sweet corn trap counts with a farmer

Calcium deficiencies in celery, lettuce, and cabbage can occur with onset of hot, humid weather & rapid growth. Death of young growing tissue (black heart of celery, tip burn of lettuce, or internal tipburn of cabbage) occurs when rapid transpiration draws water and calcium away from young tissue. Other factors include high nitrogen, sodium or potassium levels and heavy rainfall (especially after drought). Aim for even moisture, steady plant growth, and avoid excess N and K applications. Drench applications of soluble calcium can lessen or prevent the development of blackheart in celery.

Spotted Wing Drosophila captures have not gone up significantly in this and other states as of this writing. Captures have been very low thus far (0 in most traps, occasionally 1 per trap). Check https://extension.umass.edu/fruitadvisor/spotted-wing-drosophila/monitoring for updates.

Table 1. Spray Intervals for Corn Earworm		
Moths/ Night	Moths/ Week	Spray Interval
0 - 0.2	0 - 1.4	no spray
0.2 -0.5	1.4 - 3.5	6 days
0.5 - 1	3.5 – 7	5 days
1 - 13	7 – 91	4 days
Over 13	Over 91	3 days

Potato leafhoppers are still a threat to potato, eggplant, and beans, especially if nymphs are feeding.

Colorado Potato Beetle (CPB) 4th instar larvae are prevalent and very active on potato, tomato, eggplant and wild Solanaceous hosts. They will burrow into the soil to pupate after they are done feedling. Control them now to prevent a new flush of adults later.

Flea beetle pressure in Brassicas may be down slightly as we are between generations. Remember to plant fall Brassicas as far from the spring crop as feasible. Be prepared for emergence of hungry summer flea beetles in late July and early August. Striped flea beetle with two pale yellow strips on the wings is showing up this week – this species emerges earlier than crucifer flea beetle so this may be the arrival of summer adults.

Table 2. MA Corn Trap Counts 6/27/13 - 7/4/13			
Location	Total ECB reported	CEW Nightly Average	CEW Weekly Total
CT Valley			
South Deerfield	0	n/a	n/a
Sunderland	0	0.0	0
Hatfield	5	0.0	0
Hadley	2	0.1	1
Feeding Hills	0	0.4	3
Central & Eastern MA			
Spencer	5	0.7	5
Tyngsborough	0	0.1	1
Concord	0	0.0	0
Millis	0	0.0	0
Sharon	2	9.5	38*
Seekonk	0	2.1	15
Rehoboth -1	1	1.0	1**
Rehoboth -2	4	n/a	n/a
Sandwich	2	n/a	n/a
East Falmouth	1	n/a	n/a
*4 night catch, **1 night catch			

Sweet Corn Report. Corn growth is moving fast, ears are developing and first harvest will start soon. More blocks are in silk. Move your corn earworm traps to fresh silk weekly or at least biweekly for the most accurate counts. Corn earworm captures are below threshold in more northern & inland locations, but have jumped up at some sites in the Southeast to levels that call for a 4 day schedule. Others are at five day (Feeding Hills, Spencer). ECB captures are generally very low; two sites (Hatfield and Spencer) are above the 5 moths per week threshold for silk sprays to control ECB in silk. Scout blocks with emerging tassels. This week we found blocks with emerging tassels that were over the 15% threshold. Aphids are showing up, but in the fields we checked were not building up. Aphid predators such as minute pirate bug and ladybeetles were common. If sap beetles have been problem on your farm, now is the time to scout silks and look for beetles. If you are using Bt corn hybrids, remember that sap beetle is not fully controlled by the Bt protein that is present in leaves and silks. Fall armyworm not observed yet. Keep your eye out for symptoms Northern corn leaf blight in lower canopy as the season goes along. Favorable conditions for the Northern corn leaf blight are moderate temperatures (64 -81 F) and leaf wetness from rain, dew or fog for at least 6 hours. Even with hot weather, the nighttime conditions are favorable. Leaf spots are moderately large and long (1 to 5 inches), elliptical, and grayish green becoming tan with age. They show up on older leaves first. Their shape resembles a cigar or boat. Images are posted at: http://www.longislandhort.cornell.edu/vegpath/photos/NCLB_corn.html. Since many growers are not familiar with this disease, it's a good idea to use the diagnostic lab for accurate ID.

Bacterial spot and **bacterial speck** of tomato were confirmed in a tomato fields this week. These diseases are caused by *Xanthomonas campestris* pv. *Vesicatora* and *Pseudomonas syringae* pv. *tomato*, respectively. These organisms cause dark spots on tomato foliage and fruit and blacterial spot can also affect pepper fruit and foliage.

Tomato Pith Necrosis has been confirmed in at least one field in MA. This disease generally occurs on early planted tomatoes growing when night temperatures are cool, the humidity is high, and the plants are growing vigorously because of high levels of nitrogen. The disease is also associated with prolonged periods of cloudy, cool weather.

Cucurbit downy mildew (CDM) has been confirmed as far north as Medina and Wayne Counties in OH and Salem County, NJ where symptoms were found on cucumber. To date the disease has also been found in Florida, Georgia, Texas, South Carolina, North Carolina, Alabama, Maryland and Delaware. Crops affected so far include cucumber, butternut squash, acorn squash, yellow summer squash, cantaloupe, giant pumpkin, and watermelon. Cucumber is the

Table 3. GDD and BLITECAST output for Late Blight Management				
DATE: 7/5/2013	GDD Base 50F	Accumulated LB Severity Values - 7 days	Accumulated Rainfall - 7 days (in)	Recommended Spray Interval (days)
Pittsfield	782.0	19	1.08	5
Ashfield	812.1	8	3.49	5
Deerfield	996.4	18	2.87	5
Belchertown	1003.4	16	2.45	5
Bolton	1009.8	30	2.58	5
Dracut	984.2	16	2.10	5
Boston	1004.6	16	0.62	5
East Bridge-water	999.5	26	1.46	5
Sharon	1056.1	19	0.97	5
Seekonk	1037.9	25	0.98	5

most commonly reported crop affected. As of July 3 the CDM IPM-PIPE disease forecast predicts a moderate to low risk of CDM for the mid-Atlantic region. CT and Southern MA are at moderate risk, southern New England (including southern VT and NH) is at low risk, and more northern parts of New England are considered to be at minimal risk for CDM.

Late blight (LB) has been reported in Mercer County, central New Jersey on fresh market tomato, in Salem County, New Jersey on processing tomato and potato, and in Kent County, Delaware on potato. New fields reported LB in DE and NJ during the past four days. Previous reports in more southern locations (FL, WV, LA, TN, MD, KY, VA, NC) have been confirmed as Phytophthora infestans strains US-23 and US-7. Track disease progress at USA BLIGHT. Conventional and organic tomato and potato growers should be spraying those crops with protectant fungicides to prevent disease establishment. Based on high RH and favorable temperatures, Severity Value totals for the week are over 16 at most locations in MA which is very high (see table 3). A 5-day spray interval is recommended because conditions for LB are highly favorable. Note: greenhouse tomatoes have provided numerous false alarms, because botrytis and Fulvia leaf mold look very much like late blight. Still, if you suspect late blight, contact the Diagnostic lab at 413 545 3208. Remember that LB identification is free.

CUCURBIT DOWNY MILDEW

Cucurbit downy mildew (CDM) is a re-emerging disease affecting forty species in 20 genera within the Cucurbitaceae. The disease, caused by the oomycete *Pseudoperonospora cubensis*, affects cucurbit crops in fields and greenhouses throughout the US and is especially damaging in warm, humid climates where the pathogen thrives. The disease spreads north from overwintering sites in the south where cucurbits are grown continuously, and a disease forecasting service has been established by North Carolina State. From now on a CDM disease report and forecast (see above) will be published each week in Veg Notes to see how far the disease has spread and when you can expect to see it in your area.

Downy Mildew on leaf top

Symptoms and Signs. Symptoms on cucumber and squash are angular lesions that are limited by the leaf veins. Early lesions are light green in appearance (upper and lower leaves) and become progressively chlorotic and finally necrotic as host plant cells die. During periods of leaf wetness lesions can appear water-soaked. This is the earliest symptom produced by the disease, but will disappear as moisture dissipates. Severe infection results in leaves that are completely dead and curled up, a symptom known as "wildfire", since the leaves appear to be burned. On watermelon and cantaloupe the lesions are more irregularly shaped and become brown more quickly. Symptoms are less distinctive and therefore the disease can be more easily misidentified on these crops.

Downy Mildew on underside of leaf

Sporangia and sporangiophores are most noticeable during humid conditions (e.g., morning dew or after rain) on the underside of the leaf and appears as downy, fuzzy growth within leaf veins ranging from colorless to gray-brown

to deep purple. In very severe infections, sporulation can occur also on the upper leaf surface, although this is uncommon.

Downy Mildew Scorch on Melon

Life Cycle. Like other downy mildews, *P. cubensis*, is an obligate parasite, meaning that it requires living host tissue to survive. Sporangia are transported from infected plants via wind currents and can travel locally or great distances this way. Optimal temperature for sporulation is 15˚C with 6 to 12 hours of available moisture. Free moisture is required for each sporangium to release 5-15 swimming, infective zoospores. Zoospores can be released between temperatures of 5 and 28°C with an optimum temperature of 20°C and the optimum temperature for infection is 25°C. The pathogen can have many spore cycles per season, as new sporangia are produced 4-12 days after initial infection though symptoms may take 3-12 days after infection to appear.

P. cubensis overwinters on infected cucurbits, either wild or propagated, in areas that do not experience a hard frost, such as southern Florida in the eastern United States. Because *P. cubensis* can only survive in live host tissue, it only reaches New England cucurbit fields when wind currents blow spores of the pathogen northward. In this way the disease progresses in the same pattern each year, marching North from Florida to Maine with warming temperatures and availability of host plants. The disease tends to strike in New England during late summer. Researchers have begun to use this pattern to track and forecast disease development each year and that information is available here: cdm.ipmpipe.org.

Management. For decades the disease was well-controlled by resistant varieties but in 2004 a new strain of P. cubensis evolved which was no longer effected by host resistance genes. This fact combined with resistance to the QoI group of fungicides has led to the increased disease incidence and severity we have experienced in the past several years. Most cucurbit cultivars still have some level of downy mildew resistance which may delay the onset of disease or slow its progress but other control measures should be used in concert. Cultural practices to increase airflow such as trellising or increasing plant spacing should be used in field and greenhouse environments to reduce humidity and leaf wetness. Planting time can also be manipulated in some cases to avoid the disease, which occurs at around the same time each year, by planting susceptible crops earlier in the season.

Cucurbit downy mildew can be effectively controlled using the following synthetic fungicides: fluopicolide, famoxadone + cymoxanil, cyazofamid, zoxamide and propamocarb hydrochloride. It should be noted that P. cubensis is known to rapidly evolve resistance to many chemical classes and reduced efficacy of mefenoxam, metalaxyl and the strobilurin fungicides has been reported. Therefore, care should be taken to limit resistance development by rotating fungicides and tank-mixing with more broad-spectrum, protectant chemistries such as chlorothalonil. In organic cropping systems copper products can be effective when used preventatively to protect plants from infection. Copper can be phytotoxic to cucurbits, and high levels in soil are toxic to earth-worms and other beneficial organisms. Phytotoxicity is most common during cool, moist conditions, which are also the most favorable for downy mildew. Disease forecasting should be used in any system to avoid unnecessary sprays and ensure protection from imminent infection. See cdm.ipmpipe.org for updated disease reports and forecasts.

- S. Scheufele, UMass Vegetable Extension

PROTECTING BEES AND OTHER POLLINATORS

Honeybees and native pollinators visit vegetable crops during flowering and pollen shed. In crops such as cucurbits, beans, and peas, their activity is crucial to the success of the crop. In other crops such as sweet corn or potato, bees are among many beneficial insects who seek out pollen or nectar resources as a food source, but crop yield does not depend upon their activity. Populations of honeybees and native pollinators have declined worldwide in recent years. A wide range of factors have contributed to their decline. Pesticides that are applied to crops is one of these, and can affect pollinators

through multiple routes of exposure: direct contact with sprays, contact with treated surfaces, pesticide-contaminated dust or pollen particles that are collected or adhere to the body of the insect (and may be taken back to hive), and ingestion of pesticide-contaminated nectar. Decisions made by the farmer make a difference in the exposure of bees and other beneficials to toxic levels of pesticides. While pesticides on crops are only one among many factors that threaten pollinators, this is one factor that growers can do something about. Taking precautions to minimize pesticide poisoning of pollinators in all crops is an important responsibility of all pesticide applicators.

Steps that can reduce pesticide exposure of pollinators:

Timing. Avoid applications when crop or weeds are bloom. In crops that bloom over long periods, make applications late in the day or at night when pollinators are not foraging, and so that there is sufficient drying time before foraging begins. Control weeds.

Formulation. Wettable powders, dusts and microencapsulated products have a greater toxic hazard than emulsifiable concentrates. Products that do not have acute toxicity but could cause injury to immature bees if carried back to the hive should not be applied in particulate form; this includes insect growth regulators.

Drying time before exposure. Some products are highly toxic when wet, but much less so after the pesticide is dried. Spinosyns and pyrethrin have this characteristic. Apply when there will be adequate drying time (usually 2-3 hours) before pollinator activity.

Drift. Avoid drift on non-target areas near the field where blooming plants may be located. Windspeed and application equipment both influence drift.

Mode of application. Soil and seed applications reduce exposure compared to foliar applications, because they avoid direct contact between the pollinator and the toxin. However, with some products, plant uptake of the active ingredient produces residues in pollen or nectar. In the case of neonicotinoids, there is evidence that foraging bees may receive sublethal doses in pollen and nectar when cucurbit crops were treated with a systemic at early growth stages. This effect appears to be reduced by using lower rates and applying as early as possible, but may not be entirely eliminated by these methods. A sublethal dose may make bees more vulnerable to other stressors, or may combine with doses from contact with other treated plant material.

Select products with low bee toxicity. Avoid applying insecticides rated as High or Medium directly to bees that are actively foraging or to blooming crop or weeds. The label gives information about how a product is rated. EPA registration includes an acute, single-dose laboratory study designed to determine the quantity of pesticide that will cause 50% mortality (LD50) in a test population of bees. If a pesticide is to be used outdoors as a foliar application, and is toxic to pollinating insects, a “Bee Hazard” warning has generally been required in the Environmental Hazards section of the label. There are three toxicity groupings, each with associated statements that must be on the label.

High (H, rating level 1). Bee acute toxicity rating: LD50 = 2 micrograms/bee or less. Statement: This product is highly toxic to bees and other pollinating insects exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees or other pollinating insects are visiting the treatment area. (If the residues phrase is not present, this indicates that the pesticide does not show extended residual toxicity)

Moderate (M, rating level 2). Product contains any active ingredient(s) with acute LD50 of greater than 2 micrograms/ but less than 11 micrograms/bee. Statement: This product is moderately toxic to bees and other pollinating insects exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product if bees or other pollinating insects are visiting the treatment area.

Low (L, rating level 3). All others. No bee or pollinating insect caution required.

Residual toxicity. While a long residual may sometimes be desirable from a pest management point of view, it prolongs the period when exposure to treated surfaces may be toxic. If it is necessary to use a product with high toxicity during

times when bees may be foraging in the crop, selecting a short residual product shortens the risk of exposure. For products with high acute toxicity, EPA registration requires a laboratory test designed to determine the length of time over which field-weathered residues on leaves remain toxic to honeybees. This characteristic is one factor in the bee toxicity rating.

Temperature. Low temperatures prolong the residual toxicity of a product. High temperatures can cause faster degradation, but also extend the foraging time of bees later in the evening and earlier in the morning. Over 90F, bees may be foraging for water to cool the hive so that puddles or droplets of spray pose a greater risk.

Get to know the beekeepers in your area. As always, good communication helps. You can find beekeepers through regional and state (eg, massbee.org) beekeeping associations. Beekeepers may be interested in placing hives on your farm, if they know that you take precautions to reduce the risk to foraging bees. They also understand how many different factors affect colony health.

Pollinator habitat. NRCS currently offers financial assistance for growers who dedicate a small amount of land to plant and maintain pollinator habitat. Contact your district office for more details.

- R. Hazzard, UMass Vegetable Extension

USING COPPER EFFECTIVELY

Copper products play an important role in disease management in both conventional and organic fields. They are one of the most effective controls for bacterial diseases. In organic production, copper products serve as a major protectant fungicide. There are more copper products becoming available, and it is helpful to understand the differences and benefits of different active ingredients and formulations. Solubility, phytoxicity, human health risks, impact on soil ecology, labeled crops and diseases, and efficacy are important considerations in using copper.

How copper works. Copper is usually applied in the "fixed form" which lowers its solubility in water. The spray solution is actually a suspension of copper particles, and those particles persist on plant surfaces after the spray dries. Copper ions (Cu^{2+}) are gradually released from these copper deposits each time the plant surface becomes wet. The gradual release of copper ions from the copper deposits provides residual protection against plant pathogens. Copper kills pathogen cells by being absorbed by the germinating fungal spore, denaturing spore proteins and killing the fungus before it infects the plant. They also kill bacteria. Once a pathogen enters host tissue, it will no longer be susceptible to copper treatments. Thus, copper sprays act as protectant fungicide/bactericide treatments, but lack post-infection activity. Using an approved adjuvant or 'sticker' may help the product to be more rainfast, but when used with the highly soluble copper sulfate formulations, can cause phytotoxicity.

Efficacy vs phytotoxicity. Efficacy of copper products depends on release of copper ions on the leaf surface. However, because copper can kill all types of plant tissues, the use of copper fungicides carries the risk of injuring foliage and fruit of most crops. When Cu ions release too fast or are too concentrated, phytoxicity can occur. Below are suggestions:

- Less soluble formulations are usually more persistent (=longer residual activity), while more soluble formulations act rapidly but have higher risk of phytotoxicity. Active ingredients that are less soluble in water include: Copper hydroxide, copper oxychloride sulfate (COCS), tribasic copper sulfate (cupric sulfate, tricupric hydroxide, hemihydrate), or Copper salts of fatty and/or rosin acid. Basic copper sulfate or copper sulfate pentahydrate are highly soluble in water. These formulations may be applied with lime to lower their solubility and risk of phytotoxicity.
- Copper sprays will become more soluble and therefore potentially more phytotoxic if they are applied in an acidic solution. If the water used is below pH 6.5 excessive amounts of copper ions could be released which may cause damage to fruit and foliage. Most labels indicate the advisable acidity limits. Check the pH of your water source.
- Using maneb or mancozeb as a tank mix increases the release of copper ions in solution. There are copper products already mixed (eg ManKocide) and growers can make their own mixture. This may be especially helpful for controlling bacterial diseases such as bacterial speck, spot and canker of tomato.
- Copper can accumulate to high levels on plant tissue when sprayed repeatedly to cover new growth and there is no rain. In this situation, after a rain event, a large amount of copper ions may be released leading to phytotoxicity.
- Cold, wet weather (slow drying conditions) increases the availability of copper ions and, thus, increases the risk of

plant injury.

- Always read the label instructions. When mixing, follow the tank mix partner instructions.

Copper formulations. Copper formulations include basic copper sulfate (e.g., Cuprofix Ultra Disperss), copper oxide (e.g., Nordox), copper hydroxide (e.g., Kocide, Champ), copper oxychloride (e.g., a component of COCS and BadgeX2), and copper octanoate (copper ions linked to fatty acids to form a soap, e.g., TennCop, Cueva). Concentration of copper is listed as % of the type of fixed copper use (eg 23.8% copper oxychloride or 98% basic copper sulfate). For comparison of copper products, it is useful to look at the % metallic copper by weight. A product with 40% metallic copper has 0.4 lb metallic copper per lb of product. Products differ in the percent of metallic copper ion in the formulation, ranging from under 1.8% to over 50%.

Most copper products have a restricted entry interval (REI) of 24 or 48 hours, which means that workers are not allowed to come in and pick fruit or do other field work for that duration of time (always follow product label) after a spray application. Cueva has a 4 h REI but only 1.8% metallic copper equivalents. Plan your spray and harvest schedule to accommodate your marketing needs as well as the required re-entry interval. Fruit may need to be washed before marketing, as copper leaves a blue residue on fruit as well as leaves.

There are both liquid and dry formulations; liquid products are generally easier and safer to measure and mix. Finely ground copper products are more active than coarsely ground ones.

Several copper products are OMRI-listed for use in certified organic production and are registered for use in Massachusetts. These materials utilize different copper compounds including copper hydroxide, copper oxychloride, copper octanoate and copper sulfate. Trade names include: NuCop 50DF, Badge X2, Basic Copper 53, Cueva, and Champ WG. Check the OMRI website for updates. As with insecticides, dry formulations are more commonly approved for use in organic systems. Note that OMRI approval is for specific formulations, and there are often multiple formulations with the same trade name.

For each product, application rates vary with crop and disease. The recommended rate for a given crop may have a 2-fold difference between the high and low rate. Higher rates are recommended when disease pressure is high or conditions are especially favorable. Most products are labeled for a wide range of vegetable crops including crucifers, cucurbits, tomato eggplant pepper and potato.

Human Health Hazards. Eye exposure is the most serious health risk associated with using copper hydroxide. Eye damage can be irreversible. There is moderate risk from skin contact, ingestion and inhalation. Products vary in EPA hazard rating, most are Warning or Danger but Badge SC has a caution label. The greatest health risk is to the person who mixes and sprays the material. Personal protective equipment (PPE) should be worn when handling or applying copper products as with any pesticide or fertilizer. The required protective equipment is specified on the label and usually includes: long-sleeved shirt and long pants, chemical resistant gloves made of any waterproof material such as polyethylene or polyvinyl chloride, shoes plus socks, and protective eyewear. Though not usually required, you may also want to consider wearing a respirator or dust mask, especially for mixing dry formulations. Dry product sometimes comes in a paper bag that has a tendency to leak out of the seams and needs additional containment such as a plastic bin. During the REI do not let workers harvest or do other field work unless wearing PPE. Even after the REI, workers should wash hands frequently and avoid rubbing their eyes.

Environmental Hazards. Some farmers have expressed concern about copper toxicity in the soil or with respect to soil microbes and earth worms. Copper is actually a plant micronutrient; that is, it is an essential plant nutrient at low levels. In New England it is more often deficient than excessive in soils. The amount found naturally in soils in MA ranges from 0.1 to 8 ppm. The desirable level for agriculture would depend on the crop to be grown and other soil factors such as pH. Copper does not degrade in soil or leach into groundwater, but becomes chemically bound up, especially with organic matter. An application of 1 lb of active ingredient per acre is estimated to raise the copper levels about 0.5 ppm. A single application of Nu Cop at 2 lb per acre with 77% active ingredient adds about 1.5 lb copper per acre to the soil, or could raise the concentration in the soil by 0.5 to 0.75 ppm. Depending on the level in your soil, it would take numerous applications to exceed the levels that are within the normal range.

The cumulative effect of copper applications might be more of a concern in perennial planting systems. In annual rotational systems, where copper applications might only be made every 4-6 years, copper accumulation is less of a concern. Nonetheless, copper use is regulated and certified organic farmers in the US are required to restrict their use of copper

products. Regular soil tests should be taken and copper levels in the soil should be monitored. In addition, copper can be very toxic to fish and aquatic organisms, so care should be taken to apply sprays properly and avoid drift and run off.

Managing blights in organic tomato and potato using copper. Copper-based fungicides labeled for use in organic systems have demonstrated effectiveness in preventing late blight. Copper fungicides must be used preventatively in order to protect plants from initial infections. Some strains of late blight are more aggressive than others and this will also influence the efficacy of copper spray programs. Late blight, early blight and Septoria leaf blight all have a latent period when the plant is infected but does not show any symptoms. Thus, when symptoms appear, it is too late to protect the crop effectively – especially with late blight. We have seen this demonstrated many times over the past 3 years. Given the past few weeks of favorable conditions in Massachusetts, organic growers are strongly advised to apply copper preventatively on a weekly basis to protect tomatoes and potatoes from various foliar diseases.

High Tunnel and Greenhouse Considerations.

- Read the label to be sure that a product is labeled for greenhouse use. Many copper products are. Spray with high tunnel sides open for ventilation. Most labels require that in addition to the standard REI, an eyewash station and notice of eye risk should be available for 7 days after application.
- If you suspect late blight, have the disease identified. Gray mold (Fulvia) and botrytis are common diseases in high tunnel tomatoes that look very much like late blight.
- If tomatoes are grown in the same area year after year, and copper is used, build-up in the soil is more likely. Include copper levels in your annual soil testing. Rotate to other crops!

--R. Hazzard, K. Campbell-Nelson, S. Scheufele. Updated for 2013. Mode of action and phytoxicity adpated from T. Zitter & D. Rosenberg, Cornell Plant Pathology, E. NY Commercial Horticulture Weekly Vegetable Update Jun 27, 2013.
http://vegetablemdonline.ppath.cornell.edu/NewsArticles/CopperFungicides2012.pdf

WEEDS AND EXCESS WATER: OPTIONS

When it comes to weed management, excess water is more of a problem than too little water. For those using herbicides, rain allows herbicides to be activated so that they are in the zone where weeds are germinating. This is only in the top inch of soil though, so excess rain can move the herbicide below that zone and control will be reduced. When weeds emerge after the crop is up and preemergence herbicides have already been used there are a few options left. First, cultivate whenever it is dry and sunny; take advantage of those few days and don't delay. Weeds die better when they are small and remember not to cultivate too deeply. Deep cultivation destroys crop roots and brings new weed seeds closer to the soil surface. Second, check the New England Vegetable Management Guide for postemergence weed management options. As with cultivation, small weeds die easier and faster so do not delay if you have a window. Annual grasses, especially, have been a huge problem this year. They are thick, fast growing, and can easily take over a field. Just about every crop has a postemergence grass herbicide option available. Depending on the crop, these products include Poast (sethoxydoim), Fusilade (fluazifop), Select (clethodim), Assure (quizalofop), and for sweet corm only, Accent Q (nicosulfuron). Finally, hand weeding is always an option but take care not to drop those weeds back onto the soil where they might take root again. Consider using buckets or a wheel barrow to remove the weeds from the field. When pulling weeds in the holes on plastic mulch, have employees shake the weeds to remove excess soil and then place the weeds on the plastic where they have a much greater chance of dying. Good luck and stay dry.

- R. Bonanno, UMass Extension

FLOOD AND RIVER FLOW RESOURCES

In mid June, after 5 to 11 inches of rain fell within ten days in much of the Connecticut Valley watershed, farmers with fields close to the Connecticut River were worried about flooding. This week, once again, rivers were rising and flooding was a concern. There are flood control dams on many tributaries of the river, as well as numerous hydroelectric dams on tributaries and the main stem. Flood control dams are built to store water during periods of high rainfall, and are operated by the Army Corp of Engineers. Most of the hydropower dams are privately owned and are operated, generally, to maximize electricity generation; most have no ability to store a significant amount of water.

Flooded corn field, June 15, 2013. Hadley, MA

Below are three good sources of river flow and flooding information online. These may be useful if, or when, we face similar heavy rainfall events in the future. While they don't give the full picture of 'who's making what decisions, and why', they do show how high the river flow is, how full the flood control dams are, and how the risks of flooding are building up in your particular watershed.

- The Army Corp of Engineers maintains a website that documents current and forecast river flow at each of its dams for the regulated watersheds of New England Access current River Status and Forecast Status for each damsite in each of several watersheds here: http://rsgisias.crrel.usace.army.mil/nae/cwmsweb.cwmsindex. The person who is the basin regulator for each watershed is given, with an email address.
- The US Geological Survey also provides information on stream flow, including smaller rivers and tributaries. Real time flood information is available at: http://waterwatch.usgs.gov/index.php?r=ma&id=real. Select "current stream flow" link on the left and choose Massachusetts from the drop down menu. You should see all stations that monitor floods. You can click on any of those stations to get real time information on flow conditions. Historical information is also available.
- The National Weather Service also has good real time information at: http://water.weather.gov/ahps/region_forecast.php?state=ma. Select the state on the right drop-down menu and you should see all sites within the state.

-Compiled by R. Hazzard

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