Missouri Produce Growers Bulletin

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Pollutant Damage to Tomato....by Dave Trinklein

Foreign substances, or pollutants, represent a greater threat to tomato production than to any other vegetable crop. Damage from pollutants is said to be "abiotic" in that it is not caused by a living organism. Instead, it is caused by something in the environment in which the affected plant is growing. Abiotic disorders cannot be spread from one plant to another but they can have devastating consequences, nevertheless.

The most frequently encountered pollutant damage to tomato undoubtedly is caused by the gas ethylene. Symptoms include "epinastic" growth--cupping of the new leaves and downward twisting of the leaf petioles. The leading cause for ethylene damage to greenhouse tomatoes is malfunctioning unit heaters. When functioning properly, greenhouse heaters combust (oxidize) propane or natural gas. This process releases carbon dioxide, water vapor and heat energy. Carbon dioxide and water vapor are harmless; the heat energy is needed to keep internal greenhouse temperatures at desirable levels.

Greenhouse heaters that are not supplied with sufficient amounts of fresh air to completely combust their fuel source tend to form products of incomplete combustion. Ethylene is one of these products and the results can be devastating because of tomato's extreme sensitivity to the gas. Normally, ethylene produced by unit heaters is evacuated from the greenhouse via the exhaust pipe (flue) of the heater. The exit route includes passage through heat exchange tubes, which if cracked or warped, can allow the gas to be introduced into the greenhouse atmosphere by the air circulating fan located behind the heat exchange tubes.

Preventing ethylene damage to greenhouse tomatoes starts with proper heater installation and maintenance. To provide adequate oxygen, unit heaters should be provided with one square inch of free area per 2000 Btu's of heater rating. Free area is defined as an unobstructed opening to the outside of the greenhouse. This is often accomplished by ducting air from the outside and releasing it just below the unit heater. Some of the better greenhouse heaters come with this feature built-in. Additionally, heaters should be adequately vented to the outside. The exhaust pipe should extend up and out of the greenhouse to a height of two feet above the ridge of the greenhouse. The exhaust pipe should be equipped with a back draft preventer. This will prevent outside air currents (e.g. gusty conditions) from impeding combustion air from properly evacuating the inside environment. Finally, growers should check the status of unit heaters on an annual basis. This includes checking to make sure fuel combustion is complete, exchange tubes are in good repair and the exhaust pipes contain no impediment to air flow.

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Using Trap Crops to Minimize Damage by Insect Pests to Veggies

By Jaime Pinero

The Integrated Pest Management Program at Lincoln University of Missouri is seeking out for affordable alternative insect pest management strategies to combat the growing threats to the smallholder's livelihoods in Missouri. One such method is called trap cropping.

What are trap crops? Trap crops are plants that are planted next to a higher value crop so as to attract pest as either a food source or oviposition site, thus preventing or making less likely the arrival of the pest to the main crop (= cash crop). Insects congregated in trap crops can be more easily attacked by natural enemies and/or killed by insecticides or by other physical means. In other words, trap cropping functions by concentrating and/or killing the pest in the border area, while reducing pest numbers on the unsprayed cash crop. **Plant species or cultivar used needs to be more attractive to pest than crop is.**

Advantages: By using trap crops farmers can: (1) lessen pesticide use and decrease costs, (2) preserve indigenous natural enemies, (3) improve crop's quality, and (4) help conserve the soil and environment.

Tips for successful trap cropping: (1) learn to know and identify the pests and their natural enemies, (2) make a farm plan to guide you on where and when the trap crops will be planted, (3) monitor your plants regularly, (4) immediately control the pests that are found in your trap crop, otherwise they will serve as a breeding ground, (5) if needed, be ready to sacrifice your trap crop as an early crop and destroy them as soon as the pest infestation gets too high, and (6) Always keep farm records. What trap crops worked best and against which insect pests?

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Understanding Damping Off Associated with Early Transplanting of Warm Season Vegetables

...by James Quinn and Adam Leonberger (Director of MU's Plant Diagnostic Clinic)

Many growers try to plant warm season vegetables earlier to take advantage of high early season prices. Unfortunately, the chances of transplanting crops like tomatoes, peppers, and cucurbits into field conditions favorable to damping off is increased, even if using good practices like raised beds covered with plastic mulch and protected by floating row covers. This spring's fluctuating temperatures (often on the cool side), along with cloudy and rainy conditions, further aggravate the situation. So what is damping off and what can you do about this situation?

Damping-off generically refers to seedling diseases from a number of fungi including species of *Pythium**, *Phytophthora**, *Fusarium***, *Rhizoctonia***, *Sclerotinia***, *Sclerotium***, and *Botrytis***. It is often associated with germinating seeds and young seedlings, which are vulnerable to attack by these pathogens during periods of unfavorable growing conditions- damp, cool, and low light conditions.

* Oomycete ** True fungi

The best control of damping-off for early transplanted warm season vegetables is to start with disease free transplants and clean growing media. Once this disease has started in a seedling flat, it may be difficult or impossible to control or determine if 'healthy looking plants' are uninfected. Treating transplants before field planting should be considered in these situations-

- The soil temperatures are still cool, may stay cool, and wet/cloudy weather is likely;
- Damping off has occurred in your greenhouse and/or adjacent flats.

Note- Use of fungicide treated seed will provide protection in a greenhouse for 7 to 12 days and should be considered if problems have been experienced in previous years or if optimum greenhouse conditions are difficult to maintain. Only seed companies are now allowed to apply fungicide treatments to vegetable seeds commercially.

What fungicides are available to use? Unfortunately two common broad spectrum fungicides are no longer labeled for vegetables- Captan and Banrot. Synthetic products available are Terraclor (PCNB), Ridomil (mefenoxam), Previcur Flex (propamocarb), and Ranman (cyazofamid). Ridomil and Ranman are currently labeled for cucurbits and fruiting vegetables, but Previcur Flex is only labeled for cucurbits. Ridomil (mefenoxam), propamocarb (Previcur Flex), and Ranman are effective only against Oomycetes (*Pythium* and *Phytophthora*), but will not control any of the 'true fungi' damping off species (see 2nd paragraph above). Terraclor can provide protection against *Rhizoctonia* diseases. Another option is the biologically based fungicides, which are generally considered better at preventing diseases than curing them. *Streptomyces griseovirdis* (Mycostop), *Trichoderma virens* (SoilGard), and *Trichoderma harzianum (*RootShield), *Basillius subtillis* (Companion) are biological controls that are labeled for vegetables, including organic production.

A few of good questions are:

- If a mild infection occurs, do the plants recover fully, or is there a reduction in yield potential? It depends on the crop, but it is likely yields will be less. Crucifer seedlings with a mild late infection have shown significant yield reductions. For warm season vegetables a later mild infection would likely damage the vascular system near the crown and reduce yield potential.
- Will a field applied fungicide help once the disease is diagnosed? Fungicides applied at the very first signs of the disease symptoms may help reduce/ limit the infection, but at later stages the chemicals will be ineffective. A drench should reach the same depth as the transplant plug. Application instructions will likely vary with product formulation and should be carefully followed.
- And how does one separate the complicating factor of low soil oxygen aggravating the conditions……in other words, is it more about the weather than anything 'you' can do? It can be difficult to determine if the seed rot/ damping-off is from disease, excess fertilizer, temperature damage (heat and cold), soil saturation, etc. Damping-off is most effectively controlled with cultural practices (most importantly water management and sanitation) than chemicals. Weather has a big impact but things that can be done to limit damping-off damage are use of raised beds and improving soil structure. Waiting to plant in the ground until the soil temperature is conducive to good plant growth and waiting a few days after a heavy rain will also help.

MU's Plant Diagnostic Clinic reopened in December. Vegetable diseases identified this spring on greenhouse or high tunnel tomatoes–

- Phytophthora
- Root knot nematode
- Gray mold
- Tomato spotted wilt virus

Something you're unsure about? Contact your local extension agent!

NRCS Technical Assistance Available to All Producers

Vegetable producers know they can turn to their local MU Extension agronomist for expert technical assistance regarding herbicides, pesticides, fungicides, cover crops, etc. They may not know that they can receive free technical assistance from the Natural Resources Conservation Service staff at their local USDA field office for help controlling soil erosion and other conservation measures.

Alan Hayes, NRCS District Conservationist for Bates and Vernon counties, explained that their mandate is to provide technical assistance to all producers. It is best for producers wanting technical assistance to contact the field office well in advance of starting a project.

Michael Morris, NRCS District Conservationist for Miller and Morgan counties, agreed that producers do not need to seek cost-share assistance to take advantage of NRCS technical assistance to design terraces, ponds or other projects. For more information about technical services, stop in, write or call your local NRCS field office, or ask your local Extension agronomist to personally introduce you to the NRCS staff .

Pollutant Damage to Tomato (continued).....by Dave Trinklein

Herbicides represent a second major pollutant threat to a tomato crop in a greenhouse. First, it is important to state that there are no herbicides labelled for greenhouse use while plants are growing in the structure. Sadly, several growers I have visited applied a pre-emergence herbicide in their greenhouse and lost their crop as a result. Most growers are aware of the sensitivity of tomatoes to herbicides but their neighbours are not. 2,4-D remains a common herbicide for the control of broadleaf weeds in lawns and is a leading cause of herbicide damage to tomatoes. Tomatoes are sensitive to the point if one can detect the odor of 2,4-D in the greenhouse, damage is likely no matter how far away it was applied. For this reason growers should contact neighbors and ask them either not to apply herbicides at all if they or located nearby or to use a compound other than 2,4-D.

A final caution about herbicides involves the use of animal manure for compost applied to greenhouse soil. There are several herbicides used to control weeds in pastures that can remain active even after passing through the digestive system of an animal. When the manure from animals grazing on treated pastures is composted, residual herbicide contained by the compost has been sufficient in concentration to cause damage to tomato plants. While the concentration of herbicide is not great enough to kill tomatoes, it can affect their growth and render them relatively worthless.

Diagnosing pollutant damage often is difficult. If symptoms appear uniformly over an entire crop or large portion of the greenhouse, pollutant damage is a possibility. Unfortunately, tests to determine which pollutant might be the culprit are limited and expensive.

Trap Crops for Vegetables (continued)...by Jaime Pinero

Examples: (1) In Massachusetts, 6 butternut growers planted a Blue Hubbard border around butternut squash fields that ranged in size from 2 to 6 acres. These 6 fields were compared to conventional butternut fields where beetles were controlled with full-field insecticide sprays. Fields were scouted twice weekly until first leaves, then weekly until flowering. Borders were sprayed at the first arrival of the beetles. Cucumber beetles were only found in the trap crop and insecticides were only applied to the perimeter trap crop. As a result, 85% less insecticide was used

(2) In Missouri, a farmer in St. Peters was able to prevent cucumber beetles from eating his indoor cucumber transplants by using Blue Hubbard planted in pots and placed outside of his high tunnel. Four potted plants congregated hundreds of beetles while none was found inside the high tunnel. Research led by Dr. Piñero is being conducted in this area for the benefit of Missouri vegetable farmers. Other examples of specific trap crops are presented in the Table below:

Blue Hubbard has worked well as

To control	Use this Trap Crop	Observations
Cucumber beetles	Blue Hubbard squash	Plant Blue Hubbard two weeks before main cucurbit crop, can apply systemic insecticide to kill arriving beetles
Colorado potato beetle	Potato variety Superior (grows well in cool weather)	Plant the trap crop between last year's and this year's fields (near overwintering sites)
Squash bugs	Squash	Main crops: zucchini, watermelon. Can treat the trap crop with an insecticide to control an infestation
Flea beetles	Chinese Southern Giant Mustard (*Brassica juncea* var. *crispifolia*)	Main crops: cabbage, broccoli, or cauliflower. Reseeding of the trap crop may be necessary
Diamondback moth	Yellow rocket	Attracts moths, inhibits larval development. Main crops: cabbage, broccoli and cauliflower. Insecticides may not be needed as natural enemies may control the pest population
European corn borer and fruitworm	Corn (sweet or field)	Main crop: pepper (for European corn borer) and tomato (for fruitworm)

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- EPA Region 7 Strategic Agricultural Initiative 901 N. 5th Street Kansas City, KS 66101 913-551-7003 or 800-223-0425
- The Osage Valley Resource Conservation and Development Council (OVRCD) PO Box 420 Butler, MO 64730 660-679-4332

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About this mailing list

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Tissue Sampling: High Tunnel Tomatoes...by Sanjun Gu

As the weather warms up, high tunnel tomatoes rapidly grow both their vegetative parts (leaves, branches, stems, and roots) and reproductive parts (flowers, expanding and ripening fruit). At this point, adequate supply of mineral nutrients (see figure) is critical for continuous harvest at high yield. To know the status of nutrients in plants, all you need is to conduct a simple tissue test.

To sample, the most-recently-matured leaf including the blade and its petiole should be used. These leaves are generally the 4th or 5th leaf from the growing point (top), have turned from a light-green juvenile color to a darker-green color, and have reached full size. Sampling should be done at first bloom, early fruit set, first ripe fruit, and during the harvest period (weekly if possible). Eight to ten leaves are required for a good sample. Once collected, leaves should be dried and shipped to a laboratory in paper containers. University of Missouri provides this service (http://soilplantlab.missouri.edu/). The adequate level of minerals is listed below.

Macronutrients *(can be corrected with Fertigation if deficient)*					
N	P	K	Ca	Mg	S
3.5–5.0%	**0.30–0.65%**	**3.5–4.5%**	**1.0–3.0%**	**0.35–1.0%**	**0.2–1.0%**
Micronutrients *(Can be corrected with Foliage spray if deficient)*					
Fe	Mn	Zn	Cu	B	Mo
50–300 ppm	**25–200 ppm**	**18–80 ppm**	**5–35 ppm**	**30–75 ppm**	**0.1–1.0 ppm**

Note:

- Boron becomes toxic at approximately 200 ppm.
- The N:K ratio is more important than nitrogen concentration in limiting the effects of **high** nitrogen. A N:K ratio of 1.2 to 1.8 is desirable.