



Greenhouse TPM/IPM Bi-Weekly Report
University of Maryland Cooperative Extension
Central Maryland Research and Education Center

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Geraniums

Your geraniums may be humming along but make sure you are maintaining a correct pH level. If you let the pH fall off the plants will go downhill rapidly. Check your pH level at least weekly to detect any downward turns. There is a condition called sudden pH decline (SPD) where geranium crops growing at the optimum pH rapidly (1- 2 weeks) have the substrate pH shift downward 1 to 2 units. Taylor et al., 2008, reports that this occurs when phosphorus is deficient in the substrate and high temperatures cause stress of the geranium crops.



pH: The optimal pH varies by the type of geranium and root medium used. For zonal geraniums, the range for a soilless root medium is 5.8 to 6.2 and for a soil-based medium is 6.0 to 6.5. The optimal range is up to 0.3 units lower for ivy and regal geraniums (5.5 - 6.2). If modifications are required, the pH can be lowered with an acid-based fertilizer or acid injection. The pH can be increased with dolomitic limestone or hydrated lime.

Electrical Conductivity (EC): The optimal EC range is 1.5 to 2.5 mS/cm for zonal and regal geraniums. Slightly lower levels are required by ivy geraniums, usually 1.0 – 2.0 mS/cm.



Geranium with high soluble salt damage



No problems with this geranium! It's an exotic geranium 'Tricolor'.

Aphids on Geraniums: Monitor ivy geraniums for melon aphids and green peach aphids. We are seeing populations increasing in some greenhouses this week.

Control: Imidacloprid (Marathon), dinotefuran (Safari), Acetamiprid (TriStar), Endeavor, Aria, insecticidal soaps.

Diseases to watch out for on Geraniums: One disease to watch out for on geraniums is bacterial leaf spot. This disease is caused by the bacterium *Xanthomonas pelargonii* and is especially prevalent in warm, wet weather where plants are grown in crowded conditions. Disease symptoms include small (pinhead size), circular or irregular, brown, sunken spots on older or lower leaves. Large numbers of spots will occur on a single leaf, these will coalesce and can kill a large portion of the leaf which will then drop off. As the disease moves through the plant, the lower leaves wilt and yellow. In severe cases, the stem will possess black stem cankers killing the upper portion of the stem. Leaves infected with bacterial leaf spot should be removed as soon as it is noticed. Severely infected plants should be removed.

Botrytis

Monitor for Botrytis leaf spot or blossom blight. It is caused by *Botrytis cinerea*. Botrytis is favored under cool, moist conditions or where plants are watered frequently. Leaves develop zonate, brown leaf lesions which develop a grayish brown mass of fungal spores. The lower leaves will yellow and rot. Flowers may also become infected. They show discolored petals which wilt and fall. Remove affected leaves and flowers. Maintain good air circulation in the greenhouse.

Botrytis on geranium flowers and foliage



Aphid Populations Are High in Some Greenhouses

John Speaker is reporting an explosion of melon and green peach aphid this week on annual vinca, salvia, and peppers in several parts of the state. The weather conditions are just right for aphids to take off at this time of year. Monitor susceptible plant species closely for aphids this week.

Control: Treat hot spots before the aphids spread around the greenhouses. There are several control options including Endeavor, insecticidal soap, imidacloprid, Enstar II, Azadirachtin (Azatin, Ornazin), Talstar, Thiodan, and horticultural oil. Kontos from OHP is a new systemic material that can be used for aphid control that should provide at least 30 days of control.

Recent Plant Sales

Unfortunately sales were slow in most garden centers last weekend with the rain incidence and second turn plants are backing up in greenhouse. This is creating crowded conditions in many greenhouse which sets up potential problems with Botrytis. Make sure your workers keep the foliage and spent flowers cleanup to reduce food sources for the Botrytis. Make sure the HAF are working correctly to keep the air flowing around the plants. The weather is predicted to be sunny and warm for this weekend so hopefully people will start buying plants in larger quantities.

Weeds in the Greenhouse

To reduce insect and disease pressure in greenhouses, now is a good time to remove weeds from under benches and around the perimeters of the greenhouses. Weeds are hosts for insects (e.g. aphids and western flower thrips) and diseases (e.g. virus). If left to go to seed, weeds can easily become a problem in pots. When the weeds are pulled up make sure they are bagged and removed from the greenhouse so they don't serve as a reservoir for spider mites and insect pests that can spread disease in your greenhouse. Several of these weeds serve as potential inoculum source for virus vectored by aphids and western flower thrips. Weeds such as bitter cress, sorrel, chickweed and ground ivy are weeds that aphids, mites, whitefly and thrips will feed on in the greenhouse.

Controls for Weeds: Round-up is a non-selective material that can be used when the greenhouse is empty of plants. Finale, Scythe, Reward and Envoy are nonselective contact herbicides that burn back tops of weeds but not the root system. Diquat can be used below benches.



Ground ivy with twospotted spider mite damage



Common groundsel

Greenhouse Vegetables

As more ornamental bedding plant producers are expanding their vegetable plant offerings in anticipation of increased consumer demand, it is important to note that pest management options for food crops are quite different than for ornamentals. For example, many fungicides labeled for ornamentals are NOT labeled for use on food crops. Dr. Kate Everts, vegetable plant pathologist at the University of Maryland, compiled the following chart of products labeled for use on vegetables in the greenhouse. Some of these products may not be labeled for use on ornamentals – when in doubt, always check the product label!

Selected Fungicides and Bactericides Labeled for Greenhouse Use on Vegetables
Developed by Kate Everts, Plant Pathologist, University of Maryland

Fungicide	Target Diseases	Labeled Crops	Comments
BASIC COPPER SULFATE (Cuprofix Disperss) 24 hr. REI	Many diseases including angular leaf spot, downy mildew, <i>Alternaria</i> blight, <i>Anthraco</i> se, bacterial blight, etc.	Vegetables including cucumbers, eggplant, peppers, tomatoes, etc.	Crops grown in the greenhouse may be more sensitive to copper injury so the user should determine plant sensitivity. Some formulations are OMRI approved, see labels for details.
<i>BACILLUS PUMILUS</i> (Sonata) 4 hr. REI	Early blight, late blight, downy mildew, powdery mildew	Many vegetables including brassicas, bulb vegetables, cucurbits, fruiting vegetables, leafy vegetables and root and tuber crops	OMRI approved.
<i>BACILLIUS SUBTILLUS</i> , QST, 713 Strain (Serenade MAX, Rhapsody) 4 hr. REI	Many diseases including downy mildew, powdery mildew, bacterial spot, early blight, etc.	Many greenhouse vegetables including broccoli, leafy vegetables, cucurbits, peppers, tomatoes and others	Applied as a protectant fungicide. OMRI approved.
<i>CONIOTHYRIUM MINITANS</i> (Contans) 4 hr. REI	<i>Sclerotinia sclerotiorum</i> , <i>Sclerotinia minor</i>	Many vegetables including leafy vegetables, brassicas, legumes, fruiting vegetables and bulb vegetables	OMRI approved. Contains a beneficial fungus. Do not allow to stand in tank overnight following mixture. Acts as a preventative.
COPPER HYDROXIDE (Kocide 101, Kocide 3000, Kocide 4.5LF, Kocide DF) 24 hr. REI	Leaf spots, <i>Anthraco</i> se and bacterial spots	See labels for specific crops	See labels for specific usage instructions.
COPPER SALTS of fatty and rosin acids (Camelot) 12 hr. REI	<i>Alternaria</i> blight, downy mildew, angular leaf spot, powdery mildew, scab, gray mold, bacterial soft rot, bacterial spot, <i>Cercospora</i> leaf spot, etc.	Vegetables such as broccoli, cabbage, cucurbits, tomato, etc.	The user should determine if coppers can be used safely prior to application. Observe for 7 to 10 days for symptoms of injury.
DICLORAN (Botran) 12 hr. REI	Pink rot, gray mold, <i>Sclerotinia</i> and <i>Sclerotium</i> rots, leaf blight and neck rot	Many vegetables including celery, lettuce, onions, garlic and shallots	May cause leaf bronzing on lettuce. Use adequate volume of water.
HARPIN PROTEIN (Messenger) 4 hr. REI	Increases vigor and aids in the management of disease	Vegetables including cucurbits, fruiting vegetables, and leafy and cole crops	Do not use chlorinated water when mixing this product. Activates natural defense mechanism in plants. Has no direct effect on pests or pathogens.
HORTICULTURAL OIL (Ultra-Fine Oil) 4 hr. REI	Powdery mildew	Cucurbits, melons and squash	Application should be made when disease is first noticed. See label for information on plant safety. Use lower label rates in the greenhouse. OMRI approved.

HYDROGEN DIOXIDE (Oxidate, Zerotel) 0 hr. REI	<i>Anthracnose</i> , downy mildew, powdery mildew, <i>Pythium</i> root rot	Many vegetables including cole crops, cucurbits, leafy vegetables, peppers and tomatoes	Strong oxidizing agent. Contact, oxidizing sanitizer. OMRI approved
Fungicide	Target Diseases	Labeled Crops	Comments
MANCOZEB (Dithane F-45, DF) 24 hr. REI	Leaf spot diseases, seed treatment for damping off, seed rots and seedling blights	Tomatoes and others	Broad-spectrum protectant fungicide.
PENTACHLORO-NITROBENZENE PCNB (Terraclor 75 WP, Terraclor Flowable, Terraclor 15G) 12 hr. REI	Root and stem rot, damping off (<i>Rhizoctonia solani</i> , <i>Pellicularia filamentosa</i>)	Vegetable bedding plants. Limited to container-grown beans, broccoli, Brussels sprouts, cabbage, cauliflower, peppers and tomatoes.	Flowable and 75WP: Apply as a soil drench. 15G: Used as growing media mix. See label for additional information.
POTASSIUM BICARBONATE (Armicarb 100, Milstop, Kaligreen) 4 hr. REI	Powdery mildew and others	Many vegetables including cabbage, cucumber, eggplant, broccoli, cauliflower, lettuce, peppers, tomatoes and squash	Works by contact. Potassium bicarbonate disrupts the potassium ion balance in the fungus cell, causing the cell walls to collapse. Some formulations are OMRI approved. See label for details.
PROPAMOCARB HYDROCHLORIDE (Previcur Flex) 12 hr. REI	<i>Pythium</i> root rot and damping off	Tomatoes, leaf lettuce, cucurbits and peppers	See label for specific usage instructions.
PYRIMETHANIL (Scala) 12 hr. REI	Early blight and gray mold	Tomatoes	Use in well-ventilated houses only and ventilate two hours after application.
<i>STREPTOMYCES GRISEOVIRIDIS</i> strain K 61 (Mycostop, Mycostop Mix) 4 hr. REI	<i>Fusarium</i> , <i>Alternaria</i> , <i>Phomopsis</i> , suppression of <i>Botrytis</i> , and root rots of <i>Pythium</i> , <i>Phytophthora</i> , and <i>Rhizoctonia</i>	Many vegetables including lettuce, cole crops, cucumbers, melons, peppers, tomatoes and others	Contains a beneficial bacterium. Repeat applications may be needed. Use as a soil spray or drench.
STREPTOMYCIN SULFATE (Agri-mycin 17) 12 hr. REI	Bacterial spot	Tomatoes and peppers	Repeated applications can result in resistant bacteria. Do not apply through any irrigation system.
SULFUR (Microthiol Disperss) 24 hr. REI	Powdery mildew	Brassicas, cucurbits, peppers and tomatoes	Crops grown in greenhouses may be more sensitive to sulfur injury, so the lowest label rate should be tried initially. Do not use within two weeks of an oil spray treatment. Some formulations are OMRI approved, see label for details.
<i>TRICHODERMA HARZIANUM</i> (PlantShield, Rootshield) 0 hr. REI	<i>Pythium</i> , <i>Rhizoctonia</i> , and <i>Fusarium</i> . When applied as a foliar spray, suppresses <i>Botrytis</i> and powdery mildew.	Greenhouse vegetables	Contains a beneficial fungus. Avoid applications of fungicides at least one week before or after application. Acts as a preventative. Will not cure diseased plants. OMRI approved.
<i>TRICHODERMA VIRENS</i> GL-21 (formerly known as <i>Gliocladium virens</i>) (SoilGard 12G)	Damping off and root rot, pathogens <i>Pythium</i> and <i>Rhizoctonia</i>	Food crop plants in greenhouse	Acts as a preventative and will protect noninfected plants. Will not cure already diseased plants. Allow treated soil to incubate for one day prior to planting for best results. Do not use other soil fungicides at time of incorporation. OMRI approved.

Adapted from NE Region Vegetable Management Guide. If any information in these tables is inconsistent with the label, follow the label.