VEGETABLE CROPS HOTLINE

A newsletter for commercial vegetable growers prepared by the Purdue University Cooperative Extension Service

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<http://www.entm.purdue.edu/entomology/ext/targets/newslett.htm>

IN THIS ISSUE

WATER, WATER EVERYWHERE… - *(Shari L. Plimpton)* - Water suitable for agricultural uses seems to be hard to come by these days if you read all of the reports out there about water quality for fresh fruits and vegetables. We emphasize water's importance for fresh produce food safety through the GAP (Good Agricultural Practices) program across the country, yet we (those of us who are trying to be helpful) still seem to be generating as much confusion as we are solutions. So in this article I hope to address some of the questions I am hearing with some new information and a little perspective.

In January of this year, at the Ohio Fruit and Vegetable Grower's Congress, we featured Dr. Trevor Suslow, Extension Research Specialist from UCDavis to speak on the topic of Water Quality and Fresh Produce Safety. Those who were able to attend heard him report on research findings that demonstrated both bacterial survival and increasing bacterial numbers at refrigerated temperatures for certain strains of infectious organisms. Clearly, this news underscores the importance of the goal of preventing microbial contamination, since our best efforts to control microbial contamination (washing and refrigeration) are not foolproof (although both are still necessary).

Recommendations published by Dr. Suslow and other researchers, and the continued reporting of foodborne illness are driving large-scale growers to adopt water quality practices that are even more diligent than those we have recommended in the GAPs program. Growers with known contamination issues are testing their water sources for fecal coliform bacteria and *E. coli* at least twice a month if from open sources and monthly if from closed wells. Dr. Suslow is recommending that growers who have not identified a microbial contamination issue test just as frequently for at least a year before reducing the frequency to once a year for enclosed wells and at least 3 times a season (Midwest) for open water sources.

Treatment of water to be used for agricultural purposes (irrigation, spray) is an important precaution if you hit the action threshold of 1000 fecal coliform bacteria per 100 ml and/or 126 *E. coli* bacteria per 100 ml. Prior to employing your treatment options, re-test for whatever microorganisms are indicated. If you are testing a well, inspect and make sure there are no opportunities for surface water to breech the well. Shocking the well with chlorine should address the problem. Retest. With an open water source, it would be necessary to add a filtration system to the water pulling from the source and follow that with an automatic chlorination system, so you can chlorinate the water for sensitive applications. Again, retest.

Using potable water is necessary in the packinghouse to avoid introducing a microbial contamination problem that did not exist coming out of the field or orchard. Since washing does not eliminate microorganisms, the goal in the packinghouse is simply to keep the water clean enough not to cause or increase microbial contamination. Repeatedly, research is showing that the most reliable method for accomplishing this is a chlorination system that is closely monitored maintaining free chlorine levels of 150 to 200 ppm.

Monitoring the free chlorine level and pH of the water on a continuous basis is an essential part of the process. Measuring chlorine alone gives you only half of the picture: a half that may mislead you regarding the effectiveness of the sanitation of your water. If the pH is within 6.8 to 7.2, the level of free chlorine that is in the most effective form (hypochlorous acid) is at its highest. Most of our water sources tend to run basic, so acetic acid can be used to bring the pH into range.

And why am I writing about chlorine so much and not other sanitation methods? Because, current research is not showing any other methods to be as effective for the treatment of water under agricultural conditions as is chlorination. If you are using copper ionization, please

note that high levels of organic material can render it ineffective. Researchers are recommending that you supplement a copper ionization system with chlorination to improve disinfection of the water, particularly in packinghouse operations. If you are considering purchasing a copper ionization system ask the dealer to demonstrate its effectiveness in agricultural applications. A system should be able to effectively result in a five-fold reduction of fecal coliform and particularly *E. coli.* Ultimately, the goal is to minimize the risk and recognize the potential impact of the decisions you make regarding how to manage your water sources.

For more information and links to research articles on this and related topics visit <www.midamservices.org>. For free Good Agricultural Practices materials, presentations and food safety consultations contact us on the web site listed above or call Mid American Ag and Hort Services at (624) 246-8286 or send an email to: maahs@ofbf.org. You may also subscribe to a free e-newsletter by going to the web site above and clicking on the "Free Email Mailing List" button. These services are available for Ohio and Indiana producers through the Ohio & Indiana Specialty Crop Food Safety Initiative funded by the United States Department of Agriculture's Risk Management Agency.

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Managing Cover Crops in the Spring - *(Liz Maynard)* - Winter cover crops benefit the soil in many ways, but if mismanaged in the spring they can cause problems with crop production. Here are some tips to consider as fields are prepared for planting.

1. Don't let the cover crop get so big you can't manage it.
2. Consider allowing 1 to 3 weeks between killing or incorporation of cover crop and planting. This will a) provide time for some residue breakdown to minimize physical and chemical interference with crop establishment, and b) reduce chance of some insect problems such as seedcorn maggots and possibly cutworms.
3. Avoid tillage that buries cover crop residue in an anaerobic layer.
4. Avoid direct-seeding small-seeded crops after cover crops with known or suspected allelopathy (i.e. winter rye).
5. Expect cover crops with a high C:N ratio (i.e. winter rye that is in the reproductive stage) to temporarily tie up nitrogen once they are killed. Provide some readily-available nitrogen close to planting time.
6. Expect leguminous and young grass cover crops to release nitrogen that will be available to the cash crop; adjust N applications accordingly.* This is especially important to avoid delay in flowering and fruit set in crops such as melons, pumpkins, tomatoes, and peppers. There are additional considerations for no-till systems where cover crop residue is left on the surface:
7. Kill all emerged weeds before planting and carefully plan for in-season weed control.
8. Choose planting equipment that will cut cleanly through residue.
9. Choose planting equipment that will ensure good seed-to-soil or root-ball-to-soil contact and coverage.
10. Control small rodents, especially with direct-seeded crops.
11. Plan to irrigate before planting if soil is dry.

No doubt some readers have additional tips based on their own experience. To share them, send a note to emaynard@purdue.edu and we'll include them in the next issue of this newsletter.

*For information on estimating nitrogen available from a cover crop see pp. 22 - 23 in Managing Cover Crops Profitably, 2nd Ed., from the Sustainable Agriculture Network. Available in pdf format (2835 k) from <www.sare.org/coreinfo/soil.htm>. Or contact me at (219) 785-5673 to request a printout of the pages.

Cover crop of hairy vetch and winter rye in mid-May, Wanatah, Indiana. A mixture like this could supply 50 to 100 lb. per acre N to the following crop. *(Photo by Liz Maynard)*

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IVGA Invites Website Sponsors - *(Liz Maynard)* - The Indiana Vegetable Growers' Association invites sponsors for its website. For an annual contribution of $50.00 IVGA will include the Sponsor's Logo, contact information, and a link to the Sponsor's website. For more information see <www.ivga.org/sponsors.html>.

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IVGA Wholesale Vegetable Producer Directory - *(Liz Maynard)* - The IVGA wholesale vegetable suppliers list will be updated for 2006. If you have changes or wish to be included, please do the following:

1. Review the 2004-2005 directory (included with this newsletter or see online at <www.ivga.org>).
2. Respond by email to ivga@ivga.org or by fax to (219) 785-5675
   a) If no change is needed just say "no change needed"
   b) If correction is needed, please explain.
   c) If you are not listed and would like to be, please provide all information following the format in the directory. Only current members of IVGA will be included.

Please respond before May 1, 2006. Do it now, before you forget!

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Produce Industry Trade Show May 6 - 9, 2006 - Chicago will be overflowing with the latest in produce marketing trends May 6 - 9 at the United Produce Expo and

Conference. And that's not all. The All Things Organic Trade Show, the Fancy Food Show, the US Food Export Showcase, and the Food Marketing Institute Show will all be held at the same location and time. See the following Web sites for more information.
Produce Show <www.uffva.org/produceshow/>
All Things Organic Trade Show <www.atoexpo.com/>
Food Marketing Institute <www.fmi.org>
Fancy Food Shows <www.specialtyfood.com>
US Food Export Showcase <www.nasda-hq.org/nasda/nasda/Usfes/>, or call UFFVA at: (202) 303-3400

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Greenhouse Insect and Mite Management - (*Frankie Lam*) - The warm, humid, and stable conditions along with plenty of food make the greenhouse an exceptional environment for insect and mite pests. The most common insect and mite pests in greenhouse are: aphids (Fig. 1), fungus gnats, leafminers (Fig. 2), mealybugs (Fig. 3), scale insects (Fig. 4), shore flies, spider mites (Fig. 5), thrips (Fig. 6A), and whiteflies (Fig. 6B). Before seeding the plants in a greenhouse, consider the following preventive practices and scouting and monitoring methods for the management of greenhouse insects and mites.

Preventive practices

- Inspect all incoming plants and materials.
- Keep doors, screens, and ventilator in good condition.
- Pasteurized media.
- Maintain a weed-free greenhouse, and a clean, mowed area around greenhouse.
- Eliminate wet or standing water on ground.
- Remove all plant materials after each cycle.
- Avoid over watering and promote good ventilation.
- If possible, allow greenhouse to freeze in winter.

Scouting and monitoring methods

- Record all the locations of plants.
- Yellow sticky traps in 1-2 per 1000ft^2, also place near doorway and vents, and check 1-2 times per week.
- Check leaves for sooty mold – aphids, whiteflies, and mealy bugs.
- For fungus gnat larvae: Place raw potato chunks (1-inch^3) without skin on soil surface.
- Inspect soil around bases of plants.
- No exact economic thresholds; growers usually set a threshold based on past experience.

Management practices

Insects and mites in greenhouse can be managed by biocontrol agents and pesticides. The following tables list the biocontrol agents (Table 1) and pesticides (Table 2) that are labeled for greenhouse pests. Please read the label and check the crops on the label before applying pesticides. Growers, who want to apply biocontrol agents in greenhouse and/or have questions about pesticides using in greenhouse, please call and discuss with Frankie Lam at (812) 886-0198.

Fig. 1. Aphids (wingless from). *(Photo by Frankie Lam)*

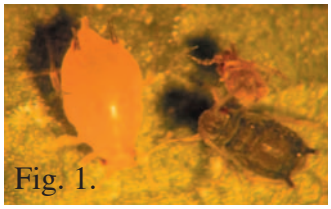

Fig. 2. Leafminer. *(Photo by Frankie Lam)*

Fig. 3. Mealybugs. *(Photo by Frankie Lam)*

Fig. 4. Scales insects. *(Photo by Frankie Lam)*

Table 1. Biocontrol agents for greenhouse pests.

Pest	Predator	Parasite/pathogen
Aphids	Lady beetles *Hippodamia convergens* Lacewings *Chrysopa spp.* *Chrysoperla carnea*	Parasitic wasps *Aphidius colemani* *Aphelinus abdomalis* Pathogenic fungus *Beauvaria bassiana*
Fungus gnat larvae	Mite *Hypoaspis miles*	Entomopathogenic nematodes *Steinernema feltiae*
Leafminers		Parasitic wasps *Dacnusca sibiriica* *Diglyphus isaea*
Mealybugs	Lady beetle *Cryptolaemus montrouzieri*	Parasitic wasp Leptomastix dactylpii
Mites	Mite *Ambylseius californicus* *Amblyseius mckenzei* *Phytoseiulus longipes* *Phytoseiulus persimilis*	Pathogenic fungus *Beauvaria bassiana*
Scales	Beetle *Lindorus lophanthus*	Parasitic wasps *Aphytis melinus* *Metaphycus helvolus*
Thrips	Mite *Amblyseius gegenerans* *Hypoaspis miles* Minute pirate bug *Orius insidiosus*	
Whiteflies	Lady beetle *Delphastus pusillus*	Parasitic wasps *Encarsia Formosa* *Eretmocerous eremicus* Pathogenic fungus *Beauvaria bassiana*

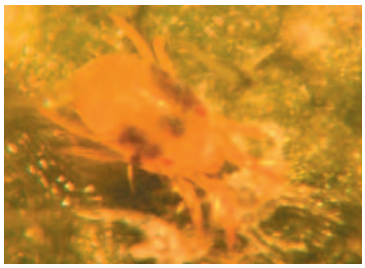

Fig. 5. Spider mite. *(Photo by Frankie Lam)*

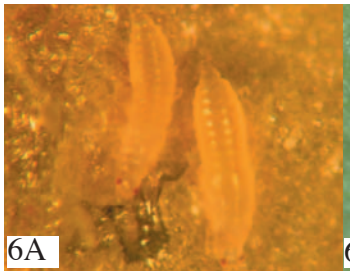

Fig. 6A. Thrips (wingless form). **6B.** Whitefly. *(Photos by Frankie Lam)*

Table 2. Pesticides labeled for use on greenhouse insects and mites.

CLASS:
BO, botanical;
CARB, carbazate;
CBOX, carboxamide;
CH, Chlorinated hydrocarbon;
IGR, insect growth regular;
ML, macrocyclic lactone;
NN, neonicotinoid;
OP, organophosphate;
PD, pyridazinone;
PL, Pyrrole;
PY, pyrethroid;
SO, soap;
SP, spinosyn

FORM:
AS, aqueous suspension;
EC, emulsifiable concentrate;
G, granule;
L, water soluble liquid;
SC, suspension concentrate;
WDG, water-disperible granule;
WG, wettable granule;
WP, wettable powder;
WSP, waters soluble packets

PESTICIDE	ACTIVE INGREDIENT	CLASS	FORM	REI (h)	APHIDS	CATERPILLARS	FUNGUS GNATS	LEAFMINERS	MEALYBUGS	MITES	SCALES	THRIPS	WHITEFLIES
Adept	Diflubenzuron	IGR	WSP	12		+	+	+					+
Avid	Abamectin	ML	EC	12	+	+				+		+	+
Azatin	Azadirachtin	IGR	EC	4	+	+	+		+				+
Citation	Cyromazine	IGR	WP	12			+	+					
Conserve	Spinosad	SP	SC	4		+						+	
Decathlon	Cyfluthrin	PY	WSP	12	+	+	+		+			+	+
Dibrom 8	Naled	OP	EC	24	+	+		+		+	+	+	+
Dipel	Bt kurstaki	MI	AS	4		+							
Distance	Pyriproxyfen	IGR	L	12			+				+		+
Endeavor	Pymetrozine	PDZ	WG	12	+								+
Enstar II	Kinoprene	IGR	EC	4	+		+		+		+	+	+
Flagship	Thiamethoxam	NN	WG	12	+				+		+		+
Floramite	Bifenazate	CARB	SC	12						+			
Hexygon	Hexythiazox	CBOX	DF	12						+			
K + Neem	Potassium salt + fatty acid	SO	L	12	+	+			+	+	+	+	+
Kelthane	Dicofol	CH	WP	48						+			
Malathion	Malathion	OP	EC	12	+	+		+	+	+	+	+	+
Marathon	Imidacloprid	NN	G	12	+		+	+	+		+	+	+
Mavrik Aquaflow	fluvalinate	PY	F	12	+	+			+	+	+	+	+
M-Pede	Potassium salt + fatty acid	SO	L	12	+			+	+	+	+		+
Neemix	Azadirachtin	IGR	EC	12	+	+		+					+
Pedestal	Novaluron	IGR	SC	12		+		+				+	+
Pylon	Carbonitrile	PL	L	12		+				+		+	
Pyrenone	Pyrethrin	BO	EC	12	+	+	+	+			+	+	+
Sanmite	Pyridaben	PD	WP	12						+			+
Tame	Fenpropathrin	PY	EC	12	+	+		+	+	+	+	+	+
TetraSan	Etoxazole	IGR	WDG	12						+			
TriStar	Acetamiprid	NN	WSP	12	+			+	+			+	+

Do You Want to Know Your Cost of Production? - *(Jennifer Dennis)* - As in any business, Indiana vegetable growers want to know how to appropriately price their vegetables. While there are a few aspects to consider such as the marketing channel and competitors' prices, the main factor in determining price is whether the chosen price will cover the grower's costs of production. While growers are quite aware of their bills, they often do not know their total costs per acre or their total costs per unit of sales. Enterprise budgets estimate the costs of production for an industry. Purdue is looking to create the first enterprise budgets specifically for Indiana Vegetables.

In order to create these budgets, we will need the assistance of Indiana vegetable growers in determining inputs and tracking or estimating costs of production. I am looking for 10 volunteers (preferably growing tomatoes, melons, sweet corn, and pumpkins) to participate in creating these enterprise budgets. Volunteers would be contacted and given instructions on what measures to document this season. An extended workshop would be provided at the Horticultural Congress in January 2007. Volunteers will be given a farm-specific cost analysis as well as free admission to this workshop. If you are interested, please contact me by April 21, 2006 by calling Brenda Pearl at (765) 494-4191 and specifying your interest in the "vegetable cost of production trial" or directly at jhdennis@purdue.edu. I'll need your name, telephone number, email address (if possible), when you plan to begin your season, and what you are growing.

American Commodity Distribution Association (ACDA) - *(Cathie McCullough)* - The ACDA is holding its National Conference April 8-12, 2006 in Denver, CO.

ACDA is a non-profit professional trade association, devoted to the improvement of the Department of Agriculture's (USDA) Commodity Food Distribution Programs. The programs support domestic agricultural production through annual purchases of approximately $1.4 billion of nutritious foods that are provided to participating school lunch and other child nutrition programs, elderly nutrition programs, supplemental feeding programs for pregnant women, infants, and children, Native American households, charitable institutions, and victims of disasters.

This nation meeting of State and Federal Government Officials, program recipients, Agricultural, and Allied interests offers a unique opportunity to broaden you knowledge about the commodity programs, learn how they operate, and how your membership might become involved in these programs. You will have ample opportunities to network with the many partners in the USDA commodity programs. We encourage you to attend!

Among other topics on the agenda, USDA staff will conduct a commodity program operations overview for industry and other commodity groups. There will also be sessions addressing commodity processing issues, procurement and delivery, food security, and USDA/FNS' Electronic Commodity Ordering System (ECOS).

This is the only national conference that comprehensively addresses the wide range of issues of interest to our partners and stakeholders in the commodity nutrition programs. Complete registration and hotel information can be accessed at the ACDA web site at <www.commodityfoods.org>. Although the registration deadline is March, attendance does not require membership and daily registration is available for non-members after that date. We hope your attendance would convince you to join this active association.

We also need to update our association contact list and ask you to provide us with your association's complete address, contact person's name, phone and fax numbers, and email address. Please provide this information via email to special.allen@fns.usda.gov.

We hope that you will give serious consideration to attending the ACDA National Conference and we look forward to meeting you there.

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¡Purdue Extension en Espanol! - A new website is available to provide basic Purdue Extension information in Spanish. See <www.ces.purdue.edu/espanol>.

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Seed Treatments - *(Dan Egel)* **-** Although most vegetable growers deal with foliar fungicides, few give much thought to what fungicides might be on the seed that is planted. Since most growers purchase seed that has been treated already, perhaps little thought is necessary. However, a few growers may save seed or purchase seed that is untreated. All growers should understand the different ways seed may be treated.

Saving seed - Growers should be aware of the risks of saved seed. Seed saved by the grower may not perform up to expectations for the following reasons: 1) Unless seed is properly cleaned and dried germination may be low. 2) Hybrid seed will not produce offspring true to type. 3) Vegetable diseases may be caused by fungi, bacteria or viruses (pathogens) that are seedborne; in such cases, the pathogens may be saved with the seed only to appear in the greenhouse and/or field next season. Growers who properly save seed, however, may choose to treat seed before planting. Table 1 lists several common diseases that may be seed borne.

Fungicide treatments - Most vegetable seed will come with a contact fungicide already applied to the seed. Examples of such fungicides are captan or thiram. These fungicides will help the seed overcome fungi such as Pythium or Rizoctonia that cause post or pre-emergent damping-off. These fungicides may also help destroy seedborne fungi that adhere to the outside of the seed coat (Fungi that are borne *inside* the seed coat will be unaffected by contact fungicides). Contact seed treatments are effective only for those fungi in direct contact with the seed surface. Therefore, direct seeded vegetables will benefit from contact seed treatments more than those vegetables planted in pasteurized greenhouse mixes.

High value vegetable seeds may be treated with a systemic fungicide. After planting, the systemic fungicide will dissolve off the seed surface and be available for uptake by the emerging seedling.

Untreated seed - Whether seed is saved or purchased untreated, the question may be asked, "should these seed be treated and if so how?"

Unless one has access to the specialized equipment and knowledge involved in fungicide seed treatment, it is best to leave such treatments to the seed companies.

There are some treatments that growers may want to try themselves if the seed has not been treated by fungicides. Some of the possible treatments are discussed below. Whatever treatment is decided on, experiment on about 100 seeds for each recipe before treating the whole batch of seeds. After treating the seed, plant each treatment in a greenhouse or isolated field and note the percent germination compared to the untreated seed and watch for any symptoms of disease. Always keep safety in mind when using treatments such as hot water or bleach. Table 1 includes examples of common seed treatments

Hot water treatment - The theory behind hot water treatment is that the temperature can be raised to a point that will reduce or eliminate the number of pathogens that might be infested in the seed while not reducing the germination beyond acceptable levels. An example of a hot water treatment is given below.

Fermenting - Upon extraction of the seed from the fruit, some procedures call for fermentation or soaking the seed in a combination of water and natural juice for a specified period of time. Depending on the crop, fermentation might play a role in improving germination and reducing the number of seed borne pathogens.

Chemical treatment - Some procedures call for seed to be treated with chemicals such as chlorine, acids, bleach, etc. As with the hot water treatments, the idea is to treat with a solution sufficiently strong to reduce the number of pathogens on the seed yet not reduce germination.

Biological treatments - Most biological treatments are designed to introduce a beneficial bacterium or fungus that will develop with the seedling and either attack or displace pathogens. Before considering a biological treatment, be sure that any seed treatment already on the seed does not counteract the beneficial organism. For example, a fungicide on the seed might eliminate a beneficial fungus.

Useful Publications or links: APS Diagnostic Compendia. *These references discuss all aspects of plant diseases complete with color photographs:* <www.shopapspress.org/disease-diagnostic-series.html>.

Vegetable Diseases and their Control. A. Sherf and A. MacNab. Second edition. John Wiley and Sons. *This is one of the bibles of vegetable diseases*.

Melons for the passionate grower. A. Goldman. Artisan, New York. *Although this book does not discuss diseases, it has a good discussion of the breeding aspects that have to be considered for cucurbits.*

A publication about bacterial spot, speck and canker of tomatoes including several seed treatments: <www.ohioline.osu.edu/hyg-fact/3000/3120.html>.

A general publication on how to save seed: <www.avrdc.org/pdf/seedbook.pdf>.

Table1: Several diseases representing various crop plants and pathogens are presented here. Although all these diseases may be seed borne, they may be disseminated in other ways as well. Seed treatments given here are for demonstration purposes only and should be carefully tested before large-scale use.

HOST	DISEASE	COMMENTS
Carrot	bacterial blight	Treat seeds in hot water at 126 F for 25 minutes
Celery	early blight	Also known as Cercospora blight
Lettuce	Septoria leaf spot	Treat seeds for 3 minutes in 118 F
Pepper	pepper mild mottle virus	Internal and external contamination of seed
Pumpkin	bacterial leaf spot	Fruit symptoms may appear as small white 'pimples'
Snap bean	common bacterial blight	Internal and external contamination of seed
Snap bean	Fusarium yellows	Spores adhere to seed coat
Soybean	anthracnose	Seed coat contaminated by spores
Soybean	Cercospora blight	Also known as purple seed stain
Tomato	bacterial canker	Most common symptom is a "firing" on leaf margin.
Tomato/pepper	bacterial spot	Spreads rapidly in warm, rainy weather.
Watermelon	anthracnose	Leaf and stem symptoms precede fruit lesions.
Watermelon	bacterial fruit blotch	Hot water and bleach not effective controls
Watermelon	Fusarium wilt	Once established in a field, can survive many years.
Watermelon	gummy stem blight	Over winters well in crop residue.
Wheat	ergot	Has been largely controlled through the use of disease free seed

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