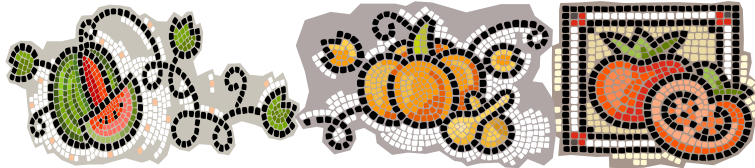


VEGETABLE CROPS HOTLINE

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

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EDITOR'S NOTE: This issue of the *Vegetable Crops Hotline* is the first of the 2011 season. The next issue of the *Hotline* will be sent out March 18. Subsequent issues will be sent out at two-week intervals. If you are receiving a paper copy of the *Hotline*, this is the last issue you will receive unless you have paid the \$15 subscription fee. On-line subscriptions are free. Also, if you join the Indiana Vegetable Growers Association (IVGA) you will automatically receive the *Hotline*. The IVGA membership form is on page 5 of this issue.



BACTERIAL SPOT OF TOMATO/PEPPER UPDATE - (Dan Egel) - In results confirmed in our laboratory late last year, several strains of the bacterium that cause bacterial spot of tomato and pepper were found to be resistant to copper. That is, the fixed copper products such as copper hydroxide and copper sulfate used for management of bacterial spot may not be effective management tools on these strains.

The strains of the bacterial spot bacterium resistant to copper are from both tomato and pepper. (Strains from pepper usually do not affect tomato and vice versa; the strains of the pathogen from bacterial spot of pumpkin do not affect peppers/tomatoes and vice versa.) One strain isolated in Indiana from tomato as far back as 1996 was resistant to copper. On the other hand, strains both resistant and sensitive to copper were isolated from tomato in 2010. Resistant strains of bacterial spot have



Figure 1: Bacterial spot of tomato can cause lesions on leaves, stems and fruit. (Photo by Dan Egel)

been found on peppers, fresh market tomatoes and processing tomatoes. Bottom line-it is impossible to know whether the stains of bacterial spot in your tomatoes or peppers are resistant without testing them.

These results are not surprising. Strains of copper resistant bacterial spot pathogens have been known from Florida for decades. However, copper resistance has not been confirmed in Indiana until now.

Bacterial spot of tomato and pepper has been known in Indiana since 1921 (Figure 1, above). Indiana was the 1st state in the U.S. to report this disease. Management of this disease has concentrated on applications of fixed copper applications. With the first report of copper resistant strains in Indiana, growers should review their control measures. Growers should assume the strains of bacterial spot in their fields are resistant to copper.

Management guidelines for bacterial spot:

- Fixed copper-growers with strains of the bacterial spot pathogen resistant to copper may have to increase the frequency of copper applications to overcome the level of resistance in bacteria. This is especially true during periods of hot, rainy weather.
- The use of mancozeb products (e.g., Dithane[®], Manzate[®], Penncozeb[®]) to accompany applications of fixed copper may allow more copper to become available on the leaf surface, thus overcoming the level of copper resistance that exists. Mancozeb products are not labeled on peppers.

- The product Actigard® may help to lessen the symptoms of bacterial spot by inducing the plant to increase its resistance to disease. This increase in resistance is not related to copper resistance. Actigard® is not labeled on bell peppers. Follow the Actigard® label closely to avoid yield loss due to the application of this product.
- Products with the active ingredient streptomycin (e.g., Agri-mycin®, Firewall®) are not affected by copper resistance. Applications of this product in the greenhouse at least once will help to manage bacterial spot. Streptomycin products are not labeled for use in the field.
- Serenade® is a biological product labeled for use on tomatoes and peppers for bacterial spot. Some research suggests that this product, used in alternation with fixed copper products, will help to manage bacterial spot. Serenade® is unaffected by copper resistance.
- The use of a virus disease of the bacterial spot strains is another option. AgriPhage® is a product that uses a virus disease of bacteria to kill the strains that cause bacterial spot. The use of such a product requires one to send in plant samples to the manufacturer so that they can customize the product for your field. Contact me for more information about AgriPhage®.
- Some pepper cultivars have resistance to some combination of races 1 through 5 of the bacterial spot pathogen. The more races the cultivar is resistant to, the better the chance of beating bacterial spot. However, any resistance may be overcome. In 2010, a race of pepper, race 6, was found in central Indiana. This race would have overcome any known resistance in commercial cultivars.

Bacterial spot is an important disease of peppers and tomatoes. Accurate diagnosis and quick action will help to manage this disease.



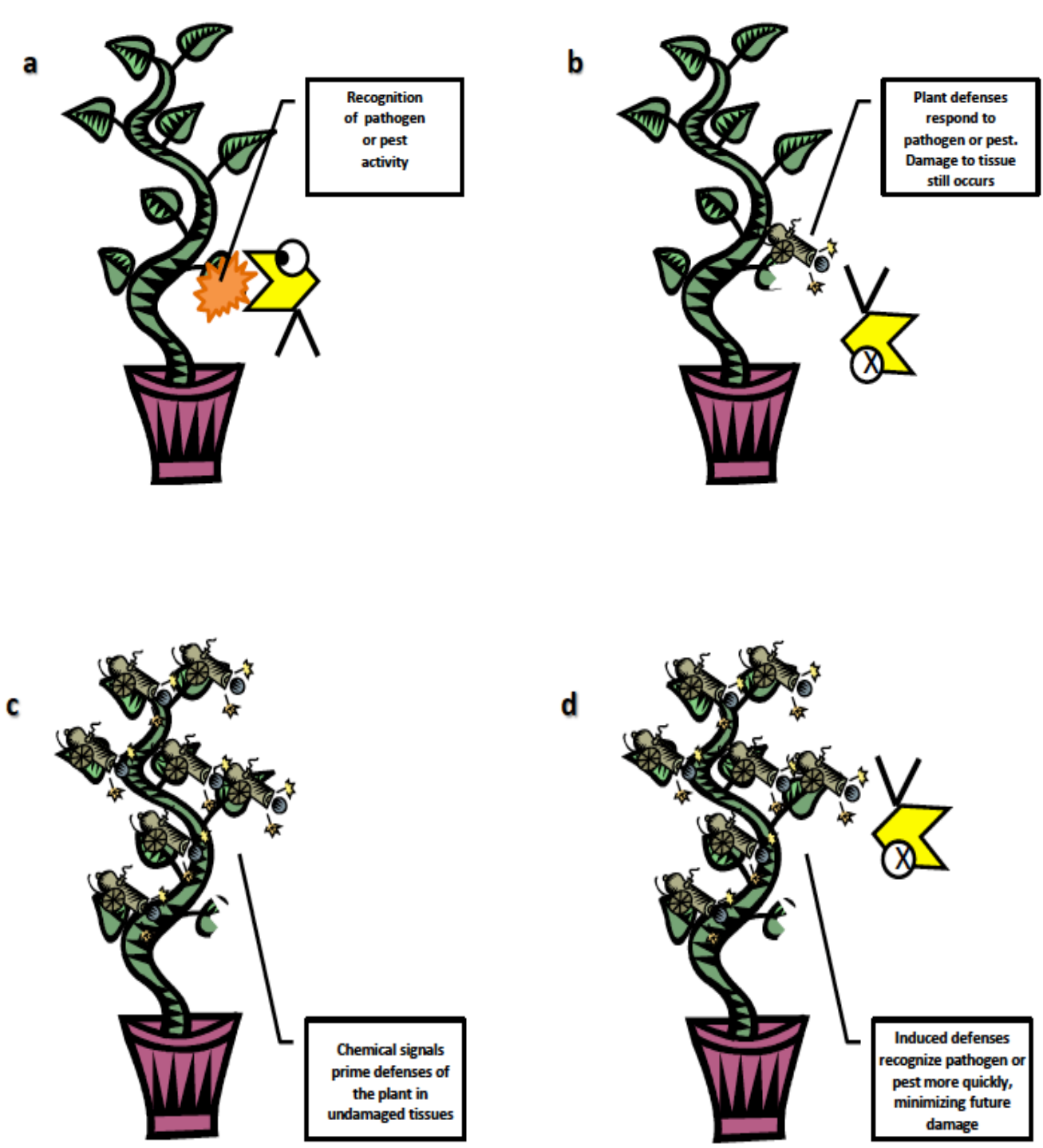
INDUCED RESISTANCE AND PLANT PROTECTION - (Nathan Kleczewski) - Many of you have gone to the doctor or a clinic to get the flu shot. A needle is poked into your arm, and a weakened or dead flu virus is injected into your bloodstream. This virus is detected by your body's immune system, which amasses a microscopic army, ready to defend your body against future flu. Plants also have mechanisms that allow the recognition of pathogens and insects. These mechanisms result in "induced resistance." Such resistance is active against many types of organisms such as bacteria, fungi, and even parasitic plants.

Induced resistance in plants is often triggered by the actions of pests or pathogens. For example, some pathogenic fungi have drill-like appendages that penetrate the plant surface and allow the fungus to grow into the plant and cause disease. Some plants have internal alarm systems that recognize that the tissue has been penetrated or that a fungus is present within the plant tissue (Figure 1-a, next page). The plant mounts a defensive response, which may kill and capture the fungus before further damage can occur (Figure 1-b). In addition, the recognition of the pathogen results in the production of chemicals that can move in the plant and signal undamaged plant cells that the plant is under attack. The plant, much like your body after receiving a flu shot, readies its defenses (Figure 1-c). If another fungus attempts to damage another portion of the plant, the defensive response is much faster, resulting in less damage to the plant (Figure 1-d). Induced resistance does not have to be caused by a pathogen. Non-pathogenic bacteria and fungi also can cause whole plant (systemic) resistance by simply coming into contact with plant tissues. Tissue damage caused by insect feeding also can result in induced resistance.

Chemical companies recognized the potential for induced resistance in plant protection on an agronomic scale long ago. Numerous chemicals are marketed on several crops, ranging from vegetables to trees. These products vary in the manner that they increase plant resistance. Some use specific organisms (e.g., non-pathogenic bacteria), chemicals (e.g., salicylic acid and phosphorous acid), as well as proteins, fatty acids, and simple sugars. Some examples of these products include Actigard® (Syngenta), KeyPlex 350dp® (Morse Enterprises), Messenger® (Eden Bioscience), OxyCom Respond Plus® (Redox Chemicals Inc.), ReZist® (Stoller Enterprises Inc.), and Serenade® (AgraQuest Inc.). These products have lower environmental and human safety issues unlike traditional chemical applications for control of pests and pathogens. However, we are not yet certain of the usefulness of these products, particularly in large-scale agricultural production. One issue has to do with the duration of the defensive response by the plant. Does it last days or weeks? What are the minimum amount of applications one could make to still be effective? A second issue deals with physiological constraints within the plant. Limitations to resources (soil nutrients, water, and sugars fixed via photosynthesis) may result in tradeoffs between plant defenses and growth or reproduction. Therefore, fruit production and size, as well as growth, may be reduced in plants with high levels of defense. Some of these questions will be addressed by researchers at the Southwest Purdue Ag Center this summer, and hopefully we will be able to provide more answers soon.



Figure 1: Cartoon depicting one possible scenario resulting in induced resistance. a) A pathogen or pest attacks a plant tissue. This activity is recognized by internal defense mechanisms of the plant. b) Plant defenses may capture or kill the pathogen or pest. c) The response in (b) results in whole plant (systemic) induction of defenses. These defenses allow for a more rapid response to future attack. d) Additional attacks on the plant are less effective, and cause less tissue damage. However, defenses are costly and may reduce plant growth or reproduction.



BE AWARE OF POTENTIAL HERBICIDE CARRYOVER - (*Liz Maynard*) - Many vegetable crops are sensitive to herbicides that may be used on field corn and soybeans. Some soil applied herbicides remain active, or carryover, for more than a growing season. These herbicides can injure sensitive crops planted the next year, or in some cases the next two or three years. Even some herbicides labeled for vegetables can cause injury on a different vegetable crop the following year. Effects of injury may vary in severity from minor to severe, including significant yield loss. Vegetable growers should be aware of herbicides used in the past three years on fields intended for vegetable production. If an herbicide has potential for carryover, the herbicide label will provide information about when vegetables of different kinds may be planted. This information is typically under the section about crop rotation.

Table 20 in the 2011 *Midwest Vegetable Production Guide for Commercial Growers* (Purdue Extension Publication ID-56) lists many soybean and corn

herbicides that can carryover and injure vegetable crops, but does not necessarily list all products that could cause a problem. The table is available online in the weed management section at <http://www.btny.purdue.edu/Pubs/ID/ID-56/>.

Herbicides likely to cause carryover injury to vegetables in Indiana can be grouped according to their mode of action, chemical family, and active ingredient. The table below lists active ingredients of most concern in Indiana grouped by mode of action and chemical family. For active ingredients listed, the range of replant restrictions for vegetable crops, and examples of products containing those ingredients are provided. Note that a single chemical family can include some active ingredients that are likely to cause carryover injury and others that don't. This table does not include the active ingredients that are not likely to carryover. Note also that the planting restriction can range from 0 months for some crops to over 3 years for others.

Selected herbicides with potential to cause carryover injury to vegetables in Indiana, grouped by mode of action and chemical family.

Mode of Action - WSSA MOA Code	Chemical Family	Active Ingredients (a.i.)	Planting Restriction (months)*	Products (single a.i.)	Pre-mix Products (two or more a.i.s)
ALS Inhibitor - 2	Imidazolinone	imazaquin, imazethapyr, imazamox	0 - 40	Pursuit [®] , Raptor [®] , Scepter [®]	Lightning [®] , Optill [®]
ALS Inhibitor - 2	Sulfonylurea	chlormuron, halosulfuron, nicosulfuron, primisulfuron, rimsulfuron	0-18	Classic [®] , Permit [®] , Accent [®] , Beacon [®] , Matrix [®]	Authority XL [®] , Canopy [®] , Cloak [®] , Canopy EX [®] , Cloak EX [®] , Envive [®] , Northstar [®] , Prequel [®] , Resolve [®] , Spirit [®] , Steadfast Q [®] or ATZ [®] , Synchrony [®] , Valor [®] , Yukon [®]
ALS Inhibitor - 2	Triazopyrimidines	cloransulam, flumetsulam	4-30	FirstRate [®] , Python [®]	Authority First [®] , Gangster [®] , Hornet [®] , Sonic [®] , Surestart/TripleFlex [®]
Photosynthesis Inhibitor - 5	Triazine	atrazine, metribuzin, simazine	0 - 18	Atrazine [®] , Sencor [®] , Princep [®]	Bicep [®] , Bullet [®] , Callisto Xtra [®] , Cinch [®] , Confidence Xtra [®] , Degree Xtra [®] , Expert [®] , FulTime [®] , Guardsman Max [®] , Harness Xtra [®] , Keystone [®] , Laddok [®] , Lariat [®] , Lumax [®] , Lexar [®] , Marksman [®] , Shotgun [®] , Stalwart Xtra [®] , Steadfast ATZ [®] , Volley ATZ [®]
Photosynthesis Inhibitor - 7	Uracil	terbacil	0 - 24	Sinbar [®]	
Pigment Inhibitor - 13	Isoxazolidinone	clomazone	0-16	Command [®]	Strategy [®]
Pigment Inhibitor - 27	Isoxazole	isoxaflutole	6 - 18	Balance Flex [®] or Pro [®]	Corvus [®] , Prequel [®] , Radius [®]
Pigment Inhibitor - 27	Triketone	mesotrione, tembotrione, topramezone	0-18	Callisto [®] , Laudis [®] , Impact [®]	Callisto Xtra [®] , Camix [®] , Capreno [®] , Epic [®] , Halex GT [®] , Lexar [®] , Lumax [®]
Seedling Growth Inhibitor - 15	Chloroacetamide	acetochlor	0 - 18	Surpass [®] , TopNotch [®] , Harness [®]	Confidence Xtra [®] , Degree Xtra [®] , FulTime [®] , Harness Xtra [®] , Keystone [®] , Surestart/TripleFlex [®] , Volley ATZ [®]

* This is the amount of time between when the herbicide was applied and when a particular crop may be planted. Refer to the herbicide label for information on when specific crops may be planted.

Indiana Vegetable Growers Association

Membership Renewal Application for 2011

Benefits of IVGA Membership:

- **Midwest Vegetable Production Guide for Commercial Growers (ID-56)** (new edition usually available in January)
- **Subscription to Purdue's Vegetable Crops Hotline newsletter**
- **Listing in IVGA Directory of Wholesale Vegetable Production (optional)**
- **Your web site linked on www.ivga.org**
- **Networking with other vegetable growers**

To renew or join, correct or fill out the form below and send in with your check payable to IVGA.

The information below will be printed in the membership directory that is sent to members only. It will also be used to mail you the Vegetable Crops Hotline, to fax or e-mail the Hotline Bulletins, and for IVGA correspondence. Please complete or correct, if necessary, the following information. If you would like anything omitted from the directory, please indicate so below.

Membership expires on Dec. 31 of every year

First _____ Last _____

Company _____

Address 1 _____

Address 2 _____

City, State, Zip _____

Phone _____ Fax _____

E-mail _____

Website _____

The Indiana Vegetable Growers' Association Directory of Wholesale Vegetable Producers will be updated yearly. To be included, please review your information below and make any necessary changes or additions. The wholesale directory is available to anyone who requests it and will be posted on the web. Indicate quantity of each item as follows: S=small quantities, X-wholesale quantities, T=semi truckload quantities. For certified organic, mark as 'O'. Contact information for Wholesale Directory if different from elsewhere on this form:

Contacts _____

Phone 1 _____ Phone 2 _____

Fax _____ Phone 3 _____

Business Address _____

E-mail _____

Website _____

ID-56 Delivery: Please indicate whether you will pick up your copy of the ID-56 at one of the following meetings: IHC (Indiana Hort Congress), IVGS (Illiana Veg Growers' School), or SW in. Melon Mtg. If you do not pick it up, it will be mailed to you in March.

IHC IVGS SW Mail Other

Would you like to receive free subscriptions to trade magazines that may be offered to IVGA members?

yes no

Check here to OPT OUT of hard copy of Vegetable Crops Hotline. If you check yes, the announcements will be sent by e-mail but no paper copy will be mailed.

OPT OUT yes no

Membership Type

Regular, \$35/year

Industry/Corporate, \$75/year

Make check payable to: Indiana Vegetable Growers' Association (IVGA).

Return to:

Indiana Vegetable Growers' Association
c/o Liz Maynard
600 Vale Park Rd.
Valparaiso, IN 46383

Office Use Only

Check No. _____ Date Rec'd _____

Check Date _____ Rec'd by _____

Apples <input type="checkbox"/>	Peaches <input type="checkbox"/>
Asparagus <input type="checkbox"/>	Peppers, bell <input type="checkbox"/>
Beet <input type="checkbox"/>	Peppers, hot <input type="checkbox"/>
Blackberries/Raspberries <input type="checkbox"/>	Potatoes <input type="checkbox"/>
Broccoli <input type="checkbox"/>	Pumpkin <input type="checkbox"/>
Cabbage <input type="checkbox"/>	Pumpkin, mini <input type="checkbox"/>
Cantaloupe/Muskmelon <input type="checkbox"/>	Radishes <input type="checkbox"/>
Cauliflower <input type="checkbox"/>	Snap bean <input type="checkbox"/>
Chrysanthemums <input type="checkbox"/>	Spinach <input type="checkbox"/>
Collards/Mustard/Turnip Greens <input type="checkbox"/>	Squash, summer <input type="checkbox"/>
Corn Stalks <input type="checkbox"/>	Squash, winter <input type="checkbox"/>
Corn, ornamental <input type="checkbox"/>	Straw <input type="checkbox"/>
Cucumber <input type="checkbox"/>	Strawberries <input type="checkbox"/>
Daylilies <input type="checkbox"/>	Sweet corn, bicolor <input type="checkbox"/>
Eggplant <input type="checkbox"/>	Sweet corn, yellow <input type="checkbox"/>
Gourds, ornamental <input type="checkbox"/>	Sweet corn, white <input type="checkbox"/>
Herbs <input type="checkbox"/>	Tomatillo <input type="checkbox"/>
Kale <input type="checkbox"/>	Tomato <input type="checkbox"/>
Lettuce <input type="checkbox"/>	Turnips <input type="checkbox"/>
Onions, bulb <input type="checkbox"/>	Watermelon <input type="checkbox"/>
Onions, green <input type="checkbox"/>	Other crops <input type="checkbox"/>

Please list _____

IRRIGATION AID - (Troy Hinkle, Knox County SWCD)

- Farmers and landowners who irrigate in Sullivan, Greene, and Knox counties in Indiana may be eligible for up to \$56 per acre for cost share practices that improve the efficiency of irrigation systems and protect well casings and pumps from back flow that could contaminate the aquifer. Conservation practices offered under the project are:

Irrigation Water Management: the program pays \$12 per irrigated acre per year for five years for detailed record keeping and data collection and for irrigating according to an approved irrigation scheduling program. You must have irrigated in two of the past five years to be eligible for this practice. A water application uniformity test and a flow test will be required.

Irrigation System Assessment: a water application uniformity assessment will be performed to determine if the irrigation system is applying water at the desired rate. The program will provide up to \$44 per irrigated acre to replace worn sprinklers and end guns or to upgrade the system to a low pressure package, and will provide producers with an Irrigation Management Plan to maximize irrigation efficiency. Farmers who sign up for this practice will be required to also sign up for the Irrigation Water Management practice.

Check Valve Installation: the program will pay up to \$1500 per well for the installation of a back flow prevention valve on systems that are being used, or may be used, to apply pesticides, herbicides or fertilizer. The check valve will protect the well and ground water from being contaminated.

For more information on this program, contact:

- Greene County: Tammy or Deborah - 812-384-4781, ext. 3
- Sullivan County: Judy or Miranda - 812-268-5157
- Knox County and Sullivan County: Tom or Rex - 812-882-8210, ext. 3



ENHANCED TAX DEDUCTIONS - Indianapolis, IN - "The Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010, recently signed into law, includes a tax incentive for private sector food donations to charities through 2011.

At a time when many food banks across the country are most in need of donations, Congress renewed a critical provision that allows all business entities - including farms, small businesses, and restaurants - to continue to receive a tax incentive to help fight hunger in their communities. Before this renewal, only C corporations, generally larger companies, were eligible for the en-

hanced deduction for donations of food. The new law means that through 2011 and retroactive to the start of 2010, small businesses, retailers, farmers, ranchers and restaurateurs have a new incentive to donate food for hunger relief.

For additional information about the special enhanced tax deduction and how food donors can utilize the deduction, please consult your tax counsel. For more information about the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010, please contact Carrie Calvert at (202) 546-7001.



FARMERS MARKET BOOT CAMP: FOOD SAFETY - Topics include Home Based Vendors, Sampling, and ServSafe. The program will be offered on March 15, 2011 at the Indiana Farm Bureau Office in Indianapolis, IN from 9am-1pm. Registration fee is \$10 (lunch included) and is due by March 9. For more information or to register, contact Tammy Goodale at 765-494-1296 or tgoodale@purdue.edu. If you can't make it to Indy for the programs, you can watch it via Adobe Connect Online at the following county extension offices: Allen, Dearborn, Fulton, Greene, Hancock, or Kosciusko or at Hendricks Regional Hospital (Room 4&5).



FARMERS MARKET BOOT CAMP: MARKET MANAGEMENT 101 - Topics include Liability, Vendor Recruitment, and Market Management. This program is being offered on the following dates: March 22, 2011 at Dubois County Fairgrounds, Huntingburg, IN; March 22, 2011 at Marshall County Building, Plymouth, IN; March 24, 2011 at Scott County Chamber, Scottsburg, IN; March 29, 2011 at Indiana Farm Bureau Office, Indianapolis, IN. All events run from 9am-1pm and registration is due 5 days before the event occurs. For more information or to register, contact Tammy Goodale at 765-494-1296 or tgoodale@purdue.edu.



REMINDER: The annual meeting for the **Southwest Indiana Melon and Vegetable Growers Association (SWIM)** will be held on March 11th at Casino Aztar Conference Center in Evansville, IN. The meeting will be held from 8:30am-3pm **CENTRAL** time. PARP will be available also for an additional \$10 fee. If you have not already RSVP, please do so to Sara Hoke at (812) 886-0198 no later than March 4th.

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