Vegetable Crops Hotline

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

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Can row covers stop cucurbit bacterial wilt, and are they cost effective? - *(This article is a short summary of research conducted at Iowa State University on bacterial wilt of cucurbits. Erika Saalau, Mark Gleason, and Jean Batzer, Department of Plant Pathology)* - Bacterial wilt is a major challenge for North Central Region cucurbit growers. This disease, caused by the bacterium Erwinia tracheiphila, can wreak havoc on all types of cucurbit crops except watermelon. Leaves and stems wilt and dry up, and infected plants typically die (see Figure 1).

Figure 1: Bacterial wilt, transmitted by the cucumber beetle, can cause the death of muskmelon plants. *(Photo by Dan Egel)*

Cucumber beetles are part of the bacterial wilt story. Two species, striped and spotted cucumber beetles, carry the bacterium from plant to plant, and infection often happens through beetle feeding wounds. Fighting bacterial wilt means fighting cucumber beetles; the main defense against the disease is stopping the beetles.

Many strategies have been tried to beat the beetles. Most growers rely on insecticides, but chemical warfare can require many applications per year, which is expensive and may also damage non-target insects, including the bees that pollinate cucurbit crops. Other tactics, such as trap crops and chemical lures, are still in the experimental stage. Organic growers have an especially difficult struggle to grow highly wilt-susceptible crops such as cucumber and muskmelon, because organically approved insecticides are not very effective against cucumber beetles. In fact, some organic growers won't plant these highly susceptible crops due to worries about bacterial wilt.

Where do row covers fit into the fight against bacterial wilt? Spunbond polymer row covers, such as Agribon® and Reemay®, have gained a foothold with North Central Region cucurbit producers for other reasons: they warm the soil, speed up crop maturity, and protect against extreme early-season weather (frost, hail, wind, heavy rain).

Row covers also have potential as a defense against bacterial wilt because they keep out cucumber beetles. As the soil warms up in the spring, cucumber beetles emerge from the ground with one mission: zero in on cucurbits. As they munch on the leaves, bacteria from their mouthparts and feces (frass) end up on the feeding wounds and enter the plants. Soon the plants start to wilt. Row covers keep out the beetles during the vulnerable early-season period.

Most growers remove row covers once flowering starts. Our research at Iowa State University (ISU) several years ago showed that deploying row covers from transplanting until the start of flowering could delay bacterial wilt. But sometimes the wilt would catch up by the end of the season, so the end result was still dead plants.

What if the row covers could stay in place a bit longer? We thought this delayed-removal idea was worth a try in Iowa.

Treatments were:

1. Row covers were removed at start of flowering.

2. Row cover ends were opened at start of flowering to enable pollinator access, and covers were removed 10 days later.

3. After a bumblebee hive (Koppert Biological Systems, Inc.) was inserted under one end of the row cover at start of flowering, the row cover was resealed and then removed 10 days later.

4. No row covers (control)

Our Iowa field trials showed that delaying row-cover removal by 10 days can provide season-long protection of muskmelon against bacterial wilt. This strategy proved to be an effective alternative for controlling bacterial wilt and cucumber beetles without insecticide applications. It could replace or reduce the need for insecticide sprays, and could be especially valuable for organic growers, who lack effective insecticides against cucumber beetles (see Table 1).

Results of the partial budget analysis suggest that when bacterial wilt epidemics occurred, the delayed-removal row cover strategy would deliver more consistent returns than either removing them when flowering starts or not using covers at all. The sensitivity analysis suggested that cost effectiveness of the delayed-removal strategy is affected by how often bacterial wilt outbreaks occur. The strategy was economically advantageous when bacterial wilt occurred in half or more of the growing seasons, but was a drag on returns when wilt was absent or less frequent.

For growers the advantage of using row covers will depend not only on the likelihood of disease occurrence but also on planting date, melon prices, availability of labor, and viability of effective alternatives to suppress the disease.

Table 1: Influence of row cover treatments on bacterial wilt incidence and yield in muskmelons in three site-years, Iowa, USA.

Year	Location	Treatment	Wilt incidence (%)[x]	Mean marketable yield (kg)[y]
2007	Gilbert	Removed at flowering[s]	58.3 a	10.9 b
		Delayed removal; ends opened[t]	5.0 b	23.9 a
		Delayed removal; bumblebees[u]	6.7 b	23.2 a
		Control	75.0 a	2.8 c
		LSD[v]	17.4	3.2
2008	Gilbert	Removed at flowering[s]	1.7 b	31.5 a
		Delayed removal; ends opened[t]	0.0 b	34.8 a
		Delayed removal; bumblebees[u]	8.3 b	42.9 a
		Control	60.0 a	8.0 b
		LSD[v]	22.1	14.7
2008	Muscatine	Removed at flowering[s]	55.0 a	24.3 b
		Delayed removal; ends opened[t]	18.3 b	49.4 a
		Delayed removal; bumblebees[u]	11.7 b	52.1 a
		Control	53.3 a	16.8 b
		LSD[v]	20.7	14.3

[s] Row covers were removed when first perfect flowers appeared.
[t] Ends of row covers were opened at flowering; row covers were removed 10 days later.
[u] A bumblebee hive (Koppert Biological Systems Inc., Romulus, MI) was inserted under one end of the row cover, and the row cover was re-sealed. Row cover was removed 10 days later.
[v] Means followed by the same letter are not significantly different within row ($P<0.05$).
[x] Final wilt incidence evaluation before first harvest
[y] Mean marketable weight per treatment, average of four subplots

Striped Cucumber Beetles - *(Rick Foster)* - Striped cucumber beetles are important in melon production, primarily because they vector the bacterium that causes bacterial wilt of cucurbits. This disease affects muskmelons but not watermelons. As a result, the threshold for treatment of muskmelons is 1 beetle per plant while the threshold for watermelons is 5 beetles per plant. This insect is fairly unpredictable as far as when it will appear in the field. They overwinter as adults and move to fields in large numbers. The timing of this movement is a mystery that we have not yet solved, but we are working on it this year. At planting, applications of Admire Pro® or Platinum® will generally provide 2-3 weeks of control of striped cucumber beetles. There are a variety of

insecticides that can be applied as foliar sprays that will also provide excellent control. One note of caution: our research over the last 20 years has shown that weekly applications of insecticides will have a negative effect on yields compared to treating only when thresholds have been reached. We don't know for sure whether this yield loss is due to some unapparent phytotoxicity or either mortality or repellency of honeybees that are there to pollinate the crop. Whatever the cause of the yield loss, growers are advised to treat only when needed rather than weekly.

Fertilizer calculations for High Tunnels - *(Shubin K. Saha)* - Commonly, fertilizer recommendations are expressed in terms of pounds per acre, however in the setting of high tunnel vegetable production it is a rare occurrence where an entire acre is under protective cover. So the simple question arises, how much fertilizer needs to be applied for crop production? The answer to this question is dependent on several parameters. The first step is to determine what the recommended rate for the crop you are planning to produce. Recommended rates vary by crops as each one has individual needs and demands. For Indiana, recommended fertilizer rates can be found for most vegetable crops in the *Midwest Vegetable Production Guide* (ID-56) **http://www.btny.purdue.edu/Pubs/ID/ID-56/** . Once you have determined the desired rate of the given element it is next necessary to determine the amount of space in the growing area. After you have determined the amount of space in your high tunnel it is necessary to choose the source for your fertilizer material and determine the product analysis, which is typically on the front of the bag in a 3 number pattern. For example, on a label for urea the analysis is 46-0-0 (Nitrogen-Phosphorus-Potassium), which indicates that the product is 46% Nitrogen by weight or volume. In 100 lbs of urea there is 46 lbs of actual nitrogen. Lastly based on your recommended rate it is necessary to determine how the fertilizer is going to be provided to the crop (i.e. pre-plant broadcast or in-season application via irrigation) Please see the following example and if there are any questions feel free to contact me: Dr. Shubin K. Saha, D.P.M., Ph.D., 812-886-0198.

High tunnel production of tomatoes for fresh market. *(Photo by Dan Egel)*

Example:
A farmer wants to grow muskmelons in his high tunnels but is unsure of how much nitrogen fertilizer he needs to apply. Based on the ID-56 it is recommended to apply 50 lbs of Nitrogen per acre pre-plant and an additional 30 lbs of Nitrogen per acre during the season via drip irrigation. The producer desires to make the in-season application of nitrogen over 6 weeks, which results in application of 5 lbs of nitrogen per week via irrigation. His high tunnel is 30 feet wide by 96 feet in length. His desired form of pre-plant fertilizer is urea (46-0-0) and his choice for in-season application via irrigation is liquid calcium nitrate (9-0-0), which has a density of 12.2 lbs per gallon. In this structure based on 6 ft row spacing there will be 5 rows that are 90 feet in length as it is not possible to use the entire 96-foot length of the structure. This implies that there is 90 feet of drip tape in each row. Lastly, there are 43,560 ft^2 in one acre and 8,712 linear feet in one acre.

Calculations:
Pre-plant application (broadcast): Material used is urea (46-0-0); 30 ft. x 96 ft. = 2,880 ft^2 = area of 1 high tunnel

$$\frac{50 \text{ lbs N}}{1 \text{ acre}} \times \frac{1 \text{ acre}}{43{,}560 \text{ ft}^2} \times \frac{2{,}880 \text{ ft}^2}{1 \text{ high tunnel}} \times \frac{100 \text{ lbs urea}}{46 \text{ lbs N}} = \frac{7.2 \text{ lbs urea}}{1 \text{ high tunnel}}$$

In-season application (via drip irrigation): Material used is $CaNO_3$ (9-0-0), density of 12.2 lbs/gal
30 lbs split over 6 weeks = 5 lbs/week
5 rows x 90 feet = 450 linear feet of T-tape

$$\frac{12.2 \text{ lbs}}{1 \text{ gal } CaNO_3} \times \frac{9\% \text{ N}}{100\% \text{ solution CaNO3}} = \frac{1.1 \text{ lbs N}}{1 \text{ gal } CaNO_3}$$

$$\frac{5 \text{ lbs N}}{1 \text{ acre}} \times \frac{1 \text{ gal } CaNO_3}{1.1 \text{ lbs N}} \times \frac{1 \text{ acre}}{8{,}712 \text{ linear feet}} \times \frac{450 \text{ linear feet}}{1 \text{ high tunnel}} = \frac{0.23 \text{ gal } CaNO_3}{\text{per week for 6 weeks}}$$

Answer: Based on the given parameters to apply 50 lbs of actual nitrogen to his high tunnel he must apply 7.2 lbs of urea and 0.23 gallons of calcium nitrate each week for six weeks via drip irrigation.

Greenhouse sanitation: Key to preventing diseases and pests - *(Nathan Kleczewski)* - It's time for some greenhouse spring cleaning! Today I would like to briefly discuss greenhouse sanitation practices and their benefit to you, the grower. When greenhouses are properly sanitized growers benefit by reducing the amount of money required to apply costly pesticides. In turn, everyone benefits from reduced pesticide use as this results in less environmental contamination and impacts on human health. The following are some tips and tricks to get the most out of your greenhouse this year.

1) Make sure everyone working in the greenhouse understands that this is a "clean area." Treat it as if it were your kitchen: wash tools before and after use, wash hands, ensure that you are not bringing in mud and dirt on your boots, etc. If the item is dirty, keep it off of your benches. Hoses used for hand watering should be hung such that the watering head does not come in contact with the floors or benches to minimize chances of accidental disease spread. Keep soil off of the ground. Keep trash or discarded soil/plant material out of the greenhouse.

2) Remove weeds from within the greenhouse. These weeds can be important reservoirs for insects (e.g. aphids, whiteflies) or pathogens. Hand weeding may not be effective for all weeds. If an herbicide is used, ensure that you follow all safety precautions and remove any crop from the area to reduce herbicide damage/death of your vegetables.

3) Inspect your plants regularly. Ensure that everyone working in the greenhouse is trained at recognizing common disease and pest associated symptoms. Immediately remove any symptomatic plants from the greenhouse.

4) If you insist on reusing pots and trays between crops, wash thoroughly with soapy water to remove adhering soil and then soak in a disinfectant (see Figure 1). Products such as quaternary ammonium (Green-Shield®, Physan 20®, Triathlon®), hydrogen dioxide (ZeroTol®, Oxidate®), chlorine dioxide (SelectrocideT®), 70% isopropyl alcohol, and dilute bleach may be effective at killing any pathogens and pests that "hide out" in your containers. Washing with soap often is not sufficient to completely remove these organisms from your trays. If you had issues with disease last year and insist on reusing trays or pots, it will be in your best interest to further protect your investment by utilizing one of the aforementioned products. If you can afford it, purchase new pots and trays between crops. Always read the label and follow the instructions carefully.

5) Disinfect your benches. If you are using one of the aforementioned products, pay attention to the label for rates and instructions. Bleach should not be used on metal benches as it can cause corrosion. Clean irrigation/fertigation tanks and lines. Some of the aforementioned products are also labeled for this purpose and can kill pathogens and algae.

6) Take a break prior to starting up your transplants. Close the vents and let the empty house sit for a week. The hot temperatures can help pasteurize the greenhouse and decrease pests and disease.

7) Maintain your greenhouse. Repair leaks, change out evaporative cooling cells if needed. Repair holes in the greenhouse. A healthy greenhouse is a happy greenhouse. A happy greenhouse leads to a healthy plants and a happy grower.

Figure 1: Transplant trays should be cleaned and sanitized between uses. *(Photo by Dan Egel)*

Seedcorn Maggots on Melon - *(Rick Foster)* - The weather throughout the state has been perfect for seedcorn maggot problems; cool and wet. I have had one report of problems from Daviess County. The grower planted on April 13 and by April 18, he was seeing large numbers of dying plants and confirmed the cause of death by splitting the stems and seeing the maggots inside (see Figure 1, top of next page). At this point, the only option for that grower is to replant. If you have not yet planted, you can avoid problems by waiting a little longer to plant. That may not fit in with your plans to take advantage of the early market, but you should be aware that seedcorn maggots can devastate that early crop, especially in a spring like this one. More information about seedcorn maggots can be found in issue #533 of the *Vegetable Crops Hotline* **http://www.btny.purdue.edu/pubs/vegcrop/VCH2011/VCH533.pdf .**

Figure 1: Seed corn maggot activity can destroy seedlings like this muskmelon plant during the early season. See article on page 4. *(Photo by Dan Egel)*

Changes to the Midwest Vegetable Production Guide for Commercial Growers 2011 (ID-56) - *(Dan Egel)* - Several changes will soon be made to the on-line version of the ID-56 and are detailed below (see Table 1). I wanted to draw your attention to one in particular.

Manzate Pro-Stick® is now labeled for use on peppers. Other products with the active ingredient mancozeb may become labeled in the next several weeks. Diseases on the Manzate Pro-Stick® label include anthracnose and Phytophthora blight. Pepper growers who use mancozeb products as labeled may find that if mixed with fixed copper products, mancozeb has the potential to increase control of bacterial spot. My thanks to Ed White in the State Chemist Office for his help on this matter.

As changes to the ID-56 are made, these changes will be detailed here **http://www.btny.purdue.edu/Pubs/ID/ID-56/** as well as in the *Vegetable Crops Hotline*.

Table 1: Recent changes made to the Midwest Vegetable Production Guide for Commercial Growers 2011.

Section	Change description
Table 4 - Pesticide use in greenhouses and high tunnels - page 12 - insecticides	• Oberon® classification changed to the column "Label Prohibits Greenhouse Use". • footnote added to Acramite® -"Not for use on greenhouse tomatoes".
Table 4 - Pesticide use in greenhouses and high tunnels - page 13 - fungicides	Contans® added to column "Labeled for Greenhouse use".
Brassica and leafy greens - page 65	Product Radiant SC®, the phrase "Leafminers only" is deleted.
Cucurbit Vegetables - mancozeb section, page 77	Statement deleted: Fungicides containing mancozeb may not be used with pumpkins. Statement added: Some mancozeb formulations may not be labeled for pumpkin.
Fruiting Vegetables, page 89	• Statement deleted from anthracnose section, mancozeb products: Fungicides containing mancozeb may not be used with pepper. Statement added: Some mancozeb formulations may not be labeled for pepper. • Add to bacterial spot treatments: Serenade Max® at 1 to 3 lbs per acre. May help bacterial spot management when copper-resistant strains are present. (Organic symbol added.) • Add to bacterial spot treatments, in the field copper: Strains of copper-resistant bacteria have been found in Indiana for bacterial spot of pepper and tomato. Mancozeb products labeled for pepper and tomato may assist in managing bacterial spot when applied with fixed copper products.
Fruiting Vegetables, page 91.	Delete organic symbol next to Tanos® in early blight/Septoria section.

NRCS Announces Opportunity for Organic Producers - USDA's Natural Resources Conservation Service (NRCS) announced another funding opportunity for certified organic producers and those transitioning to organic production to implement conservation practices on their agricultural operations. While applications are accepted on a continuous basis, NRCS will be reviewing applications submitted by May 20, 2011 for the current funding cycle.

Organic Initiative funding is provided through NRCS' *Environmental Quality Incentives Program* **http://www.nrcs.usda.gov/programs/eqip/organic/index.html** (EQIP), a voluntary conservation program that promotes agricultural production and environmental quality as compatible national goals. The 2008 Farm Bill provided assistance specifically for organic farm operations and those converting to organic production.

"Organic growers in Indiana continue to express interest in program support to implement conservation practices on their land," said NRCS State Conservationist Jane Hardisty. "This is the second funding opportunity offered this year to organic producers to help them get assistance in protecting natural resources. EQIP is a great fit for organic producers. Together, we are creating conditions that help foster sustainable organic production."

Fiscal year 2011 marks the third year of USDA's Organic Initiative. Up to $50 million is available this year to help producers plan and implement conservation practices that address natural resource concerns in ways that are consistent with organic production. For example, conservation practices include planting cover crops, establishing integrated pest management plans, constructing seasonal high tunnels, or implementing nutrient management systems consistent with organic certification standards.

Eligible producers include: 1) those who are certified through USDA's *National Organic Program* **http://www.ams.usda.gov/AMSv1.0/nop** , 2) those who are transitioning to certified organic production, and 3) those who meet organic standards but are exempt from certification because their gross annual organic sales are less than $5,000.

Under EQIP Organic Initiative contracts, NRCS provides financial payments and technical assistance to help producers implement conservation measures in keeping with organic production. Beginning, limited resource, and socially disadvantaged producers may obtain additional assistance. The 2008 Farm Bill limits EQIP payments for organic operations to $20,000 per year per person or legal entity, with a maximum total of $80,000 over six years.

Indiana producers interested in applying for EQIP Organic Initiative funding must submit applications through their local NRCS Service Center, which can be located through the website at **http://www.in.nrcs.usda.gov/contact/directory/field_offices.html** . For more information, contact Jane Hardisty, NRCS State Conservationist 317-290-3200 or Pam Davidson, Public Affairs Specialist, 317-290-3200, ext. 322.

SURE Program - The 2009 Supplemental Revenue Assistance Payments Program (SURE) is underway and continues through July 29, 2011.

SURE provides crop disaster assistance payments to eligible producers on farms that have incurred crop production or crop quality losses as a result of a natural disaster. This program addresses crop losses on all farming interests in all counties and states. SURE provides assistance in an amount equal to 60% of the difference between the SURE farm guarantee (expected revenue) and the actual farm revenue.

In 2009, Indiana had 29 counties that were either declared a natural disaster by the Secretary of Agriculture, or contiguous to a declared county. Any producer who has part of his/her farming operation in one of these counties may qualify for a SURE payment, if there was a 10% production loss of one crop of economic significance.

The 29 counties include: Bartholomew, Brown, Decatur, Elkhart, Gibson, Greene, Hancock, Jackson, Jefferson, Jennings, Johnson, Knox, LaGrange, LaPorte, Lawrence, Marion, Martin, Monroe, Orange, Posey, Ripley, Rush, St. Joseph, Scott, Shelby, Steuben, Sullivan, Vigo, and Washington.

Farmers in other counties who suffered in excess of a 50% loss and meet all other eligibility requirements may also be eligible for 2009 SURE. In addition to loss thresholds, producers must meet certain other eligibility requirements to qualify for SURE benefits. This includes the Risk Management Purchase Requirement (RMPR). The RMPR requires that a producer have crop insurance, or Non-Insured Crop Disaster Assistance (NAP) coverage on every crop of economic significance in every county where the producer has an interest. The deadline to make application for benefits is July 29, 2011. For more information on SURE, visit any FSA County Office. Additional information is available online at **http://www.fsa.usda.gov/sure** .