Great Lakes Fruit, Vegetable & Farm Market EXPO
December 5-7, 2006
DeVos Place Convention Center, Grand Rapids, MI

Vine Crops

Wednesday morning 9:00 am

Where: Ballroom Room D

Recertification credits: 1 (1A, 1B, Comm CORE, Priv CORE)

CCA Credits: PM(1.5) CM(0.5)

Moderator: Phil Tocco, Agriculture & Natural Resources Educator, Jackson Co. MSU Extension

9:00 a.m. Perimeter Trap Cropping for Squash & Cucumbers

Jude Boucher, University of Connecticut

9:25 a.m. Controlling Beetles Using Precision Banded Admire

Jim Jasinski, The Ohio State University Extension

9:50 a.m. Pollinization Issues in Seedless Watermelon

Stephen Olson, University of Florida

10:15 a.m. Rye Cover Crops for Pumpkin Production

Dale Mutch, W. K. Kellogg Biological Station, MSU

10:30 a.m. Downy Mildew and Phytophthora in Vine Crops

Amanda Gevens, Plant Pathology Dept., MSU
Mary Hausbeck, Plant Pathology Dept., MSU

Perimeter Trap Cropping for Squash and Cucumbers

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Definition & Function
Webster's Dictionary (Guralnik 1980) defines "perimeter" as "the outer boundary of a figure or area" and as "a boundary strip where defenses are set up."

Perimeter trap cropping (PTC) involves planting a more attractive trap crop so that it completely encircles and protects the main cash crop like fortress walls. The effectiveness of this trap crop system can usually be improved by adding other perimeter defenses, such as border sprays or with biological, mechanical and cultural controls.

Perimeter trap cropping functions by intercepting pest migration, regardless of the direction of attack. It then concentrates the pest population(s) in the border area, where they can be retained or killed, thus preserving natural enemies and reducing disease spread in the main crop. When installing this system on your own farm, it helps to think of PTC as a "poisoned fence."

Introduction
Cucumber beetles damage cucurbit plants mainly as young seedlings between the cotyledon and third true leaf stage. Seedlings are very susceptible to defoliation, stem feeding and water loss, and direct feeding can kill young plants or cause the loss of an entire field. The young seedling stage is also when the plants are most susceptible to infection by the bacterial wilt pathogen: another significant mortality factor spread by the beetles. Beetles can also help spread powdery mildew, black rot, Fusarium and some viruses. Managing cucumber beetle populations is crucial for cucurbit production. Until recently, cucumber beetle control was limited to long distance crop rotation, row covers (if practical) or chemical treatments.

In 2001, we began investigating PTC as an alternative control strategy for managing cucumber beetles and bacterial wilt on summer squash. We were looking for a simple system, that could control multiple pests, reduce pesticide use, improve crop quality, increase farm profitability and lead to greater adoption and implementation of IPM methods. A tall order for any new system! Like many researchers before us, we started with a series of variety trials in an attempt to find an attractive trap crop. We also used small plot trials at the UConn and UMass Research Farms and commercial farm trials in larger fields (1/4- to 8 acres) to help test the PTC systems. By 2003, we initiated similar studies for cucumbers and winter squash.

Identifying the "best" trap crop
In variety trials, we have compared many potential trap crops to see which might be the best at protecting the main crop. The cucurbit varieties tested were listed in the literature or suggested by growers. We quickly learned that although 'Turk's Turban' was the most attractive to the beetles, there were other important considerations, as 93% of the plants of this variety perished before harvest from bacterial wilt infection. It is extremely important that the variety chosen as the trap crop in a PTC system not be a

disease reservoir, or you may win the battle against the insects only to lose the war to disease. In other words, any beetle that made it through the perimeter to feed on the main crop would be a disease vector, and you may dramatically lower the number of beetles on the main crop, but suffer reduced yields due to bacterial wilt. We chose ‘Blue Hubbard’ as the trap crop for the cucurbit PTC systems, as it was highly attractive to beetles, but had a much lower incidence of wilt than other varieties tested. Since our early trials, we have found that many varieties of *Cucurbita maxima*, such as ‘Prize Winner’ giant pumpkins and buttercup squash, are also good candidates as trap crops.

Small-plot results on summer squash

In our first year or two of small-plot trails, we attempted to stop cucumber beetles, bacterial wilt and other pests with a perimeter trap crop and different supplemental controls, or a combinations of controls (i.e. sprayed trap crop on yellow plastic mulch) in the border area. When an insecticide was needed in the border area of a treatment, Sevin was used and reapplied, as needed. In 2001, over 94% of the cucumber beetles in the experiment were on plants in the perimeter of the plots. However, because 4 of our 5 treatments had ‘Blue Hubbard’ in the perimeter, we “sucked” almost all the beetles out of the control plots and ended up with no significant differences for beetle numbers on the summer squash in the center of the various treatments. Despite the low beetle numbers, we still found that trap crop plots supplemented with border sprays or yellow mulch both had significantly reduced summer squash defoliation levels compared to control plots.

In 2002, center sub-plots of summer squash from plots with a sprayed trap crop around them had significantly lower beetle numbers and bacterial wilt mortality, and higher yields, than the centers of control plots consisting of all summer squash plants. Beetle numbers on summer squash in the center of the sprayed trap crop plots were reduced by 93% when compared with plants in the center of control plots. All treatment plots supplemented with border sprays showed reduced levels of defoliation in the centers.

In 2003, we evaluated a single trap crop row of Blue Hubbard, a border-row insecticide application, and a combination of the two strategies for protecting centrally-located unsprayed summer squash (or cucumbers) from cucumber beetles and bacterial wilt. Small plot trials in 2003 were not very productive, as rainy spring weather caused delays in planting at the research farm and we missed most of the first generation beetles. There were still significant reductions in the percent damaged leaves for squash with a sprayed or unsprayed trap crop in the perimeter.

In 2004, the experiment was streamlined to include just 3 treatments: control plots with all unsprayed summer squash, plots with all sprayed summer squash, and those with unsprayed summer squash in the center with a perimeter of sprayed Blue Hubbard. The unsprayed summer squash in the center of the PTC plots had 80% fewer beetles than plants in the center of the first two treatments. The summer squash in PTC plots also had similar level of damaged leaves and defoliation as the sprayed summer squash plots, and significantly lower levels than the unsprayed control plots. When the experiment was repeated with the same three treatments in 2005, there were no significant beetle differences between the center plants of the PTC and control plots, but again the level of damaged leaves and defoliation was lower for summer squash protected by the trap crop.

In summary, PTC consistently lowered beetle damage compared with control plots, sometimes to levels that were similar to sprayed summer squash plots.

Small-plot results on cucumbers 2003 & 2005

Experimental design for small plot work on cucumbers was similar to the summer squash trials in the same year. Although a delay in planting time due to wet conditions and cloudy weather during beetle counts, prevented us from finding significant differences in beetle numbers in 2003, the other cucumber results were very impressive. When the trap crop was sprayed it dramatically reduced defoliation on cucumber seedlings in the center and completely eliminated plant death due to direct feeding damage. Nine percent of the plants were lost directly to beetle feeding in the center of control plots. The sprayed trap crop barrier also dramatically reduced losses from bacterial wilt compared with the control plots. Total plant death (directly from defoliation and from bacterial wilt) dropped from 30% in the center of control plots to 14% for the cucumbers in the sprayed trap crop plots by final harvest. The sprayed PTC treatment increased yields by 33% or 148 boxes per acre (increase of $1,480/acre gross revenue).

In 2005, cucumber plants from PTC plots again had significantly lower levels of damaged leaves and total defoliation than plants in control plots. Early season plant mortality from direct beetle feeding and bacterial wilt in control plots again resulted in an increase in yield for cucumber plants in PTC plots. Sprayed plots had the lowest damage/defoliation and the highest yields.

Field trials on commercial farms

Six CT growers using the PTC technique on their summer squash and cucumbers, compared the trap crop system to their former conventional management system, that relied on multiple full-field sprays to control cucumber beetles, and were quite impressed. In every case, the PTC system provided superior pest control compared to multiple full-field sprays and reduced insecticide use substantially. Growers estimated they saved almost 20% of their summer squash crop and a third of their cucumber crop by switching to PTC.

On most farms, insecticide sprays for cucumber beetles were limited to applications on the 'Blue Hubbard' trap crop in the perimeter of the fields only. One of the growers stated on a post-season survey that "*it blew my mind to see the beetles flock to the perimeter rows*!"

On one farm with extreme cucumber beetle populations, the grower applied an average of 1.5 perimeter sprays prior to bloom and 1.5 full-field sprays during harvest to his cucumber fields to regain control of this pest. The sprays at harvest were necessary to prevent cosmetic damage, where the beetles feed on the fruit rind and render the crop unmarketable. In past years, he normally applied 4 full-field sprays per field and still failed to harvest or market any cucumbers. He harvested and marketed a great crop of cucumbers in 2003 using PTC. This same grower was asked to plant a control field (without a trap crop) as part of the study. He made 4 full-field insecticide applications in the first 3 weeks and 60% of the plants showed signs of bacterial wilt before the plants even started to run. The entire control field was lost. When asked in a post-program survey to comment about the PTC system, this grower stated that *"I can not even get a crop of cucumbers on my farm without PTC*!"

All but one grower said that they also saved time and money using PTC and found the new system simpler to use than multiple full-field sprays. All the program participants gave the PTC system high marks for reducing pesticide use, spray time/expense, possible chemical residues at harvest, possible secondary pest outbreaks, risk of crop damage, and impacts on environment/land/water. They also gave the system high marks for improving farm profitability, for easier/faster pest detection (improved monitoring) and for easier picking/harvesting schedules (reduced REI/dh restrictions).

Massachusetts and Connecticut growers, under the direction of my co-PI Ruth Hazzard, experienced similar results on butternut squash fields. The trap crop in winter squash fields were treated with 1-3 applications of Sevin or a single application of Admire.

OK I get it, so how do I do it?

Growers wishing to try PTC should remember a few simple rules: 1) **Plant the trap crop on good ground**, so that it remains healthy and completely encircles the main crop, without large gaps in the perimeter. 2) Multiple rows (1-3) of trap crop **may** be needed if extreme pest pressure is expected, or along tree lines where the heaviest pressure usually occurs as beetles colonize the field from overwintering sites. 3) **Spray the perimeter as soon as the beetles appear and begin to feed on the trap crop**. Don't wait for beetles to colonize the main crop or for a threshold level to be exceeded on the trap crop. 4) **Monitor the field continuously until bloom or harvest** and be prepared to make 1-2 additional perimeter sprays or, if necessary, full-field applications. Repeat perimeter applications are necessary if rain washes the insecticide from the plants prematurely or if more live beetles are found on the trap crop prior to bloom. Full-field sprays should be applied when pest pressure is excessive on a particular farm, causing a breach in the perimeter and substantial main crop infestation (>2 beetles/plant for summer squash and >½ beetle/plant for cucumbers).   5) **If the trap crop planting is incomplete** or has large gaps in it, for any reason, **treat the field as if it were a conventional planting** (i.e. spray the whole field as often as needed). You do not have an effective perimeter if you fail to plant along one side or wet conditions prevent emergence of most trap crop plants.

That's it! Its cheap, its easy and almost anyone can do it! Go forth and conquer. May the PTC force be with you!

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Controlling Cucumber Beetles with Precision Banding Using Admire

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Introduction
There are over 14,500 acres of cucurbits produced in Ohio according to the USDA NASS Quick Stats in 2005. Pumpkins alone account for over 7,500 acres and are a significant source of fall income for some growers. As with most markets, growers are interested in ways to save money through reduced inputs if the practice won't put their crop at additional risk.

In 2004, a group of researchers at Ohio State University designed a precision bander to deliver insecticide (Admire) in-furrow at the time of planting. The bander functions by applying a burst of insecticide in a well defined zone around the seed as it enters the furrow. In 2005, the bander controller user interface was modified so that the volume to band length ratio could be adjusted independently.

Description of how the Precision Bander Operates
As the seed leaves the metering box on the planter it falls through a standard seed delivery tube. This tube is identical to any seed tube found on a conventional corn planter. Inside the seed tube is an optical sensor that detects the seed falling towards the soil surface. In a conventional planting system, this sensor would send a signal to the planter monitor to indicate that another seed has been planted. In this research application, the sensor signal is directed to the injector controller, which initiates the insecticide application process. The injector begins delivering material (insecticide and water solution) as a stream directed at the bottom of the seed furrow before the seed actually reaches the soil surface. This is intentional so that the seed falls within the middle of the insecticide band.

Research during 2005 allowed a much wider range of insecticide rate testing. The Precision Bander was updated with a new control technology which allowed not only the volume of the injector band, but also the length of the injector band to be controlled from a cab mounted operator panel. This enhanced researchers' abilities to carry out highly diverse testing of insecticide rates and their effect on insect control.

In order to control the band length, the on time of the injector solenoid valve needs to be controlled. A touch panel operator display was developed to allow the user to quickly change the desired band length and through a calibration equation the solenoid on time was calculated. Controlling the volume of injection material and thus the total active ingredient per seed was completed in a similar manner. The operator could select a desired milliliter of injection material per seed from the display panel.

After the band length and injection volume were set by the operator, these two variables were transmitted electronically to the planter row unit via a Controller Area Network. The row controller read these two parameters and used them to set the on time of the solenoid and the injector volume. In order to control the injector volume, the row controller implemented a Pulse Width Modulation routine which controlled the solenoid valve very much like a dimmer switch controls a light bulb in a household environment.

This improvement allowed researchers to separate insecticide response effect based on concentration and band length. In 2004 these two variables were directly tied together and it was impossible to determine which variable had the strongest influence on the effectiveness of this system.

Verifying Precision Bander Accuracy

Pumpkin, zucchini, and cucumber seeds were tested in the precision bander accuracy trials. Because these seeds vary considerably in size and weight, each type was synchronized and evaluated at planting speeds of 2.0, 3.0, and 4.0 mile per hour. There were four replications of each treatment and each plot was 150 feet long. All seeds regardless of type were dropped at a spacing of 12-14 inches.

To determine the accuracy between the injected bands with the seed, each variety was "planted " and "banded" on the soil surface. The "band" was actually a single stream of water directed at the bottom of the seed furrow. To plant on the soil surface, the planter's press wheels were removed and the planter depth adjusted to drop seeds in a 0.25 inch shallow furrow. The tractor speed was set at the beginning and maintained throughout each plot.

There were 100 seed / band events recorded per plot. Only singulated seeds were counted, any double seed drops were excluded from the data. If a seed was planted, i.e., dropped, within the water band it was considered "in the band". If a seed was planted, i.e., dropped, within 2 inches of the band (front or back) it was considered a bounce, meaning the seed initially landed in the band, then bounced out. If a seed landed farther than 2 inches from the water band it was considered a miss.

The first three trials were conducted at 3 ml injections per 5" band (Table 1). There was an additional pumpkin seed accuracy trial in which the band length and volume were doubled to 10" long and 6 mls per injection. This adjustment resulted in the highest band accuracy of all the trials in 2005, averaging 96.3% for seeds landing "in-band" and 97.9% for seeds in the "band + bounce" zone.

Table 1. Percent accuracy of precision bander at three different speeds with three seed types.

Seed Type	**Cucumber**		**Zucchini**		**Pumpkin**		**Pumpkin***		**All Cucurbits**	
Planting speed	**Band**	**Band + Bounce**	**Band**	**Band + Bounce**	**Band**	**Band + Bounce**	**Band**	**Band + Bounce**	**Band**	**Band + Bounce**
2.0 mph	97.3	99.6	96.0	98.0	95.0	96.3	96.5	99.0	96.2	98.2
3.0 mph	94.0	98.0	97.5	98.8	93.8	93.8	97.0	98.3	95.6	97.2
4.0 mph	90.0	96.0	95.0	97.3	92.5	95.0	95.3	96.6	93.2	96.2
Average	93.8	97.9	96.2	98.0	93.8	95.0	96.3	97.9	95.0	97.2

* applied at 6mls in a 10 inch band.

Verifying Bioassay Results

Bioassays were conducted on pumpkin at the cotyledon, 1st leaf, 2nd leaf, and 3rd leaf stage; bioassays for zucchini and cucumber were taken at the cotyledon, 1st leaf, 2nd leaf, 3rd leaf, and 4th leaf stage. The current development stage was determined when 50% or more of the seedlings were in that stage. As seedlings grew from stage to stage, the current developmental stage was clipped from the seedling and placed in a clear 8 ounce plastic container with a live striped cucumber beetle. Beetles fed on leaf tissue and mortality was recorded at 24, 48, and 72 hours after the bioassay began. After 72 hours, each bioassay experiment was terminated.

Seeds treated in-furrow with an imidacloprid solution were expected to uptake the nearby systemic insecticide via the roots, increasing striped cucumber beetles mortality compared to seeds treated with water only. Tukey's HSD was used to separate treatments based on the percent moribund plus dead beetles after the 72 hour bioassay reading (Table 2). Treatments followed by the same letter are not significantly different. Due to space limitations, only the pumpkin data is shown, but the trends are similar for both cucumber and zucchini.

Table 2. Bioassay mortality of striped cucumber beetles after 72 hours exposure to imidacloprid treated pumpkin seedling leaf stages.

Seedling Stage	Treatment Rate / row spacing	% Parasitism	% Moribund	% Dead	%Moribund + Dead				p-value
Cotyledon	Check	0.0	0	5.0	5.0	A			<0.0001
	PB 16oz @ 5'	0.0	2.5	92.5	95.0		B		
	CF 24oz @ 15'	0.0	2.5	94.9	97.4		B		
	PB 24oz @ 15'	2.5	0	97.5	97.5		B		
	CF 16oz @ 5'	0.0	7.5	92.5	100.0		B		
1st leaf	Check	12.5	0	5.7	5.7	A			<0.0001
	PB 16oz @ 5'	10.0	22.5	53.8	76.3		B		
	CF 16oz @ 5'	5.0	17.5	63.1	80.6		B		
	PB 24oz @ 15'	2.5	22.5	66.4	88.9		B		
	CF 24oz @ 15'	10.0	15	77.3	92.3		B		
2nd leaf	Check	2.5	0	0.0	0.0	A			0.001
	PB 16oz @ 5'	12.5	10	13.1	23.1	A	B		
	CF 16oz @ 5'	2.5	12.5	13.2	25.7	A	B		
	PB 24oz @ 15'	12.5	15	28.6	43.6		B	C	
	CF 24oz @ 15'	2.5	25	29.3	54.3			C	
3rd leaf	Check	2.5	0	0.0	0.0	A			0.005
	CF 16oz @ 5'	2.5	0	0.0	0.0	A			
	PB 16oz @ 5'	2.5	2.5	5.2	7.7	A			
	PB 24oz @ 15'	2.5	20	10.0	30.0		B		
	CF 24oz @ 15'	0.0	17.5	13.3	30.8		B		

CF-Continuous flow application, PB – Precision banded application

In table 3, a comparison is made between the fruit type, row spacing, % reduction of product, and the total cost of the program per acre using either the precision bander or conventional application.

Yield Data

Yield data was taken from the pumpkin, zucchini, and cucumber trials. Only the cucumber trial showed significant differences with the high rate of Admire at the 6ft spacing having the greatest yield.

Table 3. Comparing precision banded with continuous flow application using Admire 2F. Admire costs $4.30 / oz. Precision injection is a 5" band containing 3 milliliters of insecticide solution.

Treatment Rate / row spacing	Fruit	Rate / 1000' (oz)	Band Width (in)	Seed Spacing (ft)	Admire / A (mls)	% Reduction	PPM Soln	Cost / A
CF 16oz @ 5'	Pumpkin	1.84	5	2.5	473.2	0	1,786	$ 68.80
PB 16oz @ 5'	Pumpkin	1.84	5	2.5	78.9	83.3	1,788	$ 11.47
CF 24oz @ 15'	Pumpkin	8.26	5	2.5	709.8	0	7,816	$ 103.20
PB 24oz @ 15'	Pumpkin	8.26	5	2.5	118.3	83.3	7,816	$ 17.20
CF 16oz @ 4'	Zucchini	1.47	5	1.5	473.2	0	1,433	$ 68.80
PB 16oz @ 4'	Zucchini	1.47	5	1.5	131.4	72.2	1,433	$ 19.11
CF 24oz @ 6'	Zucchini	3.31	5	1.5	709.8	0	3,197	$ 103.20
PB 24oz @ 6'	Zucchini	3.31	5	1.5	197.2	72.2	3,197	$ 28.67
CF 16oz @ 3'	Cucumber	1.10	5	1	473.2	0	1,076	$ 68.80
PB 16oz @ 3'	Cucumber	1.10	5	1	197.2	58.3	1,076	$ 28.67
CF 24oz @ 6'	Cucumber	3.31	5	1	709.8	0	3,197	$ 103.20
PB 24oz @ 6'	Cucumber	3.31	5	1	295.7	58.3	3,197	$ 43.00

CF-Continuous flow application, PB – Precision banded application

Conclusions

After working on this project from 2004-2005, we have made considerable progress toward our end goal of designing a precision insecticide bander for direct seeded vegetable crops, in particular pumpkin, cucumber, and zucchini. The accuracy of the bander averages from 93.8 – 96.2% depending on which cucurbit seed we planted. In general, larger seeds and slower planting speeds lead to higher bander accuracy. Using the precision bander, we have managed to substantially mitigate environmental impact by reducing the amount of insecticide compared to a conventional application by up to 84% per acre. This pesticide reduction translates into a maximum savings of $86.10 per acre, based on initial rate per acre. Both of these reductions have been accomplished without sacrificing early season striped cucumber beetle control. In 2004 and 2005, 95.2% of the trials (20/21) showed no significant difference in beetle mortality between precision banded and continuously applied in-furrow insecticides.

The rate chosen for our initial precision banded project was derived from previous research with imidacloprid performed at 16.6 gallons per acre. Looking this rate from a per seed perspective, we arrived at 3 mls of solution for each 5" band. The majority of work in 2004 and 2005 was based on the assumption this was an adequate rate to separate treatment differences and significantly reduce insecticide use, while maximizing striped cucumber beetle control.

In 2005, we examined the possibility that maximizing insecticide reduction and therefore maximizing per acre savings, may not be the only way to use the precision bander. For example, seeds planted on a 30" spacing treated with a 5" band of insecticide at 3 mls per injection will reduce pesticide usage by 83.3% on a per acre basis. By reallocating 15" worth of in-furrow insecticide, along with its corresponding 9 mls of carrier to a 10" band using all 9 mls of insecticide solution, we concentrate the insecticidal solution in an area that is physically more available to the seedling for uptake. In the process, we still manage to save 50 % of the insecticide! We also increase the accuracy of hitting the seed and increase the percent control of early season pests like the striped cucumber beetle. By reallocating insecticide in the band and adjusting the volume per injection, we have managed to boost our percent mortality at equivalent stages in the bioassays 10-60%. The precision bander presents us with the flexibility to manage the crop to maximize pesticide savings or early season pest control.

We have great confidence that the precision bander can have a positive pest management effect and immediate financial return to growers willing to adopt this technology. Although we were unable to secure patent rights for this technology, we are pursuing commercialization of this technology with the current patent holder at the University of Tennessee. It is our intent to bring this technology to the marketplace within 12 months with the cooperation of the UT researchers, pending positive review by the University of Tennessee Foundation and identification of an interested commercial partner.

As a side note, seed and chemical companies have begun working with insecticide seed treatments for vegetables, including cucurbits. Although the precision bander may be a temporary solution for some growers, a long-term possibly simpler solution for most growers may be seed treatment, which should be available in the next few years.

No commercial seed treatments are currently available for cucurbits. Research is underway at many Universities, including Ohio State University, to complete their registration. Once tregistered, all that remains is to evaluate their efficacy and economics against standard in-furrow materials. Preliminary results from 2005 trials suggest seed treatment does an adequate job of reducing plant feeding from early season pests such as striped cucumber beetles.

For a complete copy of this report, please contact Jim Jasinski or visit http://champaign.osu.edu/precisionbander.html.

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Using In-Row Pollenizers for Seedless Watermelon Production

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Over the last decade the popularity of seedless watermelon has increased. During peak watermelon production in the U.S. market in 2005 and 2006, seeded watermelons only comprised 22% of the market and averaged four to five cents less per pound. When growers transfer acreage to seedless watermelon production, they must take into account that seedless watermelon plants do not produce enough viable pollen to pollinate themselves. Another source of pollen must be available to achieve acceptable levels of fruit set in the seedless crop. To achieve optimal yields, 25% to 33% of the plants in the field should be seeded. This is generally accomplished by inter-planting a seeded variety of watermelon in the same field to serve as a pollenizer, traditionally this has been done by using dedicated pollenizer rows. Every third or fourth row was planted with a seeded variety. Generally the seeded and seedless watermelons were harvested separately unless rind patterns of the two were easily distinguishable. It has now become difficult to market seeded watermelons and there are fewer growers that want to have a high percentage of their acreage in seeded watermelons. There are now multiple pollenizer varieties that are designed to be planted in-row (commonly called special pollenizers) with seedless plants. Commercially available pollenizers, their characteristics and sources are listed below. The primary role of these varieties is pollen production and most are not designed to produce marketable fruit, however ‘Jenny’, ‘Mickylee’, ‘Minipol’, and ‘Pinnacle’ may be harvested.

At planting time holes are punched and the field is planted solid with seedless. Then, another crew goes through the field and plants a pollenizer between every second and third or third and fourth plant. Most pollenizer varieties are recommended to be planted at a 1:3 pollenizer to seedless ratio. This being the case, a pollenizer would be planted between every third and fourth plant within the row. By eliminating dedicated row space in the field for pollenizers, the number of seedless plants and seedless watermelons harvested per acre increases. If a grower previously planted every third row with a pollenizer and then started using in-row pollenizers, their seedless plant population per acre would increase by 33%. This fact must be taken into account when calculating input costs as seedless seed costs about three times more than standard seed.

Research at the University of Florida and Clemson University has been conducted comparing the effectiveness of seven in-row pollenizer varieties. The following varieties performed similarly and could all be expected to produce optimal seedless watermelon yields: ‘Jenny’, ‘Mickylee’, ‘Patron’, ‘Pinnacle’, ‘Sidekick’, ‘SP-1’. ‘Minipol’ was not tested but its growth habit is similar to ‘Mickylee’ and would be expected to perform comparably.

There are substantial differences in prices of pollenizers so this must also be considered when choosing a variety. Of he cultivars recommended most can be easily distinguished from standard seedless watermelons (15-20 lbs) by their size as most pollenizer fruit is small. However, if a grower is producing mini or palm sized seedless watermelons, a pollenizer with a distinctly different rind pattern must be chosen to avoid confusion during harvest. Most companies that produce seedless watermelon seed now have pollenizers also. If the pollenizers have been tested and found to perform well, it may be preferable for a grower to have a pollenizer and a seedless variety from the same company. Even though these pollenizers are effective, if a grower still has a strong market for seeded watermelons there may be no reason to adopt in-row pollenizers.

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Commercially Available Pollenizer Varieties

Variety	Source	Vine Type	Fruit Type
‘Jenny’	Nunhems	Reduced vines, increased branching, thinner foliage	Round jubilee type stripe
‘Mickylee’	Various – Abbott & Cobb, Willhite, etc.	Standard	Round gray
‘Minipol’	Hazera	Slightly reduced standard type vines	Round gray
‘Patron’	Zeraim Gedera	Reduced vines, increased branching, thinner foliage	Gray with thin green striping
‘Pinnacle’	Southwestern Seed	Reduced vines, increased branching, thinner foliage	Jubilee type stripe
‘Sidekick’	Harris Moran	Reduced vines, increased branching, thinner foliage	Crimson sweet with dark background, very small size
‘SP-1’	Syngenta	Highly branched, thin vines with reduced leaves	Round, light green with thin green striping

Rye Cover Crops for Pumpkin Production

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Situation

Cereal rye (*Secale cereale* L.) is commonly grown as a cover crop in Michigan. Since 2004 the cover crop program at MSUE/KBS has been developing a no-till farming system where rye is rolled and crimped and its mat used for weed control for soybeans. In 2005 the roller/crimper technology was used to study no-till pumpkins in Capac, Mich.

The roller/crimper is a tool that is pulled behind a tractor (Picture 2). Our goal is to improve season-long surface residue through new killing technology (roller/crimper) which will result in cleaner pumpkins at harvest.

Picture 1. The roller/crimper knocks down cereal rye zone where burned down earlier to plant pumpkins.

Research methods

Cereal rye was seeded as a cover crop in the fall of 2005 at 2 bu/a. The farmer used a glyphosate burndown in the spring of 2006 to create about 24-inch zones to plant the pumpkin into (see Picture 1). Four treatments were evaluated for this trial: 1) glyphosate full rate, May 23, 2005; 2) glyphosate full rate, May 30, 2006; 3) half-rate glyphosate, May 30, 2006; and 4) no glyphosate. The full rate of glyphosate equaled 1 lb./a plus ammonium sulfate plus non-ionic surfactant at recommended rates. Rye was sprayed May 23, 2006, when approximately 68-inches tall and on May 30, 2006, at 72-inches tall. All treatments were rolled and crimped on June 1, 2006. Pumpkins were planted on June 2, 2006. A pre-emergence herbicide plus glyphosate burndown was applied too all of the treatments after planting.

Picture 2. Marketable pumpkins were separated and weighed.

Picture 3. Pumpkin lying on the rye residue.

Pumpkins were harvested on Sept. 14, 2006. Pumpkins were collected from two rows by 50 ft. (approximately 500 ft.^{2}) for each plot totaling eight rows for each treatment. Pumpkins were separated for marketable (at least 80 percent orange) and unmarketable (Picture 2). Pumpkins were counted and weighed. All pumpkins were rated for the amount of soil on the pumpkins. These ratings were scaled clean (no soil sticking), medium (some soil sticking), and dirty (a lot of soil sticking).

Marketable pumpkin yields, pounds/acre and pumpkins/acre are presented in Table 1 and Table 2, respectively. The highest pumpkin yields were observed when we used a full rate of burndown herbicide or when we only used the roller/crimper without burndown for both pounds and pumpkins per acre. Tables 3 and 4 show the ratio between marketable versus unmarketable pumpkins and pounds per acre. The highest yields were found where either a burndown herbicide was used on May 30 at full rate or no herbicide roller/crimper on May 30. Unmarketable pumpkins were relatively the same for all treatments.

Marketable pumpkins were evaluated for the amount of soil on them (Table 5). The rating is in percent clean, medium or dirty. All pumpkin treatments resulted in greater than 60 percent clean or medium for soil on the pumpkins.

Conclusions

These data indicate that the roller/crimper could eliminate one burn down glyphosate application without reducing marketable pumpkins. Cereal rye residues remained present throughout the season providing a mat for the pumpkins. The farmer and researchers believe a thicker planting of rye would have resulted in cleaner pumpkins and a thicker mat.

This fall the pumpkin farmer planted rye at twice the rate as 2005. The roller/crimper technology worked as expected in 2006. However, several years of research under variable weather conditions are needed to assure that this is a viable and predictable system for pumpkin farmers.

Table 1

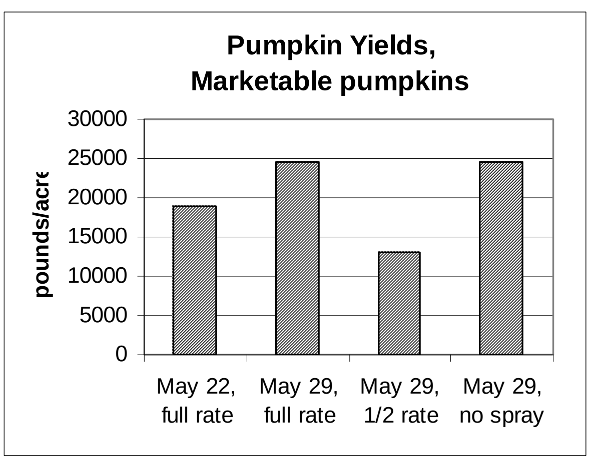


Table 2

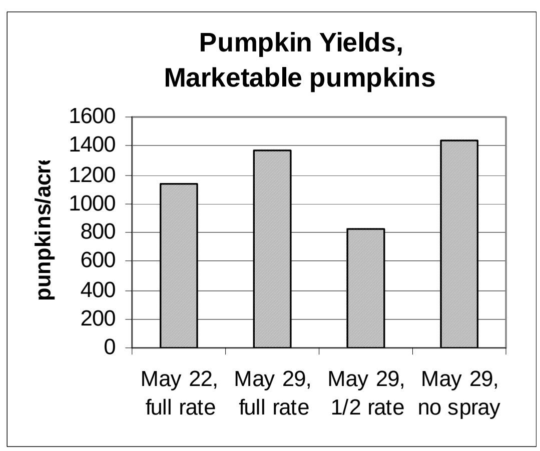


Table 3

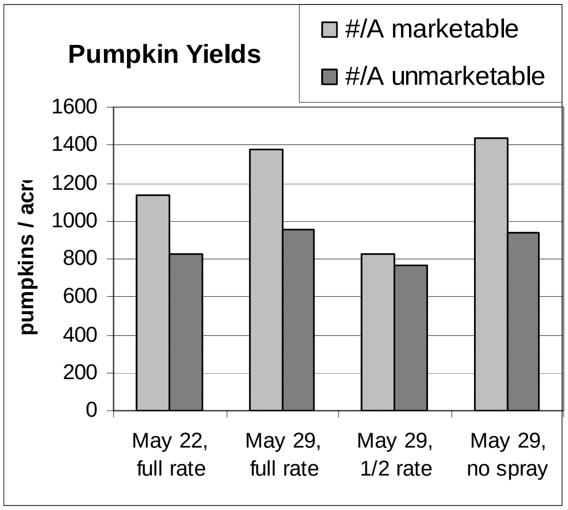


Table 4

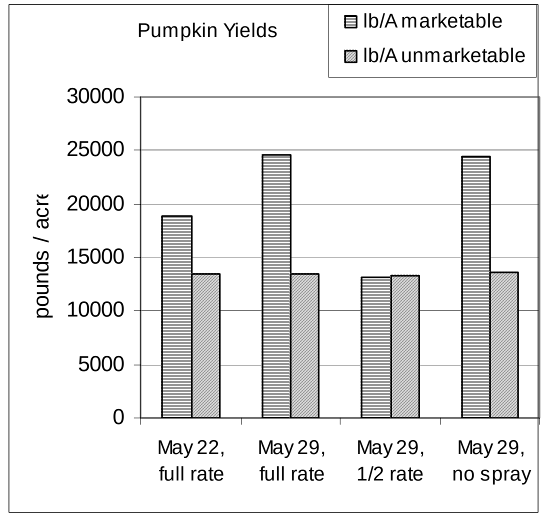
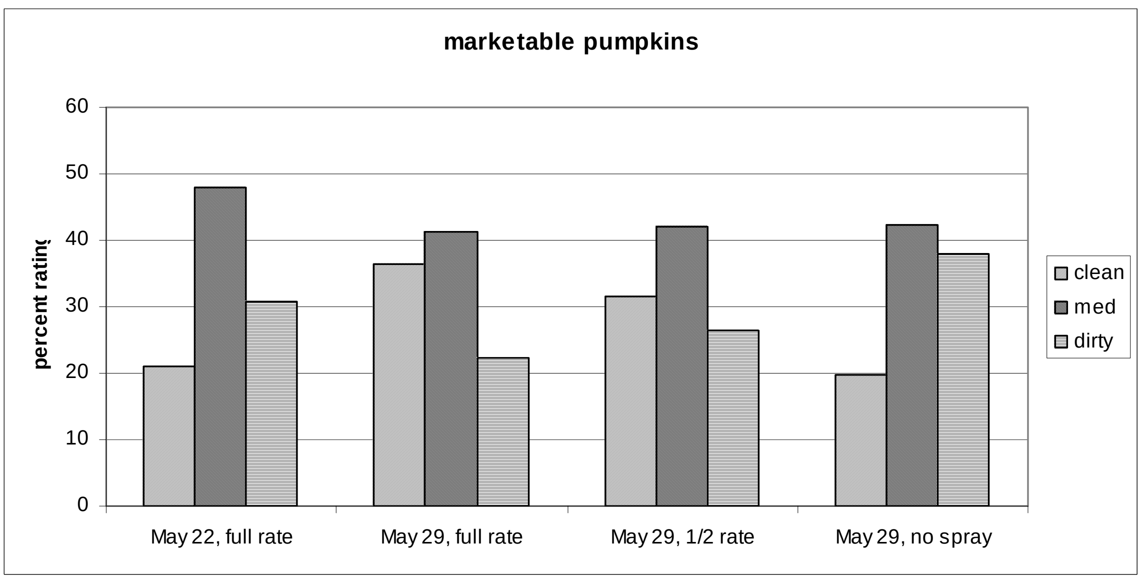


Table 5



Downy mildew and Phytophthora in Vine Crops

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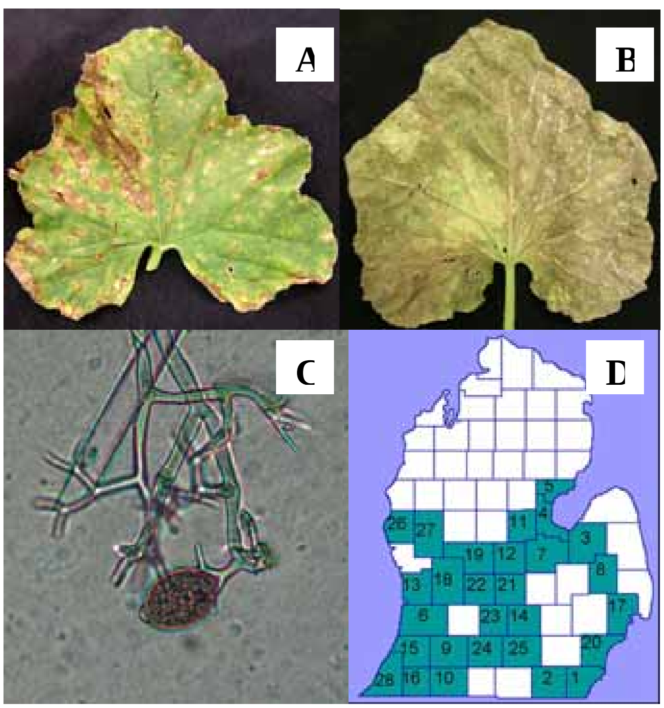
Downy mildew on vine crops

Downy mildew causes symptoms on the leaves of vine crops (such as cucumber, squash, and melon) similar to a mosaic or angular leaf spot (Fig. 1A). The tell-tale symptom of downy mildew is the purplish/gray fuzz on the underside of the leaf that gives a somewhat "dirty" or "velvet" appearance (Fig. 1B). This fuzz is made up of thousands of spores (Fig. 1C) and may be most evident in the morning. Downy mildew is well-known for causing catastrophic losses in a brief period of time. When the conditions are favorable, unprotected foliage can become completely infected and appear to be frosted within 10 days of initial infection. Downy mildew is not known to produce over-wintering spores and will not persist in soil and field debris in Michigan from year to year. Downy mildew was first reported in Michigan in 2005 and appeared again in 2006 in early June. As of September 5, 2006, 28 Michigan counties had confirmed reports of downy mildew (Fig. 1D). In both 2005 and 2006, downy mildew primarily caused disease on cucumber, however, there were reports on summer squash in 2005 and winter squash and cantaloupe in 2006.



Currently, there are few cultivars with adequate resistance to downy mildew and chemical control is the most effective tool. Products should be used in alternation with each other and applied at short intervals. Results from our 2006 downy mildew research indicated that the most effective spray programs, when applied before disease, were: Gavel 75WG (2 lb), Previcur Flex 6SC (1.2 pt), Ranman 3.6 SC (0.18 pt), and Tanos 50 WG (0.5 lb), each tank mixed with either Dithane DF Rainshield (3 lb) or Bravo Weather Stik 6SC (1.5 pt). After disease is identified in the field, the most effective products were: Previcur Flex 6SC (1.2 pt), Ranman 3.6 SC (0.18 pt), and Tanos (50 WG (0.5 lb), each tank mixed with either Dithane DF Rainshield (3 lb) or Bravo Weather Stik 6SC (1.5 pt).

Figure 1 (left). A. Downy mildew symptoms on the surface of a cantaloupe leaf and B. the underside of a squash leaf. C. Downy mildew spore. D. Confirmed downy mildew reports in Michigan as of Sept. 5, 2006.

In addition to fungicides, it is recommended that any infected vines remaining after harvest be killed with a contact herbicide or plowed under immediately so that they do not serve as a source of downy mildew for nearby crops.

***Phytophthora capsici* on vine crops**

Michigan growers producing vine crops have reported significant losses due to Phytophthora blight in recent years. The pathogen responsible is *Phytophthora capsici*. Recognizing disease due to *P. capsici* is not always easy as the disease often occurs in the low areas of a field where water accumulates. Many growers assume that when plant stunting occurs in these sites, it is due to the 'water logging' of the roots, but infection by *P. capsici* may be to blame. Under conditions of standing water, *P. capsici* produces swimming spores (zoospores) (Fig. 2A) which can move about in water and cause infection of nearby plants. Squash and pumpkin plants often have obvious symptoms of plants wilting or collapsing prior to dying. Such plants often have brown to black discolored roots and crowns. The disease is easily seen on infected fruit (Fig. 2B-D), initially as dark, water-soaked lesions which then develop a distinctive white 'powdered sugar' layer of spores on the surface of the fruit. Fruit infection is especially troublesome because the infection may occur days before the symptoms become visible. As a result, healthy-appearing fruit may be harvested and then shipped. Fruit then break down during transit or on grocers' shelves resulting in disposal cost.

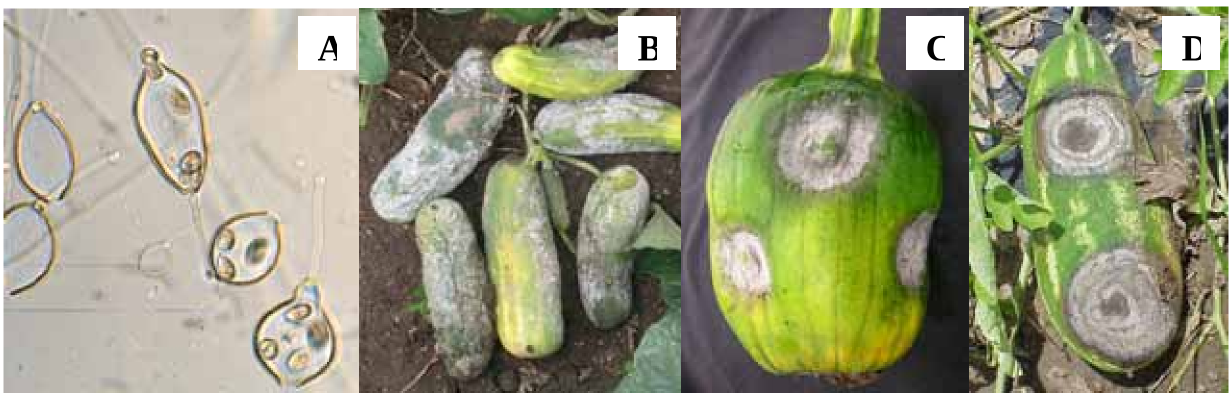


Figure 2. A. Swimming spores of *Phytophthora capsici* released under wet conditions. B-D. Fruit of pickling cucumber, pumpkin and watermelon infected with *Phytophthora capsici*

To control *P. capsici* several control measures need to be implemented. Good drainage is important in managing this disease. However, even plants growing on well-drained fields on raised beds may have severe disease if rainfall is heavy. Crop rotation may reduce the number of *P. capsici* spores remaining in a field. A minimum of 3 years crop rotation to hosts other than those listed in Table 1 is recommended to avoid build-up of *P. capsici*. Growers should avoid relying on a single fungicide for disease control in order to delay development of fungicide resistance with *P. capsici*. There are many fields in Michigan where the *P. capsici* has become resistant to the commonly used fungicide, Ridomil Gold (mefenoxam). Fungicide programs including the following may provide disease management: Acrobat 50 WP (6.4 oz), Gavel 75 DF 1.5-2.0 lb, Tanos 50 WG (8-10 oz). Fields heavily infested with *P. capsici* may require the use of pre-plant fumigation for disease control. Fumigants that are most effective include: Telone C35, Vapam HL, and Sectagon 42. Trial results from 2006 indicate that V-10161 (fluopicolide) and V-10162 appear promising and may complement a spray program that includes other oomycete fungicides.

Control of Phytophthora is complicated by its broad host range, long-term persistence in agricultural soils, presence in irrigation water sources, and ability to develop resistance to fungicides. Only an integrated production system combining optimized cultural methods and cultivars, effective fungicides and use of uncontaminated irrigation sources.

Table 1. Common vegetable hosts affected by *Phytophthora capsici*.

Cucumber	Bell Pepper	Pumpkin
Hot Pepper	Summer squash	Tomato
Winter squash	Gourds	Eggplant
Zucchini	Watermelon	Lima beans
Snap beans	Yellow wax beans	