

Title: Cucurbit IPM on Farm Demonstrations

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Cooperator(s): The three cooperating growers that participated in this project.

Abstract:

IPM practices in cucurbits were demonstrated at three different farms and on 13 fields (crops included pumpkins, zucchini, cantaloupe, squash, cucumbers, and watermelon). For each field/crop, data on pest levels, pesticide use, insect infestation and damage at harvest were collected. Each field was scouted weekly for striped cucumber beetle, squash bugs and aphids, traps were placed to monitor for squash vine borer, and samples were taken weekly of any possible diseases and brought to Dr. Frank Hay of the Plant Pathology and Plant-Microbe Biology Section for identification. Growers received weekly scouting reports and treatment recommendations. For all three farms the growers reported that having someone scout their cucurbits was extremely helpful and problems were identified much earlier than in previous years.

Background and justification:

New York farmers grow a variety of cucurbits. According to the 2012 New York Census of Agriculture, cucurbits including cantaloupes, cucumbers, pumpkins, summer and winter squash and melons, were grown on over 13,600 acres in New York. There are many insects and disease pests of cucurbits and with such a variety of crops the susceptibility to any insect or diseases can vary greatly. It is therefore important that growers identify pests early on through regular scouting of their fields. Through on farm demonstrations growers can learn pest identification and threshold levels for the various pests. Knowing when a pest has reached threshold can help time sprays better and hopefully reduce the overall numbers of sprays required to control a pest.

Objectives:

1. Work with CCE field staff to identify farmers to host cucurbit IPM demonstrations.
2. Interview growers to establish pre-season expectations
3. Use either split-field plots, with the farmer following IPM practices on one part of the field and his or her usual practices in the other; or IPM plots where IPM practices will be used in the whole field and results compared with typical practices and damage levels of the previous year.
4. Place squash vine borer pheromone traps at all demonstrations sites and begin weekly monitoring.
5. For split-field plots, flag the area in which IPM practices will be used
6. Begin weekly scouting in both areas of the field, for split-field sites or the entire field for IPM sites.
7. Provide growers with weekly scouting and trap catch reports along with pest management recommendations.

8. Conduct harvest evaluations at time of harvest for pumpkin fields (4) and for other crops as fruit ripens.

Procedures:

1. Three growers participated in the demonstrations, one in Steuben County, one in Oswego County, and one in Niagara County.
2. All growers were interviewed prior to the start of the demonstrations to determine their typical pest management practices and pest damage levels.
3. The Steuben County grower was an organic grower growing summer and winter squash, watermelon, cantaloupe, pumpkins, and cucumbers on plastic mulch. Seven of his fields were scouted weekly for insect and disease pests. The Oswego County grower was a conventional grower growing several varieties of pumpkins on plastic mulch on one 6-acre field. The Niagara grower was also a conventional grower growing pumpkins, gourds, cantaloupe, cucumbers, and summer and winter squash on open ground on 5 different fields
4. One squash vine borer pheromone trap was placed at each farm and checked weekly beginning the week of July 6th through week of August 24th.
5. No split-field plots were established this year so all results were compared to previous years.
6. Fields were scouted for insects and diseases at least weekly based on the 2000 - Cucurbit IPM Scouting Procedures (see [Zitter et al. 2000](#)) starting at time of transplant or emergence and continuing until harvest. Suspect disease samples were collected from the field and brought back for identification by Dr. Frank Hay of the Plant Pathology and Plant-Microbe Biology Section of Cornell's School of Integrative Plant Science.
7. After scouting fields, the scouting forms were given to the growers with recommendations on whether a spray application was necessary based on thresholds.
8. Harvest evaluations were conducted for each of the pumpkin fields by evaluating 10 fruit at each of 10 locations for insect and disease damage. For all other crops, fruit was evaluated throughout the season as it ripened.

Results and discussion:

Scouting and Harvest Evaluation

Steuben County

Scouting began as early as May 29th for some of the early planted crops (cucumber) and continued through September 15th for the later crops (pumpkins). The Steuben site was an organic site. Harvest evaluations could only be compared to the grower's overall impression of the previous seasons and no sprays were used for either season.

Seven different fields were scouted on a weekly basis shown in Table 1 below. There was very minor insect pressure and none of the seven fields ever scouted above threshold for striped cucumber beetle, squash bug, squash vine borer or aphids.

The primary diseases observed at this site were alternaria leaf blight (*Alternaria cucumerina*), downy mildew (*Pseudoperonospora cubensis*) and powdery mildew (*Podosphaera xanthii*). In addition there was also bacterial leaf spot (*Xanthomonas campestris* pv. *cucurbitae*) on pumpkins, *Ulocladium* leaf spot (*Ulocladium cucurbitae*) on cucumbers, and angular leaf spot

(*Pseudomonas syringae* pv. *lachrymans*) on watermelon, but all were very minor and did not affect harvest.

Table1. List of crops scouted at the Steuben County site.

Field	Crop
1	Squash
2	Watermelon
3	Pumpkin
4	Cantaloupe
5	Cucumbers
6	Zucchini
7	Sunburst Patty Pan

Alternaria leaf blight was detected as early as June 19th in the cantaloupe (Figure 1), but was also found in the watermelon, squash, cucumbers, and zucchini. Alternaria did not appear on any of the fruit at harvest but the severity on the cantaloupe leaves (nearly 100% at time of harvest) probably led to reduced fruit set and smaller fruit overall.

Downy mildew was observed in the cucumbers (Figure 2) beginning on July 28th. Since no sprays were made at this site Downy was able to spread rapidly leading to near 100% defoliation in the two varieties of cucumbers. Green Finger seemed to a bit more resistant than Marketmore but by the end of the season both varieties were completely defoliated. Very few fruit were unaffected most were deformed (curved) or shriveled at one end.

Powdery Mildew was present in most of the crops and was first observed on July 7th in the zucchini. Only some minor powdery mildew was found on the watermelon at harvest (1/35 with powdery on fruit) and on the handles of the pumpkins (77/100 with powdery mildew on handles, see Table 3). This farm sells primarily to CSA members and the powdery on the handles was not of great concern. The grower mentioned that powdery mildew was greater than previous years but was unable to quantify and therefore a comparison between years could not be made.

Though the grower did not spray for any of the diseases present he did find scouting helpful in identifying diseases early. He also indicated that he currently only has a 4-gallon sprayer and plans to upgrade to a larger sprayer for next season so that he can address problems as they reach threshold. In addition to acquiring a larger sprayer the grower will also research disease resistant varieties and use those when possible in the future. Since he plants more than he needs the loss due to diseases did not impact his ability to meet his CSA needs this year.

Oswego County

Scouting began on July 2nd and continued through to harvest on September 16th. This site consisted of one 6-acre field of pumpkins. Again insect pressure was very low and never went over threshold.

The primary diseases observed at this site were alternaria leaf blight (*Alternaria spp.*), which was thought to have come in with the transplants and did not progress much into the new leaves, powdery mildew (*Podosphaera xanthii*), angular leaf spot (*Pseudomonas syringae* pv. *lachrymans*) and bacterial leaf spot (*Xanthomonas campestris* pv. *cucurbitae*). The grower began spraying for powdery mildew 5 days after it was first detected over threshold (see Table 2).

Table 2. Date of first detection of pest over threshold at Oswego County pumpkin field and date pesticides were applied to control target pest.

Over threshold	Pest	Date of Spray	Product Applied	Target Pest
7/8/15	Alternaria			
7/15/15	Alternaria			
7/22/15	Powdery, Alternaria	7/27/15	quintec, dithane, bravo	powdery, alternaria
7/29/15	Powdery			
8/7/15	BLS, Powdery			
8/12/15	BLS, Powdery	8/17/15	nu-copHB, dithane, bravo	bacterial leaf spot, powdery, alternaria
8/19/15	BLS, Powdery	8/24/15	nu-copHB, dithane, bravo	bacterial leaf spot, powdery, alternaria
8/26/15	BLS, Powdery	9/1/15	nu-copHB, dithane, bravo	bacterial leaf spot, powdery, alternaria
9/2/15	BLS, Powdery			
9/9/15	BLS, Powdery			
9/16/15	Harvest			

BLS - Bacterial leaf spot

Bacterial leaf spot (Figure 3) was the biggest problem in this field and resulted in 10% of pumpkins with unmarketable lesions at harvest and an additional 16% with minor lesions (≤ 5 lesions) (Table 3). This field has been in pumpkins for 5 consecutive years. To manage this disease the grower will rotate away from the field for a minimum of 2 years to a new field that has no recent history of cucurbits.

The results from weekly scouting allowed the grower to pick up powdery mildew in his field several weeks earlier than in previous years. He did increase his sprays more this year, but the crop quality was much better and he had his “largest yield thus far”. The bacterial leaf spot that has probably been present in his field for several years was identified and he now knows to rotate away from this field to decrease the chance of this affecting his crop again next year.

Table 3. Pumpkin harvest evaluation for Steuben County, Oswego County and the two Niagara County sites.

Damage	Pumpkin Site			
	Steuben County	Oswego County	Niagara County 1	Niagara County 2
Bad Handle	2	0	2	0
SCB stem feeding	0	0	11	0
SCB fruit feeding	0	3	3	0
PM on stem	77	0	7	0
BLS ≤5 lesions	1	16	8	1
BLS >5 lesions	0	8	7	0
BLS soft fruit	0	2	0	0
Other (deer/rodent/scratches)	5	5	6	14

SCB - Striped cucumber beetle

PM - Powdery mildew

BLS - Bacterial leaf spot

Niagara County

Scouting began at the Niagara site on June 5th and continued through September 17th. Five different fields were scouted weekly. Scouting results for the five fields along with spray applications are given in Table 4. This site had very high striped cucumber beetle (SCB) pressure and scouted over threshold for four of the five fields. The pumpkin/gourd field was a later planting and located a considerable distance away and did not experience the same amount of SCB pressure. Squash bug, squash vine borer and aphids remained below threshold for all five fields scouted at this site.

The primary diseases observed at this site were powdery mildew (*Podosphaera xanthii*), septoria leaf spot (*Septoria cucurbitacearum*), downy mildew (*Pseudoperonospora cubensis*), alternaria leaf blight (*Alternaria cucumerina*), and bacterial leaf spot (*Xanthomonas campestris* pv. *cucurbitae*).

Powdery mildew was first observed on July 16th in zucchini but was eventually also seen in the pumpkins, gourds and squash. The only crop unaffected by powdery were the cucumbers and melons. Spray recommendations were made weekly to all fields affected beginning with the first sign of the disease, however only two sprays were made (Table 4). On July 16th Septoria leaf spot was also detected in the squash. It was localized within one area of the field but triggered weekly spray recommendations through to harvest.

Downy mildew was first observed in the cucumbers on July 30th. This is a disease that can spread very rapidly and by August 13th nearly 100% of leaves were either dead or infected. The cantaloupe located adjacent to the cucumbers began showing signs of downy on August 5th and alternaria was observed on August 13th. Bacterial leaf spot was not observed until late in the

Table 4. Date of first detection of pest over threshold at the five Niagara County fields and date pesticides were applied to control target pest.

	Pumpkins	Zucchini	Cucumbers/ Cantaloupe	Squash	Pumpkins/ Gourds	Date	Product Applied	Target Pest
Date	Over threshold	Over threshold	Over threshold	Over threshold	Over threshold			
6/10/15		SCB						
6/17/15	SCB	SCB	SCB					
6/24/15								
7/1/15				SCB				
7/9/15								
7/16/15		Powdery		Septoria				
7/23/15		Powdery		Septoria, Powdery		7/18/15	Inspire Super, Rally, Assana	powdery, SCB, Septoria
7/30/15		Powdery	Downy	Septoria, Powdery				
8/5/15	Powdery	Powdery	Downy	Septoria, Powdery	Powdery			
8/13/15	Powdery	Powdery	Downy, Alternaria	Septoria, Powdery	Powdery			
8/20/15	Powdery	Powdery	Downy, Alternaria	Septoria, Powdery	Powdery	8/15/15	Cueva, Inspire Super	Powdery, Bacterial Spot
8/27/15	Powdery	Powdery	Alternaria	Septoria, Powdery	Powdery			
9/3/15	Powdery, BLS	Powdery	Alternaria	Septoria, Powdery	Powdery			
9/10/15	Powdery, BLS	Powdery	Alternaria	Septoria, Powdery	Powdery, BLS			

SCB - Striped cucumber beetle

BLS - Bacterial leaf spot

season, September 3rd, on the pumpkins and probably did not affect the overall harvest (see Table 3).

The grower reports that this was a very poor season for them. The fields remained wet early in the season causing a delay in planting. Once the crop did get into the ground the cold weather slowed down germination. There was high weed pressure as well as competition from volunteer pumpkins in the main pumpkin field. Because the ground remained wet so long the grower was unable to cultivate. Downy mildew caused a loss of most of the cucumbers and the downy and alternaria caused a loss of most of the cantaloupes. The only crop that did well was the zucchini and summer squash.

The scouting procedures developed in 2000 ([Zitter et al. 2000](#)) worked well for all the sites. Diseases were identified early and spray recommendations were made to limit the spread. The overall results of the demonstrations however did not greatly improve the quality of the harvest. This was in large part due to no sprays (Steuben County) or limited sprays (Niagara County). All three growers did learn the importance of early detection. They also stated that using more resistant varieties in the future would be of great benefit to them.

One workshop with 14 attendees was held to educate growers on cucurbit pests and scouting procedures. They learned when and how to scout for the various pests and thresholds for each of the pests. They were also provided with factsheets for most of the common cucurbit pests to make identification in the field easier.

Project location(s): Niagara County, Oswego County and Steuben County, NY

Sample of Resources developed:



Figure 1. Alternaria leaf spot, *Alternaria alternate* f. sp. *cucurbitae*, on cantaloupe



Figure 2. Downy mildew, *Pseudoperonospora cubensis*, on cucumber



Figure 3. Bacterial leaf spot, *Xanthomonas campestris* pv. *cucurbitae*, on pumpkin



Figure 4. Striped cucumber beetle in young squash leaves



Figure 5. Pumpkin harvest