Title: **The Impact of Flooding on the Movement and Management of *Phytophthora capsici* on Vegetable Farms in Eastern New York**

Project Leader(s):
· Charles Bornt, Extension Associate, Capital District Vegetable and Small Fruit Program

Cooperator(s):
· Laura McDermott, Extension Associate, CDVSFP
· Crystal Stewart, Extension Associate, CDVSFP
· Dr. Chris Smart, Associate Professor, Plant Pathology Dept., NYSAES Cornell, Geneva

Abstract: Phytophthora blight (*Phytophthora capsici*) of cucurbit and solanaceous crops has been found on Eastern NY farms for many year but the number of farms infected with the disease seemed to remain the same. However, catastrophic flooding in 2011from Hurricane Irene and Tropical Storm Lee was directly responsible for spreading the disease to even more farms in 2012 that did not report Phytophthora blight prior to these flooding events. This was confirmed by field visits to flooded farms in 2012 and samples of disease fruit were sent to Dr. Chris Smart for confirmation.

Background and Justification: Phytophthora blight poses a serious threat to vegetable growers, especially those growing cucurbit and solanaceous crops. In eastern NY, these two crop groups make up a majority of vegetable acreage in this area, along with sweet corn. Cornell Cooperative Extension Capital District Vegetable and Small Fruit Program have provided growers with information on Phytophthora blight through newsletters, educational meetings, webinars and farm visits. We have stressed to growers how devastating and long lived this disease can be and that the greatest control measure is to avoid introducing it to your farm.

However, growers have no control over the weather and major flooding events like those experienced in 2011 from Hurricane Irene and Tropical Storm Lee. These events can move Phytophthora blight onto farms that had never previously reported the disease. In addition to being impossible to stop in flooding events, the pathogen has also exhibited high levels of tolerance or resistance to Ridomil (mefenoxam) fungicide, which was the main fungicide used for control. Lab work conducted by Dr. Chris Smart determined that many of the samples collected from eastern NY farms prior to 2011 were Ridomil resistant or tolerant.

Data gathered in this project may assist efforts to gain further funding for *P. capsici* research and development of future research and educational projects. Growers exposed to information about Phytophthora blight will gain an understanding of the disease and how management of *Phytophthora capsici* will positively affect the production of many economically important susceptible cucurbit and solanaceous crops grown on fresh market vegetable farms.

Objectives:
1. Document *Phytophthora capsici* presence on farms in the Capital District of NYS.

2. Survey those farmers with confirmed *P. capsici* as to the impact of 2011 flooding and perceived presence or absence of *P. capsici* prior to flooding event.
3. Evaluate the efficacy of the project in meeting the above objectives.

Procedures:

In order to determine the extent of flooding in the region and the potential for the spreading of *Phytophthora capsici*, 39 farms in the 11 county CCE CDVSFP were identified as having experienced flooding issues from Hurricane Irene and Lee. Each of these farms was contacted either by phone or in person to describe this proposed project and ask for their cooperation. They were all given a fact sheet on *P. capsici.* These growers were asked to contact one of the extension educators participating in this grant if during the growing season they suspected Phytophthora blight in their vine crops, peppers or tomatoes. During the course of the growing season these growers were visited or contacted at least once by the three educators to determine if they were experiencing any difficulties with those crops. If *P. capsici* was suspected, samples were collected and sent directly to Dr. Chris Smart's Lab in Geneva, NY. Here the disease was confirmed or not and if confirmed strain identification was determined and mefenoxam fungicide tolerance determined. At the end of the 2012 growing season these growers were asked to participate in a survey in order to determine if *P. capsici* was a problem prior to or post flooding, what crops seemed impacted and what were the flooding sources (rivers, creeks, etc.). See attached supporting file.

Results and Discussion:

Survey results:

- Of the 39 farms that had flooded in 2011 and participated in the survey, 32 indicated that they never had *P. capsici* confirmed on their farms.
- 3 of those 32 thought they might have had it prior to 2011 but never had it confirmed by a lab or other disease expert.
- Seven of the farms indicated they have had *P. capsici* confirmed at some point on their farm.
- The most common crops grown and infected with *P. capsici* were pumpkins, green and yellow squash followed by gourds and peppers.
- The approximate acreage of vegetables on these 39 farms that flooded was 1,200 acres of which only about 15 acres flood annually.
- The sources of flood water can be found in Table 1 and included major waterways such as the Hudson River to minor creeks like the Onesquethaw Creek.
- In 2012, all but 2 farms planted susceptible crops into fields that had flooded in 2011.
- At the end of 2012, we confirmed *P. capsici* on 20 of the 39 farms.
- Of the 20 farms confirmed with *P. capsici* in 2012, 13 had never reported the disease before the flooding of 2011.
- Of the seven farms that reported *P. capsici* prior to 2011, only 2 did not report it in 2012.
- Again the most commonly infected crops were pumpkins, green and yellow squash and peppers.
- 30 of the 39 growers surveyed had participated in a meeting or read an article in a newsletter in which *P. capsici* was discussed.

- 28 *P. capsici* samples were submitted to the lab and all of these samples were determined to be mefenoxam tolerant.

At the end of 2012 it was clear that flooding from Hurricane Irene and Tropical Storm Lee resulted in the spread of *P. capsici* to farms that had never had the disease before. For many of these farms their land is contiguous (border one another with no hedgerows etc.) so in 2011 nearly all of fields used for vegetable production flooded. And even though we found *P. capsici* on all 20 of these farms, the level of infection and crop loss varied from 5% to 100% in 2 cases. The two farms that had a reported history of the disease which did not report any in 2012 was a result of that farm producing all their vine crops on a separate farm which had never flooded. They were also aware of the potential of moving the disease on soil from infected fields and developed a protocol of washing equipment after working in fields that had *P. capsici* and moving to "clean" fields.

Also in 2012, one farm with nearly 100 acres of vine crops which had a history of *P. capsici* stopped using mefenoxam fungicides as a drench and foliar application on this acreage due to the fact that nearly 100% of the different *P. capsici* strains tested from that farm were resistant or highly tolerant. This resulted in nearly 37 gallons of mefenoxam that was not used and approximately $10,000 in fungicide savings for one farm as a result of this project. This also does not take into account the amount of time required for the grower to apply this product to his 100 acres. However, several growers with a history of *P. capsici* (including this grower) started to apply newer fungicides that were being recommended for disease control (Ranman, Presidio, Tannos, etc.) prior to rainfall events as a preventative management strategy. We did not calculate how much product that was or the costs involved.

Nearly all the farms that we worked with were aware of the impact of *P. capsici,* but many did not understand the rotational requirements needed in order to reduce the level of disease. Those that could rotate susceptible crops from fields with known infestations did. However, several growers that planted susceptible crops in flooded fields without a history of the pathogen did have sections of pumpkins that were positively identified with *P. capsici.* They followed recommended strategies to minimize the loss including disking under sections or in some cases whole fields, including a border area and applying recommended fungicides to the rest of the field.

Through this project we were able to identify farms with a high probability for *P. capsici* introduction and disease spread. We were able to help growers identify the disease and develop a management plan once the disease was identified on their farm and helped them minimize the spread and impact on that seasons crop and future crops. In one case that we know of, we prevented infected pumpkins from being sold from one grower to another, which could have potentially spread the disease to even more fields when the buyer dumped the rotten fruit in his fields. We also prevented some potentially infected fruit entering the wholesale market where the end users (in this case a supermarket chain) would not have been happy receiving bins of pumpkins that within a couple days melted down due to *P. capsici*. We were also able to sample and identify strains of the pathogens that were tolerant to one frequently used fungicide (mefenoxam).

Supporting materials:

Table 1: County and sources of flood water of the 39 farms flooded in 2011 and surveyed for *P. capsici* in 2012.

County	Flood source		County	Flood source
Albany	Onesquethaw Creek		Rensselear	Vlockie Kill
Columbia	In-Field flooding		Saratoga	Hoosic River
Columbia	Kinderhook Creek		Saratoga	Hudson and Mohawk Rivers, small creeks around property
Columbia	Roeliff Jansen Kill		Schenectady	Mohawk River
Columbia	Roeliff Jansen Kill		Schoharie	Schoharie and Fox Creek
Columbia	In-Field flooding		Schoharie	Schoharie Creek
Columbia	Claverack Creek		Schoharie	In-Field flooding
Columbia	Claverack Creek		Schoharie	Schoharie Creek
Columbia	Claverack Creek		Schoharie	Schoharie Creek
Greene	Catskill Creek		Schoharie	Schoharie Creek
Greene	Kaaterskill Creek		Schoharie	Schoharie Creek
Greene	Vloman Kill		Washington	In-Field flooding
Greene	Hudson		Washington	Hoosic River
Rensselaer	Tomhannok Creek		Washington	Batten Kill River
Rensselaer	In-Field flooding		Washington	In-Field flooding
Rensselaer	Postenkill Creek		Washington	Hoosic River
Rensselaer	Kinderhook Creek		Washington	Batten Kill River & Hudson River
Rensselaer	Hoosic River		Washington	In-Field flooding
Rensselaer	Hudson River		Washington	Batten Kill River
Rensselaer	In-Field flooding		Washinton	Hudson River

Phytophthora capsici Blight Survey

We appreciate your help with this survey. Your information will be kept confidential and used to improve the understanding of the diversity and distribution of this pathogen on vegetable farms in the Capital District.

1.) Have you ever had Phytophthora capsici identified on your farm prior to 2011? (Please circle one your answer) Yes No

2.) If you answered yes to question 1, which crops was it identified in?

(Circle those crops below. If the crop is not there, please add it)

Snap Beans Cucumbers Melons Green or Yellow Squash

Pumpkins Gourds Winter Squash Eggplant

Tomatoes Peppers

3.) Did any of the fields you either own or rent flood in 2011 due to rains from Hurricane Irene and Tropical Storm Lee? Yes No

4.) Approximately how many total acres of vegetables that you own or rent flooded during those storm events? _____acres

5.) Do these fields flood on an annual basis? Yes No

6.) What was the main source of flooding (river, creek, general in-field flooding)? If it was a creek or river, please give us the name (ie. Hudson River)

7.) Was Phytophthora capsici identified in your fields after the flooding in 2011? Yes No

8.) If so, which crops was it identified on?

Snap Beans Cucumbers Melons Green or Yellow Squash

Pumpkins Gourds Winter Squash Eggplant

Tomatoes Peppers

9.) Did you plant vegetables in 2012 into fields that were flooded in 2011?

Yes No

10.) If yes, what crops did you plant?

11) Did you see problems with this season's crops (2012) in fields that flooded during 2011?

12) If yes, please describe:

13) Have you attended any formal or informal educational sessions about Phytophthora capsici? Please circle any of the following that apply:

Farm visit by extension educator and/or faculty

Workshop on P cap

Read an article on P.cap

Attended a webinar on P. cap.

Other: (explain)

Field of pumpkins 5 days after Hudson River flooded from Hurricane Irene and Tropical Storm Lee in Rensselaer County.

Pumpkins washed from a field about a quarter mile upstream 3 days after Onesquethaw Creek flooded from Hurricane Irene and Tropical Storm Lee in Albany County. According to the grower, this was the first time this creek flooded since he has owed the farm (34 years).

Flood water level as seen on this greenhouse from the Schoharie Creek 2 weeks after flooding from Hurricane Irene and Tropical Storm Lee in Schoharie County.

Forty acre field of pumpkins about 5 weeks after Hoosic River flooded from Hurricane Irene and Tropical Storm Lee. This field never had a history of *Phytophthora capsici* until flooding occurred in 2011 and was a complete loss to the disease costing the grower nearly $100,000 in retail sales.

In-field flooding of tomatoes from 23 inches of rain from Hurricane Irene and Tropical Storm Lee in Columbia County. Note the water was over the top of these raised mulched beds for nearly 6 days post flooding.