Evaluation of Cultural Control Methods Against *Phytophthora capsici* in Winter Squash and Pumpkins

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Abstract
Phytophthora capsici is a fungus that attacks a wide variety of vegetables, fruit, grain, and floral crops. Once the disease is in the soil, it may remain viable for ten years or more. The disease can totally wipe out a crop in wet years attacking the roots, crown, or fruit. This project was to examine if certain cultural practices or using the new chemical controls might reduce the incidence of the disease. The intent was to try using straw mulch thickly laid between rows to keep squash fruit off the ground, use raised beds to keep the roots drier, use short vining varieties, reduce compaction, and to try several of the newer chemical sprays rather than the older types. Inclement weather and miscommunication with farmers and field hands caused us to lose results from three trials. Two fields in the fourth trial showed positive results with cultural practices and using a new chemical spray.

Background and Justification
Phytophthora capsici fungus is the scourge of a wide variety of crops. Soybeans, floral crops, tree fruit, and ornamentals are attacked by this disease. In vegetable crops, winter squash, pumpkins, zucchini, eggplant, peppers, and tomatoes are often infected. *Phytophthora* can cause total losses in the field. Once in the soil, the disease can remain viable for up to 10 years making for difficult vegetable production of susceptible varieties.

NY state vegetable production is worth more than $322 million with more than 6000 acres devoted to pumpkins worth more than $25 million (www.nass.usda.gov/ny/01jan/veg50131.htm). The return on investment for pumpkins and squash is low. Having to fight *Phytophthora* as it increases across the state will be an economic hardship most New York farmers can hardly afford.

Phytophthora is a soil borne fungus that can attack the roots, crown, and fruit of many crop varieties. The disease is more active in wet conditions and is spread by contamination of soil. The disease travels on soil, residue, or infected fruit coming from outside sources.

In 2002, an IPM grant was awarded and undertaken to look at cultural practices. Unfortunately, the season was dry and the disease was not seen. In 2004, which was a wet year, P*hytophthora* showed up in numerous squash and pumpkin fields (as well as peppers and tomatoes) in Niagara and Erie County. In 2005, the disease was reported in Niagara, Orleans, Monroe, and Wayne counties despite being mostly hot and dry. There were several rain events that provided enough moisture for the disease to infect plants. Prevention through sanitation is the ideal scenario but through more contacts among plants, products, and machinery, the spread of the disease will become wider. Long rotations of resistant crops between the plantings of susceptible crops can stem the impact of the disease on the farms; this would severely impact the profitability of farmers who depend on a diverse crop mix for the marketplace.

There are some chemical compounds available for fighting the disease. Chemicals are costly, especially for a low-return crop (unless there is large contiguous acreage planted). In Michigan, fungicide resistance is starting to be seen in *Phytophthora*. If the disease becomes more wide spread and more chemical applications are made, the chance for increased fungicide resistance is possible. Farmers need tools to deal with the disease once it is on the land.

Objectives:

1) Demonstrate cultural practices that have been cited in the literature that are supposed to prevent or reduce the spread of the disease once it is in the soil (in winter squash and pumpkin crops).
2) Lay out demonstration plots showcasing cultural practices: mulch covered soil, cover cropped soil, raised beds, ridge planting, and other ideas from the farmers. There will be several farm sites across the region that had experienced the disease last year therefore are more likely to have it in 2006.
3) Evaluate the effectiveness of these controls against plots that a) have no control methods b) use current chemical controls. The evaluation will use quantitative measures of percent infected plants, yields, and percent infected fruit.
4) Present results s at field sites for farmers to see trials for themselves and discuss what their experiences are and what they will do in the future. The results will also be published in the **PestMinder** and **VegEdge** newsletters that reaches vegetables farmers in NY. . The results will be presented at farmer meetings/conferences and will also be posted on the Cornell Vegetable Team website (http://cvp.cce.cornell.edu).

Note: These objectives failed to truly materialize due to problems with three sites and these plots were abandoned. The weather and other complications forced the project to quickly find a farming situation that could implement some type of cultural practice. We were fortunate (except for the loss the farmer had from getting the disease) to come across a situation that we could try something.

Procedures:

1) In fields where the disease was reported in the last two years, put in plots of winter squash and/or pumpkins with four 40ft rows per treatment with enough plants to provide at least 10 for inspection during the season. There will be at least three sites between Wayne and Niagara counties.

2) The treatments will be: mulch covered soil, cover cropped soil, raised beds, ridge planting, and compost-applicated soils, no control, and a chemical control that each farmer has used in the past.
3) The evaluation for the effectiveness of the treatments will be based on: Quantitative measures of percent infected plants, yields, and percent of infected fruit.
4) The farmers will be evaluated on their willingness to adopt cultural practices for disease control of *Phytophthora* depending on the results observed in this project. If the project is successful, a follow-up survey will be posted in our website and in our newsletters to see if other farmers who have seen the results of this project have attempted to use some of these proposed cultural practices in their fields.
5) ADJUSTMENTS – due to an excessively dry field plot, and excessively wet/ partially flooded fields, and miscommunications concerning treatments implemented, the original three trials were abandoned. A fourth farmer was found with crops already planted and with disease signs beginning. Treatments were adapted to fit these sets of circumstances. Compaction was holding water above ground causing it to spread across the field. Cultural practices were implemented to assist in drainage. In another planting, the new chemical, Ranman, was used per label instructions.

Results and discussion:

After the failure of crop stands in one field and the mistake of plowing under of the killed cover crop we were going to use as a reduced-till experiment in two fields, the project found a farmer growing winter squash and zucchini in two fields. Due to the wet weather and having Phytophthora on the farm from previous years, a new outbreak occurred. The spread of the disease started at the one of the edges of each field where equipment would drive into.

The lay of the land was slightly sloped. The soils are gravelly yet became quite compacted quickly. Rain water collected in ruts between the rows of squash. As the rain overflowed from one filled rut into the next, the disease started to take down plants. In the field of zucchini, we decided to try the cultural practice of sub-soil ripping (mount a long vertical shaft onto the back of the tractor that digs into the soil down about 18-24" and about 1 inch wide) to breakup the hardened compacted layers of soil. The hope was to facilitate drainage as quickly as possible before the disease could move across the field. It was also thought that with this type of soil disturbance, more air would dry out the soil somewhat limiting the disease.

The treatment appeared to have been successful. The disease could be seen (by observing the dying plants) initially moving in a fan-shaped pattern starting at the edge of the field with plants at the point of the fan-shape dying quickly. After sub-soiling the water quickly drained away and the spread of the disease ceased within several days. Plants outside of the fan-shaped areas grew large and some of the plants within the fan-shaped disease stricken area started to regrow.

The real test came when several more rain events occurred. The soils continued to drain off the water and the disease did not spread. A decent crop was harvested.

In the field where winter squash was grown sub-soiling was not used. A large section of the squash plants were wiped out. The new chemical, Ranman (cyazofamid) was sprayed

at a rate of 2.75oz/acre. This chemical is supposed to also be effective against downy mildew (which was also a huge problem this season and was a big problem early in the season for this farm on cucumbers).

Both diseases seemed to be reduced due to the treatment using Ranman. The farmer said he used less chemical applications because he could use this one treatment for both diseases. A crop was harvested from this field and the farmer believes he saved the crop from being a total loss. More might have been saved if sub-soiling had been used at the onset of the disease.

The real lesson of the cultural practice of sub-soiling here is that good soil health where drainage and aeration need to be a full season goal to work for. Letting soils become compacted just asks for trouble when dealing with *Phytophthora*. The farmer in this case was able to save one field because he could get into the field and sub-soil. However, he could not get into the second field fast enough. The vines were too extensive to allow for each row to be sub-soiled. Spraying with a long boom was the only option.

More research and implementation of cultural practices need to happen in the areas of soil health management. Reducing compaction, reducing water flow across fields, using cover crops, and strategically designing the lay-out of fields to allow for equipment to get in without further compacting soils or driving over vines are some topics that need further investigation.

The 2006 growing season will go down as one of the wettest on record in many areas. In the state of NY, there are over 280 farmers markets. There are hundreds more roadside stands. There are three fresh produce auctions. There are hundreds of farmers who sell larger scale to wholesale markets and processors. A large percentage of these growers all have some crops that are susceptible to *Phytophthora* disease. Reducing the devastation it causes will result in improved profitability. Yields will be markedly improved by first and foremost having a yield rather than being wiped out.

If part of the management for Phytophthora includes cultural practices, then the amount of pesticides will be reduced. Using pesticides that also fight other diseases will also reduce the total amount of chemicals needed to be sprayed. If soils can drain off better then less pesticide will be used and those that are used will less likely be washed off the field. This is a great benefit to the environment. Pesticides will continue to be used.

Conclusion

This project has just scraped the surface and due to the problems of getting it going, it just scraped by. More research needs to be done. Working out in the field with more on-farm research is essential. Getting more farmers to learn about using cultural practices to their advantage is essential. First there needs to be articles written for publications like our *Veg Edge* monthly newsletter. Secondly, there needs to be field day demonstrations showing how these practices can benefit and getting farmers to attend. Our project couldn't pull this off as initially planned. At educational meetings where I will be giving presentations, I will be including discussion of what was seen in the Erie Co. fields. It is unfortunate that the other sites couldn't be used but even so, we did see some interesting results.