2009 Pennsylvania Vegetable Marketing and Research Program
Pennsylvania Vegetable Growers Association Report
December 7, 2009

On-farm evaluation of cucurbit powdery mildew fungicide resistance using a cucurbit seedling bioassay and resistance variety trial evaluation.

Principle Investigator:

Beth K. Gugino, Dept. of Plant Pathology, The Pennsylvania State University, University Park, PA 16802; (814) 865-7328; bkgugino@psu.edu.

Collaborators:

Michele Mansfield, Dept. of Plant Pathology, The Pennsylvania State University, University Park, PA 16802; (814) 863-0565; man203@psu.edu.

Timothy E. Elkner, Penn State Cooperative Extension, Lancaster County, 1383 Arcadia Road, Room 140, Lancaster, PA 17601; 717-394-6851; tee2@psu.edu.

Margaret T. McGrath, Dept. of Plant Pathology, Cornell University, Long Island Horticultural Research and Extension Center (LIHREC), 3059 Sound Ave., Riverhead, NY 11901; 631-727-3595; mtm3@cornell.edu.

Thomas Butzler, Penn State Cooperative Extension, Clinton County, 47 Cooperation Lane, Mill Hall, PA 17751; 570-726-0022; tmb124@psu.edu.

Eric Oesterling, Penn State Cooperative Extension, Westmoreland County, 214 Donohoe Road, Suite E, Greensburg, PA 15601; 724-837-1402; reo1@psu.edu.

Introduction:

Resistance is a major issue annually confronting powdery mildew management in cucurbit crops especially since fungicides are heavily relied upon as a management tool even when coupled with planting resistant varieties. The mobile fungicides used to effectively control powdery mildew on the lower leaf surface are constantly at risk for losing efficacy due to their specific mode of action and the genetic ability of the pathogen to readily mutate. Past control failures resulting from the development of resistance have already been well documented for Benlate, and Bayleton and now more recently with the QoI fungicides (Amistar, Quadris, Cabrio, and Flint). Often, growers do not know they are using a fungicide affected by resistance because they are using it in a program with other fungicides. The tank-mixed protectants may be providing control on the upper leaf surface but unless the lower leaf surface is examined, a potential control failure might not be suspected. Applying a fungicide that is ineffective because of resistance is not only a waste of money; it puts the crop at risk for disease control failure and facilitates the development of resistance to the other fungicides being used. Tank-mixing with protectant fungicides as well as alternating between fungicides in different chemical classes are the primary practices for managing (e.g. delaying) resistance development.

Through a previous project lead by Dr. Meg McGrath (Cornell University), resistance to QoI fungicides and to Topsin M was found to be high in spring squash crops in July during initial disease development. Resistance to these fungicides is qualitative, thus they are completely ineffective against resistant pathogen strains and are not recommended where resistance is common. The bioassay also revealed that the pathogen in eastern PA exhibited reduced

sensitivity to Pristine and DMI fungicides, Nova (now Rally) and Procure, but was highly sensitive to Quintec. Pathogen sensitivity to fungicides, in particular to DMI fungicides and Pristine, on Long Island, NY, exhibited some differences compared to eastern PA, which led to the development of different fungicide recommendations and emphasized the need for local information on resistance.

Resistant varieties are another important tool for managing powdery mildew and are often the first line of defense against the disease. However, just as the pathogen has the ability to readily develop resistance to fungicides, it can also genetically mutate and overcome the resistance genes in the variety (s). This has already been demonstrated in melon and since resistance in pumpkin and squash are based off a single major gene, the likelihood of the pathogen resistance increases as more resistant pumpkin varieties are planted. Therefore, the continued evaluation of powdery mildew resistant pumpkin varieties is important in aiding the grower in the selection of varieties and the development of an integrated powdery mildew management program that is based on local information.

Here, we report our efforts during 2009 to address the following objectives.

Objectives:

The purpose of this project is to:

1. Determine the sensitivity of the powdery mildew pathogen in central and western PA to the active ingredients in fungicides currently recommended for control as well as Quintec, a relatively new fungicide registered for use on melons and hopefully soon expanded to other cucurbits.
2. Incorporate results into fungicide recommendations that can be used in 2009 on later season cucurbits.
3. Evaluate powdery mildew resistant varieties of squash and pumpkin.
4. Disseminate results and recommendations to growers via newsletters as well as summer and winter field meetings.

Methods and Results:

Objective 1-2:

A seedling fungicide sensitivity bioassay was conducted in six cucurbit fields in Central (Clinton Co.) and Western (Westmoreland Co.), PA in collaboration with Tom Butzler and Eric Oesterling on 12 Aug and 14 Aug, respectively. Due to the early and widespread outbreak of late blight which diverted resources, these bioassays were conducted later than desired. Greenhouse grown pumpkin seedlings cv. “Sorcerer” were treated with different fungicides at various doses based on the label rates (2 seedlings per treatment per location) and placed out in fields where symptoms of powdery mildew were observed for at least 4 hours to collect spores. The bioassay seedlings were re-collected and maintained in a greenhouse at the Plant Pathology farm at Rock Springs. After approximately ten to fourteen days, the seedlings were evaluated for symptom development and/or severity. The fungicides evaluated included Flint (QoI, FRAC code 11) at 50 ppm, Topsin M (MBC, code 1) at 50 ppm, Rally (DMI, code 3) at 20, 80 and 120 ppm, Procure (DMI, code 3) at 80 and 120 ppm, Endura (boscalid, code 7, an active ingredient in Pristine) at 50 and 175 ppm, and Quintec (quinoxfen, code 13) at 1 and 10 ppm. An additional set of

bioassay pumpkin plant cv “Howden” were set out in Tom Butzler’s late planted pumpkin powdery mildew cultivar evaluation trial at the Horticulture Farm at Rock Springs for 8 hours on 4 Oct. The amount of powdery mildew that developed on treated plants was compared to the untreated control. For two of the Clinton Co. fields, powdery mildew never developed on the controls and thus were excluded the data analysis.

Similar to bioassays conducted by Meg McGrath (Cornell) in previous years, resistance to Topsin M (FRAC code 1) was identified in 4 of the 5 fields evaluated. Although not frequently used, strains still resistant to FRAC code 1 fungicides are persisting in the environment. Resistance to these fungicides is qualitative, thus increasing the application rate will not improve control; the pathogen is either susceptible or resistant.

Resistance to the QoI fungicides (FRAC code 11) Flint and boscalid (Endura), the code 11 component of Pristine, was identified at all rates in PA. However, powdery mildew was less severe on the boscalid treated plants relative to the untreated controls and Flint treated plants. Resistance to stand-alone QoI fungicides is widespread and therefore not recommended for managing powdery mildew in PA. However, Prisitine, which contains both boscalid (FRAC 11) and pyraclostrobin (FRAC 7), at the highest label rate (18.5 oz/A) provided excellent powdery mildew control in our 2009 pumpkin fungicide trial at the Plant Pathology Farm at Rock Springs.

Powdery mildew developed on all rates of Rally (FRAC code 3) tested, however severity was less at the higher rate (120 ppm) rate evaluated. Powdery mildew also developed on plants treated with the lowest rate of Procure (FRAC code 3) and to a lesser extent at the higher rate (120 ppm). Resistance to this group of fungicides is quantitative therefore the highest label rate of Procure (8 oz/A) is recommended because it provides twice as much active ingredient as Rally at its highest label rate. In our 2009 fungicide trial, Procure (8 oz/A) provided very good powdery mildew control.

In 2009 the registration label for Quintec (FRAC 13) was expanded to include pumpkin. All fields were found to be sensitive to the higher 10 ppm rate of Quintec however several small lesions did develop on one bioassay plant treated with 1 ppm Quintec and placed at the Horticulture farm.

For cucurbit powdery mildew management, the current recommendation is to start applying mobile fungicides when the scouting threshold of 1 out of 50 older leaves is showing symptoms. Early in the season there is less selection pressure for resistant powdery mildew spores because fewer spores are exposed to the active ingredient. Later in the season then switch to a protectant spray program. When applying mobile fungicides (Quintec, Pristine, Procure) always tank mix with a protectant and alternate between modes of action or FRAC codes. Two consecutive applications of Quintec can be applied but there is a total crop limit of 4 applications. After initiating a spray program continue to scout the fields looking at both the upper and lower leaf surface to evaluate your level of powdery mildew control.

Objective 3: *Evaluate powdery mildew resistant varieties of squash and pumpkin.*

In collaboration with Tim Elkner, a replicated planting of 39 varieties of pumpkin was established at the Penn State SE Research and Extension Center in Landisville in June using the no-till method into a rye residue. Varieties were selected to evaluate powdery mildew resistance compared to standard, non-resistant varieties. Recommended spacing, fertility and pest management methods were used to grow the crop. As a result of the cool, wet growing conditions this season, powdery mildew did not occur in the planting until late in the season and no measurement of varietal resistance could be made. Data was collected on yield and fruit quality (but not reported here). The same varieties were planted at the Penn State Research Farm in Rock Springs and differences were noted in the occurrence of virus symptoms among these varieties.

Objective 4: *Disseminate results and recommendations to growers via newsletters as well as summer and winter field meetings.*

Information regarding managing powdery mildew using fungicides and resistant varieties was presented at the 2nd Annual Vegetable and Small Fruit Growers Field Day at SEREC on 13 Aug. It is also anticipated to a common topic presented during the upcoming winter meetings since it is of concern to growers annually.