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Cucurbit Downy Mildew (Pseudoperonospora cubensis) QoI Insensitive Isolate Identification, Implications for Commercial Control & Recommendation for use of QoI-containing Fungicide Products Technical Information from BASF

Summary
BASF has detected the gene-mutation for reduced sensitivity to QoI (strobilurin) fungicides in 4 samples of Pseudoperonospora cubensis from the eastern US. Without knowing the local or regional frequency of the mutation, these limited observations of the gene cannot be extrapolated to 1.) conclude that QoI (strobilurin) products will not effectively control downy mildew (DM) in 2005, or 2.) to explain poor product performance in 2004. In order to prevent the gene-mutation from increasing in frequency and to limit the potential for poor DM control, BASF recommends tank-mixing a non-QoI mode of action DM fungicide when using QoI-containing fungicide products and control of DM is a priority objective for the spray program.

Background
In 2004, some areas of the eastern U.S. (notably Georgia, North Carolina) experienced very high cucurbit downy mildew (DM) pressure not seen in a very long time. The weather conditions in GA and NC during that time greatly favored a rapid development of cucurbit downy mildew, and this had a negative influence on the level of DM control expected from all fungicides.
BASF worked with university cooperators to investigate DM samples from research plots in GA and NC in the fall of 2004 where strobilurin (QoI) fungicides appeared to not show their expected level of performance. Samples were also taken from FL commercial fields in the spring of 2005 where strobilurin performance was satisfactory.

These investigations have led to the detection of a genetic mutation in one, one and two samples from GA, NC and FL, respectively. The detected mutation has been associated with diminished performance of strobilurin (QoI) fungicides in a number of fungal pathogens. Currently, BASF has no information about the frequency of the mutant strains in each of the tested samples, in the specific fields the samples were taken from or mutation distribution across regional cucurbit growing areas in the US.
The detection of the gene for reduced QoI sensitivity in a population does not translate automatically to universal commercial control failure by QoI products. Therefore it is uncertain as to whether the mutation was the full cause, a partial

cause, or not a cause at all in the performance concerns of QoI fungicides against cucurbit DM in the fall of 2004. Similarly, it is not possible to predict the role of the reduced sensitivity mutation in the performance of strobilurin (QoI) products in the future.

Based on these observations, BASF is concerned about the potential for reduced cucurbit downy mildew performance of QoI-containing fungicide products in 2005. In order to reduce the potential for diminished product performance and to slow the increase of frequency of mutant strains in the cucurbit DM population, BASF recommends using QoI-containing fungicide products (see list below) in a tank-mixture with a non-QoI mode of action DM fungicide when control of DM is a priority objective for the spray program.

QoI-Containing (Strobilurin) Products Labeled for Use on Cucurbit Crops
AMISTAR (azoxystrobin);
CABRIO EG (pyraclostrobin) ;
FLINT FUNGICIDE (trifloxystrobin);
PRISTINE FUNGICIDE (pyraclostobin + boscalid)
REASON 500 SC (fenamidone);
TANOS (famoxadone + cymoxanil)

Strobilurin (QoI) insensitivity found in cucurbit Downy mildew
Andy Wyenandt, Ph.D., Specialist in Vegetable Pathology.Rutgers Cooperative Extension. From Plant and Pest Advisory, May 18, 2005

Strobilurin (FRAC group 11) insensitivity was found in cucurbit Downy mildew this past winter and early-spring in the southern United States. Strobilurin insensitivity (SI) in Downy mildew was detected in FL, GA and NC. What does this mean? Along with ideal weather and heavy disease pressure in many areas, insensitivity to the QoI fungicides was detected. This does not automatically translate to the failure of all QoI products used last year for Downy mildew control and for any use this upcoming season. Last year, Downy mildew was extremely destructive on cucurbit crops grown up and down the East Coast and many growers in different areas had difficulty in controlling the disease. Unfortunately, a busy 2004 hurricane season helped to spread Downy mildew northward much faster than normal and weather remained constantly favorable in many areas for the development of the disease. The detection of SI in cucurbit Downy mildew should be seen as a warning sign for the upcoming season. Growers should take every precaution to mitigate the chances for Downy mildew resistance developing this coming season. Recommendations for the 2005 season include tank mixing all QoI fungicides (FRAC group 11) for Downy mildew and/or Powdery Mildew control on cucurbits with non-QoI fungicides (protectants, M) when either disease is the priority of the spray program. Never tank mix QoIs (Group 11) fungicides together and never apply any Group 11 fungicide in consecutive applications for Downy and/or Powdery mildew control.

When to begin spraying for Downy mildew on cucurbit crops?
The biggest question being asked thus far is when to start spraying for Downy mildew this coming year? Remember that Downy mildew is favored by prolonged wet/humid weather. Fortunately, we have few factors in our favor right now. First, Downy mildew has to work its way north from cucurbit crops grown in the south and second, there needs to be weather patterns which favor spreading the disease northward. Presently, Downy mildew should not be an immediate threat to our region. However, this will most likely change over the next month as hurricane season begins (forecasters are expecting a season similar to last years) and more cucurbit acreage is planted in the south. Remember, Downy mildew was detected near Vineland, NJ during the last week of June last summer! However, that doesnt mean it will show up in our area at the same time this year. The best approach in determining when to spray for Downy mildew will be to be aware of the weather, especially weather systems coming out of the south. Weve been in a rather dry spell this spring, not exactly Downy mildew weather, thus far, however, that could change anytime. As cucurbit crops begin to develop canopy make sure to scout on a regular basis, especially if wet weather has been around for a few days. Once Downy mildew has been forecasted or detected in our region, basic fungicide maintenance programs will need to be adjusted to include Downy mildew control. Strobilurin (Group 11) fungicides should not be applied when conditions for Downy mildew (or Powdery mildew) do not exist and/or are not an immediate threat. Thus, broad-spectrum protectant fungicides (Bravo, Maneb, copper, sulfur) should be applied until either disease is forecasted and/or detected in the Mid-Atlantic region (i.e. VA, DE, MD, NC - just to our south). Once Downy mildew is present, weekly fungicide programs should shift to include a protectant fungicide plus a Downymildew specific fungicide such as Gavel (zoxamide + mancozeb, 22 + M3) at 1.5 to 2.0 lbs/A, or Previcur flex (propamocarb, 28) at 1.2 pt/A, or Curzate (cymoxanil, 27) at 3.2 oz/A alternated with Ridomil Gold Bravo (mefenoxam + chlorothalonil, 4 + M5) at 2 lb/A and/or alternated with a protectant fungicide plus Tanos (fomoxadone + cymoxanil, 11 + 27) at 8 oz/A, or Cabrio (pyraclostrobin, 11) at 8 to 12 oz/A, or Pristine (pyraclostrobin + boscalid, 11 + 7) at 12.5 to 18.5 oz/A.

Never apply fungicides in FRAC groups 3, 7, 11, or 27 in consecutive applications and always tank mix with a protectant fungicide (Group M). The key to successfully controlling Downy mildew is to use different fungicide chemistries (i.e. FRAC groupings) against it to prevent resistance from building up against any one specific chemistry and to keep up with an aggressive weekly spray schedule. Just to keep in mind, reports from FL indicate that an aggressive spray program incorporating the use of the newer, specific fungicide chemistries has been the only method for keeping up with Downy mildew in some areas! Thus, not keeping up with regular scouting and spraying and/or the overuse of a single fungicide chemistry may mean the difference in producing a successful crop and losing a crop to Downy mildew.

Although Strobilurin-insensitivity in Powdery mildew has not been documented in New Jersey, a few fungicides in Group 11 that are listed for the control of Powdery mildew (Amistar, Flint, Pristine, Cabrio) are also recommended for Downy mildew

(Cabrio, Pristine, Tanos). The overuse of any Group 11 fungicide specifically for Powdery mildew or Downy mildew control and/ or both may help to exacerbate the potential for resistance to develop to all Group 11 fungicides for either disease. Therefore, the keys to controlling Powdery and Downy mildew will be to keep up with an aggressive spray program, tank mix any Group 11 fungicide with a protectant, and to incorporate different fungicide chemistries (FRAC groupings) into your fungicide program to help reduce the potential buildup of resistance. To track the progress of Downy mildew in the eastern US and to keep up with reports of Downy mildew from other states please visit North Carolina State Universitys Cucurbit Downy Mildew Forecasting Center at http://www.ces.ncsu.edu/depts/pp/cucurbit/.

Editors Note: Downy Mildew came in fast and furious on pumpkins and other vine crops towards the end of summer last year. Many growers were caught off guard. Also, I am not aware of any cases of strobilurin insensitivity (SI) in OH at this time.

Crop Reports South east Ohio, Hal Kneen
Meigs County growers continued to look for moisture. About one third of an inch of rainfall fell on Saturday May14. Rain has been in the forecast the past five days but none has fallen. Irrigating tomatoes and peppers. Finishing up planting watermelons, cantaloupes, cucumber and squash transplants. Seeded vine crops also being planted. Cabbage heads are only only small fist size. very limited cabbage this year no price in past couple of years. 2004 receipts showed 50 pound box (16-18 head) only received $8.00 which doesn't leave much after paying $1.65 per box and $0.50 to a $1.00 per loaded box freight.

Sweet corn and tomatoes growing now that warmer day and night temperatures prevail. Tomatoes are beginning to flower.
Many calls on applying herbicides. Remember to track what kinds of weeds are causing you problems and how well herbicides you are applying are controlling the weeds. Two or three day delay in applying herbicides can make a difference in how well the herbicide works. Consider crop rotation before you apply herbicides.

SOUTHERN OHIO Brad Bergefurd
Some rough weather hit SW Ohio last Friday (May 13) afternoon. Strong thunderstorms which brought over 2 inches of rain in an hour and large hail, hit some vegetable farms around the Cincinnati area. The hail caused some damage to early planted Cabbage, sweet corn, summer squash, winter squash, muskmelons, watermelons, tomatoes, kohlrabi and bell peppers, with plastic mulch in fields getting holes punched in it by the hail and strong winds . Most plantings should grow out of the damage due to the small size of the plants at this stage of growth, however some areas of pepper and watermelon fields experienced many plants, up to 30% in some parts of fields, with broken stems. USDA adjusters are making damage assessment reports of these crops this week. Some portions of fields were being replanted this week (see picture). Overall crops should quickly outgrow any

damage experienced by the storms if we get some sunshine and warmers temperatures. Staking, suckering and tieing of tomatoes in the field has begun.

Monday morning (May 16) some growers reported morning lows in the 30's and some light frost damage was reported to early planted sweet corn and melons. Harvest of the first high tunnel tomatoes has begun. Harvest of green onions, radishes and lettuce crops continues. Kohlrabi crops are within 2 to 3 weeks of harvest. Sweet corn and cabbage is being sidedressed with 28% nitrogen and is being cultivated to loosen soil crusting. Plasticulture strawberry harvest is increasing, the cool temperatures have slowed down ripening and harvest, but quality, sweetness and berry size is great. Plants continue to remain in a reproductive state with the cool nighttime temperatures and continue to bloom and set fruit. Many growers are replanting portions of sweet corn crops that were planted between April 7 and 15 due to poor emergence from cool and wet soil conditions, especially in light colored soils.

Planting of cucumbers, summer squash, sweet corn, green beans, melons and watermelons continues. Growers continue to prepare vegetable fields and continue to lay plastic mulch and form raised beds for later plantings. Seed corn maggots are being reported in sweet corn fields and is reducing plant stands somewhat. Seeding of large and giant pumpkin for transplanting is being done in the greenhouse for a memorial day transplanting. Seeding of late melon, cucumber and watermelon crops are being made in the greenhouse. All plastic has been removed from early planted sweet corn under clear plastic mulch with this corn being over 2 feet tall in some early fields. Growers are beginning to run trickle irrigation and are fertigating early planted vegetable crops. Cucumber beetle populations have diminished from the hot spots that were reported by growers last week. Some squash, cucumber and melon transplants coming out of greenhouse have some powdery mildew lesions showing up, however, once these transplants are set in the field these lesions are drying up. Planting of lima beans will begin next week if soil temperatures increase.

Central OH.
Late April planted se corn is finally in the two leaf stage. Plastic sweet corn is nearly 1 foot tall. Some plasticulture strawberries are now available for pick your own and should be in full production by next week. Some growers report a delay in the strawberry season between 5-10 days. Planting of sweet corn, tomatoes and other crops continues but was halted late Wednesday after a one inch plus soaking rain. Field operations should resume next week depending on whether or not it rains on Sunday.