

SUCCESSFULLY MANAGING THE MANY DISEASES PLAGUING CUCURBITS

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Every year in NY cucurbit crops are potentially affected by more diseases than other vegetable crops. All cucurbits at a minimum are affected by powdery mildew due to the quantity of easily wind-dispersed spores that the pathogen produces. Pathogens causing other diseases are not as widely dispersed. Several can survive in the soil, thus rotation is an important management practice. Most diseases are more severe during a rainy than dry season because wet leaves or soil are favorable conditions for most pathogens (exceptions include powdery mildew, bacterial wilt, and virus diseases). Successful management is based on knowledge of pathogen biology, in particular sources of inoculum and conditions favoring disease development, which is used to identify appropriate cultural management practices. Knowing early symptoms facilitates early detection. It is also important to have current information on fungicides and resistant varieties. Below is information on select diseases followed by an integrated management program. See also: vegetablemndonline.ppath.cornell.edu and www.nysaes.cals.cornell.edu/recommends.

Phytophthora blight. This destructive disease was more severe in 2011 than during recent years in areas where there were intensive rainfall events, which created unusually favorable conditions. A key to successfully managing this disease is managing soil moisture to avoid saturated conditions. Achieving this is difficult when rainfall amounts are large. Another key has been fungicides registered in recent years with targeted activity for pathogens in this biological group (Oomycetes): Forum (FRAC Code 40), Revus (40), Tanos (27), Presidio (43), Ranman (21), Gavel (22), and phosphorous acid fungicides (33). These are considered the reason many growers have been effectively managing Phytophthora blight. A preventive fungicide program is considered essential. Ineffective control in 2011 appeared to be due to poor application timing in some fields (application missed when rain began before expected) while in others favorability of environmental conditions seemed to have been too great. Development of fungicide resistance is a concern with all targeted fungicides due to single site mode of action; therefore, alternation amongst chemistry is recommended. Resistance to Ranman has been detected in the southeastern US. Gavel, Tanos, and several copper fungicides are available for use in NY for Phytophthora blight under FIFRA 2(ee) Recommendation, a copy of which must be in the applicators' possession when any of these are used in NY. A copy (tif file) can be obtained on the web at http://pmep.cce.cornell.edu/regulation/nysdec-lib/2ee/fung_cucurbit.html. Coppers are not sufficiently effective to be recommended alone for Phytophthora blight. Presidio has a long rotational interval of 18 months for non-labeled crops, which can be a constraint on production. All cucurbits, fruiting vegetables, tuberous and corm vegetables (except potato), and leafy vegetables are now labeled; carrot, sugar beet, potato and rotational wheat will be labeled soon; and rotational field corn is expected in 2012. Typically Phytophthora blight begins to develop in low areas where water drainage is poor, but symptoms have been found first in sloped areas. This documents the need to look throughout a crop for symptoms and not focus exclusively on low areas. It is better to avoid planting low areas. While crops planted in a field lacking the pathogen (based on crop and disease history) typically will be free of Phytophthora blight, this is not absolute. The pathogen can be moved between farms via water. Biofumigation with mustard cover crop entails growing a biofumigant mustard in the spring or fall, chopping into small pieces 4-6 weeks after onset of flowering, and immediately incorporating the mustard then sealing the soil surface with a culti-packer and irrigation. Plant after at least 10-14 days.

Powdery mildew. An integrated program with both management tools (resistant varieties and fungicides) is recommended to maximize likelihood of effective control. Evidence has been

obtained that the pathogen is evolving and becoming less effectively controlled by currently-available tools. The most effective fungicide program for powdery mildew is weekly applications of targeted, mobile fungicides, applied in alternation (based on FRAC Code) and tank mixed with a protectant fungicide, beginning very early in powdery mildew development (one older leaf out of 50 with symptoms). Quintec (FRAC Code 13) has been the most consistently effective fungicide in fungicide evaluations, therefore it is recommended as the main mobile fungicide to use on labeled crops (pumpkin, winter squash, gourd, melon) where the crop rotational restriction of 12 months is acceptable. Recent crop additions to the Quintec label have increased the options of what can be planted within 12 months of the last application. The Quintec label specifies no more than two consecutive applications plus a crop maximum of four applications. Alternate Quintec with Procure or another DMI fungicide (Code 3) and Pristine (Code 7 and 11). Highest label rate is recommended. These fungicides have exhibited variable control when tested along in fungicide evaluations. Isolates have been detected fully resistant to boscalid, the Code 7 ingredient in Pristine. They were effective in an evaluation conducted on LI in 2011. Resistance continues to be very common to MBC fungicides (FRAC code 1; Topsin M) and QoI fungicides (Code 11; Quadris, Cabrio and Flint); therefore, these continue to not be recommended. There are several protectants for powdery mildew, including chlorothalonil, sulfur, copper, botanical and mineral oils, and several biopesticides.

Prospect looks good for improved control of powdery mildew in the future. There are new mobile fungicides on track for registration soon that are highly effective for powdery mildew. Similar to the targeted, mobile fungicides currently in use, they do have risk of resistance developing because they have single site mode of action. Therefore it will be critical to always use a resistance management program. Hopefully these fungicides will be registered before the pathogen has developed resistance to Quintec so that all can be used together in a fungicide resistance management program. Torino is a FRAC code U6 fungicide. 'U' designation means it is unknown mode of action. US federal registration is pending and anticipated in spring 2012 for crops including cucurbits. Vivando is a FRAC code U8 fungicide. It was registered in the US in 2011 with approval for use on grapes. Additional crops including cucurbits are anticipated to be labeled in 2013. Like Quintec, both of these fungicides are only effective for powdery mildew diseases. Three new fungicides in development have an active ingredient that belongs to the carboxamide class of fungicides (FRAC Code 7): Fontelis, Merivon, and Luna series fungicides. These fungicides have been more effective than Pristine in fungicide evaluations documenting differences in activity of fungicides in this group. Federal registration of these is expected in 2012 to 2013. They will be recommended as alternatives to Pristine rather than as additional products to add to a program. This chemistry is also effective for gummy stem blight/black rot.

Plectosporium blight. This disease occurred more commonly in 2011 than previous years, reflecting that rainy weather provided favorable conditions. Rotate, clean equipment between fields, apply chlorothalonil before rain, and incorporate infested debris right after harvest.

Downy mildew is primarily managed with fungicides. Resistance bred into cucumbers provides some suppression of the pathogen strains present recently, but substantially less than what was achieved against strains present before 2004. However, they are still considered a worthwhile component of an integrated program. As with powdery mildew, fungicide resistance is also a concern with the downy mildew pathogen and therefore the fungicide program recommended is also targeted, mobile fungicides applied in alternation based on FRAC Code on a weekly schedule and tank mixed with a protectant fungicide (chlorothalonil or mancozeb) beginning very early in disease development. The downy mildew forecasting program is a valuable tool for determining when fungicides are needed. Recommended fungicides are Ranman (FRAC Code 21), Forum (40), Revus (40), Presidio (43), Curzate (27), Tanos (27), Gavel (22), and Previcur Flex (28). Curzate and Tanos have some curative activity (up to 2 days under cool temperatures) but limited residual activity (about 3-5 days necessitating a short application interval). Presidio has an advantage over Curzate and Previcur Flex of also being labeled for Phytophthora blight. Efficacy of Revus has varied among crop types with control being good on pumpkin but poor on

cucumber. Based on results from an analysis of all published data from these evaluations, Presidio has been the most effective fungicide, followed by Previcur Flex and then Ranman. Presidio was effective in an evaluation conducted on LI in 2011, but not in an evaluation elsewhere suggesting that resistance may have developed to Presidio. Resistance to mefenoxam (FRAC Code 4) and to QoI fungicides (11) is sufficiently common that fungicides with these active ingredients are no longer recommended.

A new mobile fungicide, Zampro, is anticipated to be registered during the later part of 2012 for use on cucurbits and other crops. It is effective for Phytophthora blight as well as downy mildew. Zampro contains new fungicide chemistry, ametoctradin (FRAC code 45), plus dimethomorph (40), the active ingredient in Forum. Once this fungicide is registered it will be recommended as a component of the fungicide program in place of the code 40 fungicide in use.

Chlorothalonil and mancozeb are the main protectant fungicides for downy mildew. Copper is not as effective. Dithane now has a supplemental label that includes pumpkin, winter squash and gourd.

An important tool for determining when fungicide application is warranted is the forecast web site for this disease at <http://cdm.ipmpipe.org>. Cucurbit plants are susceptible to downy mildew from emergence; however, this disease usually does not start to develop in the northeast until later in crop development when the pathogen is dispersed by wind into the region. The forecast program monitors where the disease occurs and predicts where the pathogen likely will be successfully spread. The pathogen needs living cucurbit crops to survive, thus it cannot survive where it is cold during winter. The risk of downy mildew occurring throughout the eastern US is forecast and posted three times a week. Forecasts enable timely fungicide applications. Growers can now subscribe to receive customizable alerts by e-mail or text message. Information is also maintained at the forecast web site of cucurbit crop types being affected by downy mildew. This is important because the pathogen exists as pathotypes that differ in their ability to infect the various crops. All pathotypes can infect cucumber; some also can infect melons and squashes are susceptible to others. Success of the forecast system depends on knowledge of where downy mildew is occurring; therefore prompt reporting of outbreaks by growers is critical.

Integrated Management Program for Cucurbit Diseases:

Sign up for alerts about downy mildew occurrence before the season at the forecast web site <http://cdm.ipmpipe.org>. Monitor the web site during the season for information on outbreaks.

Select resistant varieties. See vegetablemdonline.ppath.cornell.edu/Tables/TableList.htm.

Use fungicide-treated seed and/or seed that has been tested for pathogens. FarmMore commercial seed treatment also has an insecticide. [Alternaria leaf blight](#), [angular leaf spot](#), [anthracnose](#), [damping-off](#), [Fusarium wilt](#), [gummy stem blight/black rot](#), [scab](#), [Septoria leaf spot](#).

Rotate land to control diseases caused by pathogens that can survive in soil or on weeds in hedge rows, which include [Alternaria leaf blight](#), [anthracnose](#), [angular leaf spot](#), [Fusarium crown and fruit rots](#), [Fusarium wilt](#), [gummy stem blight/black rot](#), [Phytophthora blight](#), [Plectosporium blight](#), [scab](#), [Sclerotinia white mold](#), [Septoria leaf spot](#), and [viruses](#).

Select a well-drained site to manage [cottony leak](#), [damping-off](#), [Phytophthora blight](#), [Rhizoctonia belly rot](#), and [scab](#).

Minimize leaf wetness. Select a site with good air movement and overhead irrigate when leaves will have time to dry before evening dew period to manage foliar diseases.

Physically separate cucurbit plantings.

Avoid moving infested soil into clean fields. Work last in fields where pathogens occur that survive in soil, then clean equipment before working in fields where these diseases haven't occurred (see list under rotate above). Apply pesticides to areas without soil-borne diseases first.

Scout for diseases regularly during the growing season. Focus on older leaves as diseases often start to develop there. Look on both leaf surfaces. It is especially important to scout once plants start to produce fruit. Check low areas for Phytophthora blight. Monitor downy mildew forecasts. Also look for cucumber beetles early in crop development.

Apply pesticides as needed (fungicides before rain for most diseases except powdery mildew):

Insecticide Admire Pro at planting or transplanting for cucumber beetles, which carry bacteria that cause bacterial wilt. Or use FarMore-treated seed. Planting Blue Hubbard or another cucurbit highly attractive to beetles around the crop to form a perimeter trap is an effective strategy that can result in insecticide only being needed on the trap plants.

Contans before or at planting for white mold.

Ridomil Gold EC (Code 4) at planting for damping-off and cottony leak. Another option for damping-off is Previcur Flex (28).

Phosphorous acid fungicides (33) at planting for Phytophthora blight.

Protectant fungicides (chlorothalonil, mancozeb, and/or copper) before disease onset. A preventive schedule is especially important with copper for angular and bacterial leaf spots.

Where bacterial wilt is a concern, apply insecticide if treatment at planting is no longer killing cucumber beetles early in crop growth, especially prior to canopy closure. Labeled products are Asana, Assail, Baythroid, Brigade, Danitol, Lannate, Pounce, Sevin XLR Plus, Volium Xpress, and Admire applied through drip.

Phytophthora blight. Alternate among the following fungicides tank mixed with copper or chlorothalonil beginning before symptoms are observed: Forum (FRAC Code 40), Revus (40), Tanos (27), Presidio (43), Ranman (21)*, Gavel (22), and phosphorous acid fungicides (33).

Apply targeted fungicides in alternation based on FRAC code when the following diseases occur starting at first symptom, tank-mix with protectant fungicide:

Alternaria leaf spot. QoI fungicides (11), Reason (11), Inspire Super (3,9), Pristine (7,11), Tanos (27).

Anthraco nose. QoI fungicides (11), Inspire Super (3,9), Pristine (7,11), Tanos (27), and Topsin M (1).

Belly rot. Quadris (11) and Topsin M (1).

Downy mildew. Previcur Flex (28), Curzate (40), and all fungicides for Phytophthora blight except phosphorous acid fungicides.

Gummy stem blight. QoI fungicides (11)*, Inspire Super (3,9), Pristine (7,11)*, Switch (9,12), and Topsin M (1).

Plectosporium blight. QoI fungicides (11)* and Inspire Super (3,9).

Powdery mildew. Quintec (13), Pristine (7,11)* and Procure or other Code 3 fungicide.

Septoria leaf spot. Inspire Super (3,9).

* Resistance detected in the US.

Hasten decomposition of infested crop debris by chopping debris to break it up and then incorporating with disk, roto-till or plow. Do immediately after harvest.

Please Note: The specific directions on pesticide labels must be adhered to -- they supersede these recommendations, if there is a conflict. Note that some products mentioned are not yet registered for use on cucurbits. Check labels for use restrictions. Any reference to commercial products, trade or brand names is for information only; no endorsement is intended.