Vegetable Crop Update

A newsletter for commercial potato and vegetable growers prepared by the University of Wisconsin-Madison vegetable research and extension specialists

No. 19– July 2, 2015

In This Issue

Calendar of Events

July 15 – UW-Hancock ARS Field Day, 12:30PM, Hancock, WI
July 17 – Rhinelander State Farm Field Day, Lelah Starks Elite Found. Seed Farm, Rhinelander, WI
August 19 – UW-Arlington ARS Agronomy/Soils Field Day, 8AM, Arlington, WI
August 20 – UWEX Langlade County Airport Field Day, Antigo, WI
August 25-27 – Wisconsin Farm Technology Days, Statz Bros., Inc. Farm, Sun Prairie, WI
September 1 – UW-Arlington ARS Organic Agriculture Field Day, Arlington, WI

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Veg Pathology Webpage: http://www.plantpath.wisc.edu/wivegdis/.

Current P-Day (Early Blight) and Severity Value (Late Blight) Accumulations (R.V. James, UW-Plant Pathology/R.V. James Designs): A P-Day value of ≥ 300 indicates the threshold for early blight risk and triggers preventative fungicide application. A DSV of ≥ 18 indicates the threshold for late blight risk and triggers preventative fungicide application. Red text in table below indicates threshold has been met/surpassed. NA indicates that information is not available. Blitecast and P-Day values for actual potato field weather from Grand Marsh, Hancock, Plover, and Antigo are now posted at the UW Veg Path website at the tab "P-Days and Severity Values." http://www.plantpath.wisc.edu/wivegdis/contents_pages/pday_sevval_2015.html

Location	Planting Date	50% Emergence	P-Day Cumulative	Disease Severity Value	Date of DSV Generation	Increase in DSV from 6/26
Antigo	Early 4/25	5/25	**221**	**42**	6/30	2
	Mid 5/5	6/1	**221**	**42**	6/30	2
	Late 5/15	6/15	**123**	**16**	6/30	2
Grand Marsh	Early 4/5	5/10	**357**	**61**	6/30	7
	Mid 4/15	5/15	**347**	**60**	6/30	7
	Late 5/1	5/21	**313**	**58**	6/30	7
Hancock	Early 4/10	5/15	**348**	**56**	6/30	6
	Mid 4/20	5/18	**324**	**53**	6/30	6
	Late 5/5	5/25	**290**	**48**	6/30	6
Plover	Early 4/15	5/20	**351**	**63**	6/30	5
	Mid 4/25	5/22	**311**	**60**	6/30	5
	Late 5/10	5/30	**249**	**44**	6/30	5

Potato Early Blight Preventive Management: P-Days have surpassed threshold of 300 in early and mid-plantings in the Grand Marsh, Hancock, and Plover areas, as well as the late-plantings in the Grand Marsh location. All other locations have not yet reached threshold. We are beginning to see early blight in lower potato plant canopies in commercial production fields of southern and central Wisconsin. Areas in which this threshold has been reached should be on a preventive program for control of early blight, especially on highly susceptible cultivars in areas of concentrated potato production. On May 8th, I provided a summary of fungicides for control of early blight in conventional potato in this newsletter, please find the link to this information below.
http://www.plantpath.wisc.edu/wivegdis/pdf/2015/May%208,%202015.pdf

Late Blight Updates: The DSV 18 threshold has been met/surpassed for all plantings and locations with the exception of late-planted potatoes in the Antigo area. This threshold indicates that environmental conditions have been met to promote late blight disease activity. At 18 DSVs, preventive applications of effective late blight fungicides is recommended. Accumulation of DSVs over the last four days has been low-moderate, however, cloudy days, heavy dews, and in some areas, sporadic showers are creating site specific conditions which do favor late blight. At this time, late blight has been detected in a commercial potato field in northern Adams County Wisconsin. Several surrounding fields also showed symptoms and were either vine killed or placed on an intensive fungicide program to limit new infections and limit sporulation. The genotype/strain of the late blight in northern Adams County is US-23 which is sensitive to phenylamide fungicides such as mefenoxam and metalaxyl. Due to the nature of some farms, ground rig access to fields for application of fungicides may be limited. However, late blight still requires management to limit sporulation and spread to area fields. Aerial fungicide application may be the only effective method if ground access is limited on a routine basis.

There was a new detection of late blight in Franklin County Washington on potato this past week www.usablight.org. The genotype has not yet been determined. To date, nationally, there have been confirmations of late blight (US-23) in FL, CA (US-11), NC (strain not yet determined), TX (not reported on usablight.org/strain not yet identified), and WI (US-23).

Fungicides are critical for protection of potato and tomato crops at this time.
There is not one recommended fungicide program for all late blight susceptible potato (and tomato) fields in Wisconsin. Fungicide selections may vary based on type of inoculum introduction, proximity to infected fields, crop stage, late blight strain, and other diseases that may be in need of management. Please see UWEX Veg Crop Updates article on fungicide selections from June 5 at link below.
http://www.plantpath.wisc.edu/wivegdis/pdf/2015/June%205,%202015.pdf or a listing of 2015 WI potato late blight fungicides:
http://www.plantpath.wisc.edu/wivegdis/pdf/2015/Potato%20Late%20Blight%20Fungicides%202015.pdf

If you suspect/detect late blight, have the disease confirmed (free diagnostics through my lab and the UWEX Plant Disease Diagnostic Clinic) and we can genotype for further information on the nature of the pathogen.

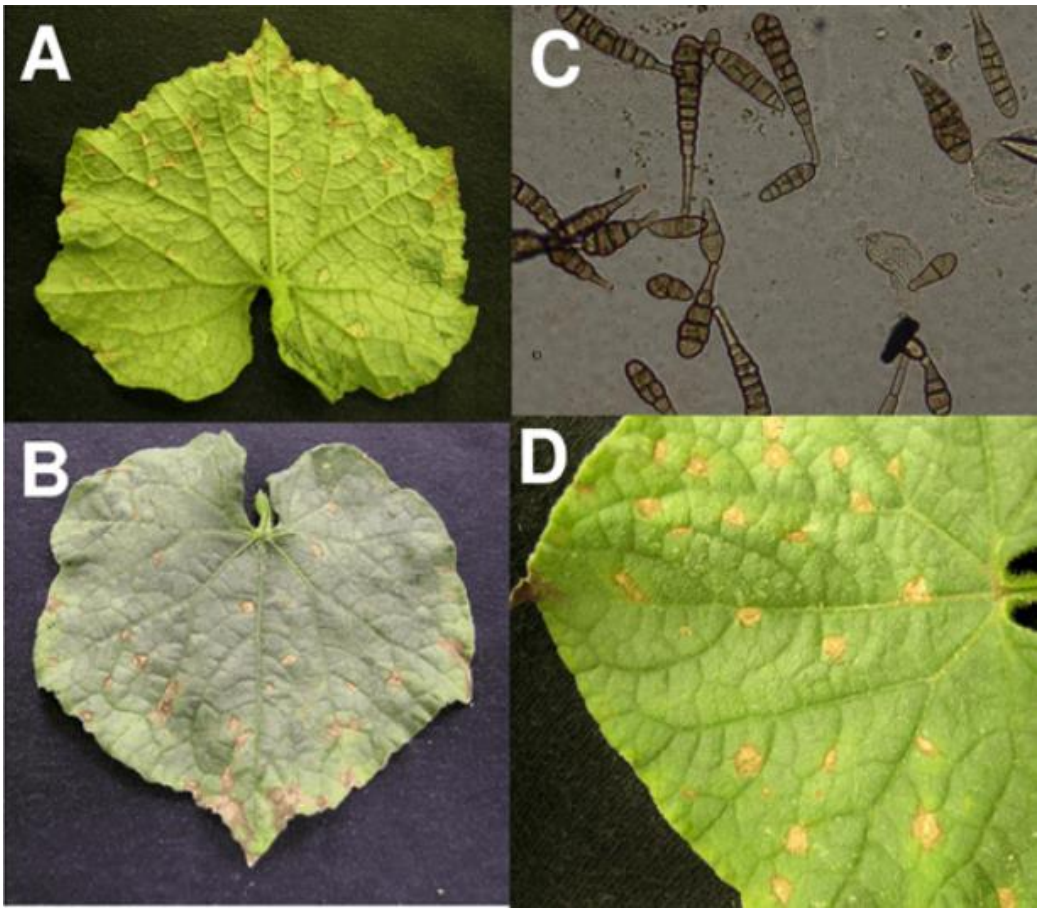
Further details on registered fungicides for WI vegetables can be found in the Univ. of WI Commercial Vegetable Production in WI Guide A3422, http://learningstore.uwex.edu/assets/pdfs/A3422.PDF.

Cucurbit disease control programs: Several fungal and bacterial diseases including Alternaria and angular leaf spot have been active in cucurbit crops in Wisconsin over the past week. In some fields, soilborne *Phytophthora capsici* which causes Phytophthora crown and fruit rot, may also be active given the persistent moisture in some areas. Fungicides specific for each disease along with pictures of symptoms are provided below. Many of the fungicides that work best on true fungal pathogens will have activity against both Alternaria and anthracnose. As angular leaf spot is caused by a bacterium, copper containing fungicides offer the best control. Phytophthora crown and fruit rot as well as downy mildew are oomycete or 'water mold' pathogens and require unique fungicides for specific and often residual control. Base protectants such as mancozeb and chlorothalonil offer sound, broad spectrum disease control activity against all disease with the exception of angular leaf spot.

Angular leaf spot is caused by the bacterium *Pseudomonas syringae* pv. *lachrymans.* Cultural controls include maintaining dry plan canopies through limited overhead irrigation and increased plant spacing. Some varieties have resistance. Copper-containing fungicides applied on a 5-7 day spray program when disease is favored (warm/wet conditions) can limit spread and development of infection. For more information, see link below. See pictures of angular leaf spot from Professor Emeritus in Vegetable Pathology Dr. Walt Stevenson, below (note characteristic tattered appearance of leaves with 'shot hole' appearance and white, scabby look to rough leaves). http://learningstore.uwex.edu/assets/pdfs/A3801.PDF

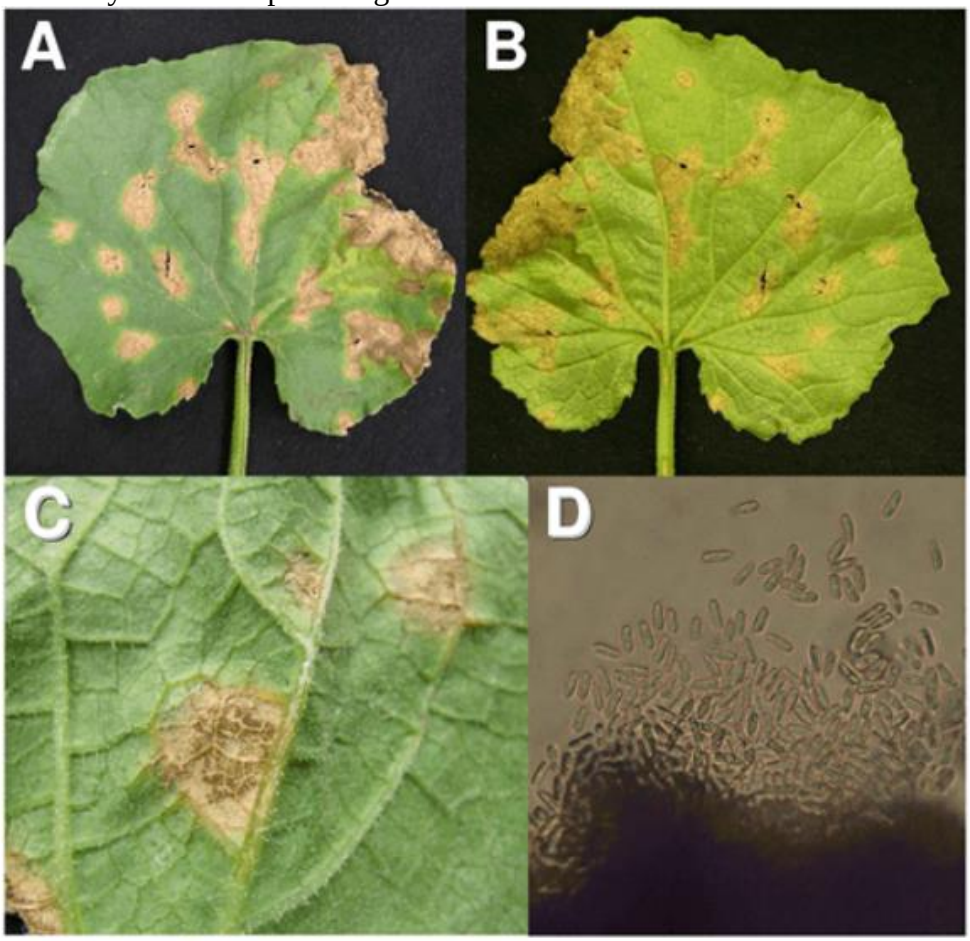
Alternaria leaf spot caused by the fungus *Alternaria cucumerina* (and possibly other species) can be managed best with fungicides in the strobilurin group such as: Quadris (azoxystrobin), Quadris Opti (azoxystrobin+chlorothalonil), Quadris Top (azoxystrobin+difenoconazole), Reason (fenamidone), Cabrio (pyraclostrobin), Tanos (famoxadone+cymoxanil), Pristine (boscalid+pyraclostrobin), Sovran (kresoxim methyl), and Evito (fluoxastrobin). Most strobilurins have a 0 or 1 day PHI depending upon the pre-mix and formulation. Chlorothalonil offers better control of Alternaria than mancozeb when compared directly (and without tank-mixes of reduced risk single site mode of action fungicides in several southeastern US field

trials). Topsin (thiophanate methyl, 1 day PHI) can also offer good control. See pictures of Alternaria leaf symptoms from Dr. Mary Hausbeck, Michigan State University, below.



Belly rot is caused by the soilborne fungus *Rhizoctonia solani*, causes a fruit rot where fruit are in contact with soil, and can be best controlled with strobilurin fungicides such as azoxystrobin (PHI 1 day), pyraclostrobin (PHI 0 day), and fluoxastrobin (PHI 1 day) (as listed above for Alternaria) and with thiophanate methyl fungicides such as Topsin (REI 24 hr/PHI 24 hr). Pictures of belly rot from Ontario Vegetables (website) are below.

Anthracnose is caused by the fungus *Colletotrichum orbiculare (*syn. *Lagenarium*). More information can be found at link: http://learningstore.uwex.edu/assets/pdfs/A3279.pdf Pictures of anthracnose symptoms on cucumber from Dr. Mary Hausbeck, Michigan State University, are below. Varietal resistance and plant spacing are non-chemical disease control options. However, if necessary fungicides can be useful in limiting disease. Base protectants chlorothalonil and mancozeb provide good control. Strobilurins, such as azoxystrobin and others previously listed alos provide good control.



Phytophthora crown and fruit rot and downy mildew are diseases I have previously addressed more thoroughly in previous newsletters. For specific recommendations for downy mildew and Phytophthora crown and fruit rot, please go to Newsletter #16 from June 23, 2015:

http://www.plantpath.wisc.edu/wivegdis/pdf/2015/June%2023,%202015.pdf

I have also included tables below from the 2015 Southeastern Vegetable Crop Handbook which compare efficacy of fungicides for key cucurbit diseases. Keep in mind this categorization is based primarily on southeastern US field trials and commercial field performance, however, it is useful in selecting fungicides for control of multiple diseases – and for referencing Pre-harvest intervals – which is critical in a multi-pick crop like cucumbers.

Cucurbit powdery mildew: Powdery mildew is beginning to show up in southern Wisconsin squash and pumpkin fields. In average years, cucurbits can tolerate some powdery mildew without need for fungicides. However, when powdery mildew comes early, as it has been doing in recent years, some cucurbits, particularly pumpkins, may need a fungicide to maintain health and quality of vines and fruit. The use of fungicides for controlling this disease may be necessary to maintain fruit quality, quantity, and storability if disease level becomes high and you're raising a susceptible variety. While there is good varietal resistance in cucumber and watermelon, many pumpkin and squash varieties are susceptible to powdery mildew. Symptoms seen below in Figure begin on lower, older leaves and can rapidly spread to petioles and 'handles' affected vigor and function of leaves. Infected stems can be very dry and brittle and often appear bleached out. Bleached and shattered or missing handles can impact marketability as well as storability of pumpkin fruit as the broken stem often leaves a wound site into which secondary and saprophytic microorganisms can enter and cause storage break down.

The timing of fungicide control measures is important, as some of the registered materials have reduced efficacy if applied after infection is well established. Among conventional fungicides labeled for squash and pumpkin powdery mildew, the following list includes those with good performance: Procure (triflumizol), Pristine (pyraclostrobin + boscalid), Quintec (quinoxyfen), Cabrio (pyraclostrobin), Topsin (thiophanate methyl), Torino (cyflufenamid), and Sovran (kresoxim methyl). Rally (myclobutanil) has been less effective in recent years in WI likely due to development of resistance in the pathogen population. Our trial in Hancock last year, as well as commercial reports would indicate that this is no longer working to control powdery mildew. Quintec was the most effective fungicide trt in controlling powdery mildew on pumpkin in Hancock last year. It is recommended that the above-listed materials be tank-mixed and alternated with broad spectrum fungicides such as mancozeb or chlorothalonil to limit the development of pathogen resistance and to provide a fungicide program with a broad disease management scope. In organic production, there are products with some efficacy against powdery mildew: oils, bicarbonates, sulfur, and copper. We are currently conducting trials in Hancock and Cashton, WI to identify best fungicide selections for cucurbit powdery mildew in both organic and conventional systems.

Figure 2. Powdery mildew on pumpkin. A. White powdery pathogen growth on pumpkin stem. B. Powdery mildew signs (white powdery spores) and symptoms (yellow/dying leaves). C. The spores of the powdery mildew pathogen that can be wind dispersed.

Cucurbit downy mildew updates: We have had no reports of downy mildew on cucurbits here in WI at this time. Downy mildew has been confirmed DE, GA, NC, NY, OH, Elgin Ontario Canada, and SC reported in the past week. For more information on symptoms, disease cycle, and general management, please visit: http://learningstore.uwex.edu/Assets/pdfs/A3978.pdf

Nationally, in the past week, there were several new diagnoses of cucurbit downy mildew from DE, GA, NC, NY, OH, Elgin Ontario Canada, and SC reported to http://cdm.ipmpipe.org/ So far in 2015, there have been confirmations of cucurbit downy mildew in LA, NC, FL, GA, SC, TX, MI, and Ontario Canada on various cucurbit types including summer and winter squash, watermelon, cucumber, and pumpkin. No forecasted movement of the pathogen to WI at this time.

TABLE 3-12. EFFICACY OF PRODUCTS FOR DISEASE CONTROL IN CUCURBITS

L. Quesada-Ocampo, Plant Pathologist, NCSU; A. Keinath, Plant Pathologist, Clemson University; S. Bost, Plant Pathologist, UT; M. Paret, Plant Pathologist, UF

Scale: "E" excellent; "G" good; "F" fair; "P" poor; "NC" no control; "ND" no data.

Product[1]	Fungicide group[F]	Preharvest interval (Days)	Alternaria Leaf Spot	Angular Leafspot	Anthracnose	Bacterial Fruit Blotch	Belly Rot	Cercospora Leaf Spot	Cottony Leak	Damping off (*Pythium*)	Downy Mildew	Gummy Stem Blight	Phytophthora Blight (foliage and fruit)	Phytophthora Blight (crown and root)	Plectosporium Blight	Powdery Mildew	Target Spot
acibenzolar-S-methyl (Actigard)	21	0	NC	ND	NC	F	NC	NC	ND	ND	ND	NC	ND	ND	NC	ND	NC
ametoctradin + dimethomorph (Zampro)	45 + 40	0	ND	NC	NC	NC	NC	NC	ND	ND	F	NC	G	G	NC	NC	NC
azoxystrobin[3] (Quadris)	11	1	G	NC	G	NC	F	G	NC	NC	NC[R]	NC[R]	NC	NC	F	NC[R]	G
azoxystrobin + chlorothalonil (Quadris Opti)	11 + M	0	G	NC	G	NC	F	G	NC	NC	NC[R]	F	NC	NC	F	F	F
azoxystrobin + difenoconazole (Quadris Top)	11 + 3	1	ND	NC	G	NC	ND	ND	ND	ND	ND	F	ND	ND	F	F	ND
chlorothalonil[6] (Bravo/Terranil/ Equus)	M	0	G	NC	G	NC	NC	G	NC	NC	F	F	NC	NC	F	F	G
cyazofamid (Ranman)	21	0	NC	NC	NC	NC	NC	NC	ND	NC	G	NC	F	NC	NC	NC	NC
cyflufenamid (Torino)	U6	0	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	E	NC
cymoxanil (Curzate)	27	3	NC	NC	NC	NC	NC	NC	ND	ND	F	NC	F	NC	NC	NC	NC
cyprodinil + fludioxonil (Switch)	9 + 12	1	ND	NC	F	NC	ND	ND	NC	NC	NC	F	NC	NC	F	F	NC
difenoconazole + cyprodinil (Inspire Super)	3 + 9	7	ND	NC	P	NC	NC	ND	NC	NC	NC	F	NC	NC	F	F	ND
dimethomorph (Forum)	40	0	NC	NC	NC	NC	NC	NC	NC	NC	P	NC	P	NC	NC	NC	NC
famoxadone[3] + cymoxanil (Tanos)	11 + 27	3	ND	NC	P	NC	NC	ND	NC	NC	F	NC	ND	NC	NC	NC	NC

[1] Efficacy ratings do not necessarily indicate a labeled use for every disease.

[2] Control cucumber beetle from emergence to fruit set; bactericidal sprays alone are not effective.

[3] Curative activity; locally systemic.

[4] Systemic.

[5] When used in combination with chlorothalonil or mancozeb, gives increased control.

[6] Contact control only; no systemic control.

[8] Fixed coppers include: Basicop, Champ, Champion, Citoop, Copper-Count-N, Kocide, Nu-Cop, Super Cu, Tenn-Cop, Top Cop with Sulfur, and Tri-basic copper sulfate.

[9] Applications should begin at bloom; after symptoms are observed on watermelon fruit, it is too late to begin a copper spray program.

[10] Sulfur products include: Kumulus, Liquid Sulfur Six, Microthiol, Sulfur DF, and Thiolux.

[11] Check manufacturers label for compatibility with other products.

[P] Can be phytotoxic at temperatures above 90° F; read the label carefully.

[F] To prevent resistance in pathogens, alternate fungicides within a group with fungicides in another group. Fungicides in the "M" group are generally considered "low risk" with no signs of resistance developing to the majority of fungicides.

[R] Resistance reported in the pathogen.

TABLE 3-12. EFFICACY OF PRODUCTS FOR DISEASE CONTROL IN CUCURBITS (cont'd)

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fenamidone (Reason)	11	14	F	NC	ND	NC	NC	NC	ND	NC	F[R]	NC	F	NC	NC	NC	NC
fixed copper[P,6,9]	M	1	P	F	P	F	NC	F	NC	NC	P	P	ND	NC	P	P	P
fluopicolide (Presidio)	43	2	NC	NC	NC	NC	NC	NC	NC	NC	P[R]	NC	F	F	NC	NC	NC
fluopyram + tebuconazole (Luna Experience)	7 + 3	7	ND	NC	NC	NC	ND	NC	NC	NC	NC	G	NC	NC	NC	G	NC
fluopyram + trifloxystrobin (Luna Sensation)	7 + 11	0	ND	NC	F	NC	NC	NC	NC	NC	NC	F	NC	NC	NC	F	NC
kresoxim-methyl (Sovran)	11	0	ND	NC	ND	NC	ND	ND	NC	NC	ND	NC[R]	ND	NC	ND	NC[R]	ND
mancozeb (Dithane, Manzate, Penncozeb)[6]	M	5	F	NC	G	NC	NC	G	NC	NC	F	F	P	NC	F	P	G
mancozeb + fixed copper[6] (ManKocide)	M + M	5	P	F	P	F	NC	P	NC	NC	P	NC	P	NC	P	P	F
mandipropamid (Revus)	40	0	NC	NC	NC	NC	NC	NC	NC	NC	NC[R]	NC	F	P	NC	NC	NC
mefenoxam[4] (Ridomil Gold EC, Ultra Flourish)	4	0	NC	NC	NC	NC	NC	NC	F[R]	G[R]	NC	NC	F[R]	F[R]	NC	NC	NC
mefenoxam[3] + chlorothalonil[6] (Ridomil Gold/Bravo, Flouronil)	4 + M	0	F	NC	F	NC	NC	F	F[R]	F[R]	F[R]	F	F[R]	NC	F	F	F
mefenoxam[3] + copper[6] (Ridomil Gold/Copper)	4 + M	5	P	P	F	P	NC	P	F[R]	F[R]	F[R]	P	F[R]	NC	P	NC	P
mefenoxam[3] + mancozeb[6] (Ridomil Gold MZ)	4 + M	5	F	NC	F	NC	NC	F	F[R]	F[R]	F[R]	F	F[R]	NC	F	NC	F
myclobutanil[3] (Rally)	3	0	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	F	NC
penthiopyrad (Fontelis)	7	1	ND	NC	F	NC	ND	ND	NC	NC	NC	NC[R]	NC	NC	NC	F	NC
phosphonate[11] (Aliette, Agri-Fos, Phostrol, ProPhyte)	33	0.5	NC	NC	NC	NC	NC	NC	NC	NC	P	NC	NC	F	NC	NC	NC
potassium phosphite + tebuconazole (Viathon)	33 + 3	7	ND	NC	ND	NC	ND	ND	ND	ND	P	F	ND	ND	NC	F	NC
propamocarb (Previcur Flex)	28	2	NC	NC	NC	NC	NC	NC	NC	ND	F	NC	G	NC	NC	NC	NC
pyraclostrobin[3] (Cabrio)	11	0	G	NC	G	NC	NC	ND	NC	NC	NC[R]	NC[R]	P	NC	G	NC[R]	E
pyraclostrobin[3] + boscalid[3] (Pristine)	11 + 7	0	G	NC	F	NC	ND	G	NC	NC	NC[R]	NC[R]	P	NC	F	F	E
quinoxyfen (Quintec)	13	3	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	E	NC
sulfur[P,8,10]	M	0	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	G	NC
tebuconazole (Monsoon)	3	7	ND	NC	NC	NC	NC	ND	NC	NC	NC	F	NC	NC	NC	F	NC
thiophanate-methyl[4] (Topsin M)	1	1	F	NC	F	NC	F	F	NC	NC	NC	F	NC	NC	F	NC[R]	P
trifloxystrobin[3] (Flint)	11	0	G	NC	G	NC	ND	ND	NC	NC	NC[R]	NC[R]	NC	NC	G	NC[R]	G
triflumizole (Procure)	3	0	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	F	NC
zoxamide + mancozeb (Gavel)	22 + M	5	F	NC	F	NC	NC	F	NC	NC	F	F	P	NC	F	P	F

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TABLE 3-13. IMPORTANCE OF ALTERNATIVE MANAGEMENT PRACTICES FOR DISEASE CONTROL IN CUCURBITS

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Strategy	Alternaria leaf blight	Angular leaf spot	Anthracnose	Bacterial fruit blotch	Bacterial wilt	Belly rot	Cercospora leaf spot	Choanephora fruit rot	Cottony leak	Downy mildew	Gummy stem blight	Mosaic virus	Phytophthora blight	Plectosporium blight	Powdery mildew	Pythium damping off	Root knot	Target spot
Avoid field operations when leaves are wet	P	F	P	F	F	NC	NC	P	NC	P	P	NC	NC	ND	NC	NC	NC	NC
Avoid overhead irrigation	F	F	F	F	P	NC	P	NC	NC	F	F	NC	F	P	P	NC	NC	P
Change planting date from Fall to Spring[1]	G	P	G	P	P	F	G	F	F	G	G	F	F	F	F	G	G	G
Cover cropping with antagonist	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	F	NC
Crop rotation with non-host (2 to 3 years)	F	F	F	F	NC	P	F	NC	NC	NC	F	NC	F	F	NC	P	F	F
Deep plowing	P	NC	P	NC	NC	F	P	NC	NC	NC	F	NC	P	P	NC	P	F	P
Destroy crop residue immediately	F	P	F	P	P	P	P	NC	P	F	F	F	P	P	F	NC	F	P
Encourage air movement[2]	F	P	F	P	NC	NC	F	F	F	F	F	NC	NC	P	NC	NC	NC	F
Soil organic amendments[3]	ND	NC	ND	NC	NC	P	ND	NC	F	NC	ND	NC	P	ND	NC	F	F	ND
Insecticidal/horticultural oils[4]	NC	NC	NC	NC	F	NC	NC	NC	NC	NC	NC	F	NC	NC	F	NC	NC	NC
pH management (soil)	NC	NC	NC	NC	NC	NC	NC	NC	ND	NC	NC	NC	ND	NC	NC	ND	ND	NC
Plant in well-drained soil	NC	NC	NC	NC	NC	F	NC	P	F	NC	NC	NC	F	NC	NC	F	P	NC
Plant on raised beds	NC	NC	NC	NC	NC	P	NC	P	F	NC	F	NC	F	NC	NC	F	P	NC
Plastic mulch bed covers	NC	NC	NC	NC	NC	F	NC	P	F	NC	F	NC	F	P	NC	NC	NC	NC
Postharvest temperature control (fruit)	NC	NC	F	F	NC	F	NC	F	F	NC	F	NC	F	F	NC	NC	NC	NC
Reflective mulch (additional effect over plastic mulch)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	F	NC	NC	NC	NC	NC	NC
Reduce mechanical injury	P	P	P	P	F	P	P	P	P	NC	P	P	P	P	NC	NC	NC	P
Rogue diseased plants/fruit (home garden)	F	P	P	P	P	NC	P	P	P	P	P	F	F	NC	NC	P	F	P
Row covers (insect exclusion)	NC	NC	NC	NC	G	NC	NC	NC	NC	NC	NC	G	NC	NC	NC	NC	NC	NC
Soil solarization (reduce soil inoculum)	P	NC	P	NC	NC	F	P	NC	P	NC	P	NC	P	P	NC	F	P	P
Pathogen-free planting material	P	E	F	E	NC	NC	NC	NC	NC	NC	E	NC	NC	NC	NC	F	NC	NC
Resistant cultivars[5]	^	^	E	^	^	E	^	^	^	E	^	E	^	^	E	^	^	^
Destroy volunteer plants	F	F	F	F	F	NC	F	NC	NC	F	F	F	F	NC	F	NC	P	F

[1] Early planting reduces risk.

[2] Air movement can be encouraged by increasing plant spacing, orienting beds with prevailing wind direction and increasing exposure of field to prevailing wind.

[3] Soil organic amendments = cover crops; composted organic wastes.

[4] Insecticidal/Horticultural oil = Sunspray Ultra-Fine Spray Oil (Sun Company, Inc.), JMS Stylet oil; Safe-T-Side (Brandt Consolidated, Inc.); PCC 1223 (United Ag Products).

[5] Resistance available in some cucurbits.

^ No resistance available in cucurbits.