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Cucurbit Disease Management Strategies for 2013 T.A. Zitter Pl Path

Diseases of Cucurbits (pumpkins, cucumbers, muskmelons, watermelons, summer and winter squash, and even gourds) can be difficult to control because they are susceptible to so many diseases that can potentially destroy an entire field. Management strategies need to include the following:

1.) Begin with a resistant or tolerant Powdery Mildew (Fig 1) variety (IR) available for squash and pumpkins and some muskmelon and Downy mildew (Fig 7) varieties for cucumber. See Table 1. Since some varieties have only intermediate resistance, these can still benefit from the use of fungicide sprays.

Fig 1. Powdery mildew upper & lower leaf.

2.) Crop rotation is critical for reducing the number of diseases found in cucurbits, so a minimum of 2 years, with a 3yr rotation out of all cucurbits being preferred. Diseases for which rotation is an important criterion are:

A. Gummy Stem Blight (GSB)/also called Black rot (BR) (Fig.2).

Fig 2. Gummy stem blight (Blk rot) Pumpkin & B'nut. squash.

Foliar symptoms of GSB are rarely seen in NY on pumpkin, spaghetti squash or winter squash, but typical symptoms can appear on fruit in the field, which of course is too late to take corrective actions. BR is also a postharvest storage problem, especially for Butternut.

B. Plectosporium Blight (Fig.3) - this disease only affects Zucchini Squash and Pumpkins, with the soilborne inoculum surviving for at least 2 years.

Fig 3. Plectosporium on Pumpkin handle & fruit; leaf bottom.

C. Phytophthora Blight (Fig 4) – is the quintessential disease since it can infect multiple crops including cucurbits. In addition to rotation, water management is necessary to reduce standing water in fields (create waterways, subsoiling to remove hardpans, and use dome-shaped beds for bush-type crops).

Fig 4. Phytophthora blight on pumpkin fruit.

3.) Always purchase seed from a reputable seed company. Scab (Fig 5L, fungal) or Angular Leaf Spot (Fig 5R, bacterial) does not occur on a regular basis which suggests that seed may introduced the pathogen into the greenhouse or field.

Fig 5L, Scab/pumpkin; Fig 5R. Angular leaf spot/zucchini.

4.) If you choose to spray, then spray preventatively as determined by scouting for PM or following DM (Fig 6) tracking maps: http://cdm.ipmpipe.org/scripts/map.php (which monitors airborne spores of DM from Michigan, Ontario, Pennsylvania or New Jersey)

Fig 6. DM lesions on top, sporulation bottom; Upright curling of

5.) Opposite page provides fungicides for conventional, organic and home garden use. For commercial, select fungicides to be used for the entire season from those with different Modes of Action (MOA) - indicated by the Group Nos. Follow the label to avoid making sequential applications before alternating MOA. (Prepared JAN 2013 by T.A. Zitter, Dept. Plant Path. Ithaca, NY). Additional Cucurbit Disease Resource at: http://vegetablemdonline.ppath.cornell.edu/DiagnosticKeys/CucKey.html

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2013 PM Tolerant Pumpkin & Squash, DM Tolerant Cucumbers.

Table 1. Cucurbits with resistance:

Pumpkins – Large (25-45lbs)	Pumpkins – Sm (2-7lbs) and Pie	Pumpkins - Specialty
20 Karat Gold R, IR, Semi-bush	Cannon Ball H, IR, F1	Gold Dust R, S, IR, Semi-Bush,F1
Aladdin H, IR, F1	Chucky S, IR, Bush, F1	Half Pint S, IR, F1
Apollo H, IR, F1	Field Trip H, IR, F1	One Too Many R, IR
Captain Jack S, IR, F1	Iron Man H, IR, PhyT, F1	WeeeeeOne R, IR
Conestoga Giant S, IR, F1	Jack Sprat S, IR, Restricted, F1	
Super Herc H, IR, F1	Little Giant H, IR, F1	
Pumpkins – Medium (10-30lbs)	Mystic Plus H, IR, F1	
Charisma J. IR, F1	Prankster S, R, IR	
Gladiator H, X2, F1	Rockafellow S, IR, Semi-Bush, F1	
Magic Lantern H, IR, BWS	Touch of Autumn R, S, IR, Semi-Bush	
Magic Wand H, IR, F1		
Magician H, X2, IRZYMV		
Racer Plus PMR J, IR, F1, Semi-Bush		
Rival J, IR, F1		
Warlock H, IR, F1		

IR= Intermediate resistance, has PM resistance from 1 parent; X2 – has PM resistance from both parents; Phyt = Phytophthora tolerant; BWS = Bac. Wilt sus.; H = Harris or HMoran, J = Johnny's SS, R = Rupp, S = Siegers.

Winter Squash - Acorn	Winter Squash - Butternut	Winter Squash - Specialty
Celebration CU & R, IR, Bush, F1	Betternut 401 R, S, IR, Semi-Bush	Sweet Lightning R, S, IR, Semi-Bush
Harlequin CU & R, IR, Bush, F1	Betternut 900 R, IR, Semi-Bush	Bonbon Buttercup H, IR, Semi-Bush
Table Star R, IR, Bush, F1	Bugle R, IR	Bush Delicata CU, H, IR
Table Treat R, IR, Bush, F1	Chieftain H, IR, Bush, F1	
Autumn Delight H, S, IR, Semi-Bush, F1	Butterfly H, IR, F1	
Royal Ace PM H, IR, Semi-Bush, F1		

Summer Squash – Yellow	Summer Squash - Zucchini	Sum. Squash Grey Zucchini
Delta H, IR, Semi-crook, F1	Spineless Perfection, H, S, IR, F1	Hurakan H, IR, F1
Cheetah H, IR, Str-neck., F1	Reward H, IR, F1	
	Felix H, IR, F1	

Downy Mildew Resistant Cucumber hybrids (Rupp, Seedway, Siegers, Stokes)
SV3462CS – vigorous, Uniform Dk. Gr., High Res. for Scab, Ang LS, Anth; IR for DM and PM
Sv4719CS – Mod. Vigorous, Uniform Dk. Gr., HR for Scab, Ang LS, Anth; IR for DM and PM

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ABCs **of Fungicides for Cucurbits 2013** - T. A. Zitter

Numbers used before or after the Product (registered NYS) refer to fungicides with different MOA, followed by preharvest interval. [FRAC No.ie 40 Product 4PHI] See: http://vegetablemdonline.ppath.cornell.edu (JAN 2013) (Prepared by T. A. Zitter, Department of Plant Pathology, Ithaca, NY)

Fungicides (Conventional, Organic, and Home = Garden) are for all cucurbits unless noted. **Systemic** fungicides are in **Bold**, and protectants include: *chlorothanonil*, *sulfur*, *mancozeb*, *copper*, or combination sold as ManKocide (*mancozeb + cu hydroxide*).

A.) Powdery Mildew (PM) - occurs every year, so use a IR variety if available for squash or pumpkins. Beginning when lesions are 1st detected inside the canopy on lower leaves (top or bottom). PM sprays

- 13Quintec3 (*quinoxyfen*) (not registered on cucumber or summer squash); begin usage early in the PM cycle then alternate with one of the following:
  - M2Sulfur0 (good protectant, alone or tank-mixed with Quintec); Organic = Kumulus or OLP
  - 3**Procure**0 (*triflumizole*) at Hi rate 8 oz + M5Bravo0 (or OLP) or 3**Rally**0 (*myclobutanil*) at Hi rate 5 oz + M5Bravo0 (or OLP) (NOTE: both **Procure** and **Rally** are in the same fungicide group, choose 1)
  - Consider 11+7Pristine0 (*pyraclostrobin + boscalid*), 3+9**Inspire Super**7 (*difenoconazole + cyprodinil*), or †9+12**Switch**1
  - Protectants & Organic = NAJMS Stylet0; M1 coppers0 like Champ WG, NAM-Pede0; MMilStop0 or OLP; Home = Bonide Fung-onil, Bonide Copper, Trilogy XL, or OLP

Note on PM: The strobilurin (Group 11) fungicides are not listed due to fungicide resistance for PM, and include Cabrio, Flint, Quadris, Quadris Opti, Sovran, Tanos, etc.

B.) Gummy Stem Blight (GSB)/also called Black rot - occurs most seasons when moisture is adequate after fruit set (end of July or beginning of Aug), and if rotation of less than 2 years is practiced.

GSB sprays should include:

- M3Penncozeb5 (or OLP) or M5Bravo WS0 (or OLP)
- 3+9**Inspire Super**7 (GSB) or †9+12**Switch**1
- Protectants & Organic = M1 coppers0 like Champ WG; Home = Bonide Fung-onil, Bonide Copper.

Note on GSB: The strobilurin (Group 11) fungicides are not listed due to fungicide resistance for GSB, and include Cabrio, Flint, Quadris, Quadris Opti, Sovran, and Pristine. Also 1 + Prot.**Topsin M**1 (or OLP) are no longer effective for GSB.

C.) Plectosporium - if disease has been previously found in Zucchini Squash or Pumpkins, and less than 2 year rotation is practiced, and if July-August rains occur (wet soils) then sprays (for above crops only) should include:

- M5Bravo Ultrex0 2ee
- 3+9**Inspire Super**7 (Plectosporium)
- 11Quadris1 , 11+3Quadris Top1, 11Cabrio0, 11Flint0 (but don't rely on sprays of these products for PM or GSB control)

Note on Plectosporium: Rare for Organic or Home production.

D.) Phytophthora (P) and Downy Mildew (DM) – if P has previously occurred on your farm, you must utilize disease management practices (see over).

IF DM is reported on tracking maps: http://cdm.ipmpipe.org/scripts/map.php (which monitors airborne spores of DM from Michigan, Ontario, Pennsylvania or New Jersey), **Then** the

Top 5 DM/P choices used "preventatively"

- *22+M3*Gavel 50WG5 (*zoxamide + mancozeb*) (not Pumpkin or W. Squash) (DM, P)
- *43**Presidio**2 (*fluopicolide*) (DM, P) + must use protectant
- *28**Previcur Flex**2 (*propamocarb*) (DM) + protect.
- 21Ranman 400SC0 (*cyazofamid*) (DM, P) + protect.
- 11+27**Tanos 50WG**3 (*famoxadone + cymoxanil*) (DM, P suppression) + protectant

Top 4 DM choices used "after disease is already present"; The same four fungicides listed above less Gavel 50WG.

Note on Phytophthora blight: Disease is rare for Organic or Home, but DM can occur in both. Organics = M1 coppers0 like Champ WG; Home = Bonide Fung-onil, Bonide CU.

E.) If SCAB occurs: M5Bravo WS0 or OLP; M1*fixed coppers*0, (per label) M3+M1ManKocide5 , M3*mancozeb*5 (all); 4+M5**Ridomil Gold** Bravo0; Organic = Basic CU 53 or OLP; Home = Bonide Cu

F.) Angular leaf spot bacterial (ALS) = M3+M1ManKocide5, all coppers; Organic = all OMRI coppers; Home = Bonide CU or OLP.

See:http://vegetablemdonline.ppath.cornell.edu/NewsArticles/Cuc_OverviewRoster.pdf for complete roster and OLPs.

Key: MOA= Modes of Action; OLP= other labeled product and/or formulations are available; M = multi-site activity and mixing partner to reduce risk of developing fungicide resistance; NA= not assigned; *= Restricted to use by registered applicators; † = Not for use on Long Island

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Complete Cucurbit Fungicide Roster for 2013

See: http://vegetablemdonline.ppath.cornell.edu for more updates (underlined = labeled in NYS) [FRAC No. 40 Product 4DTH]

T. A. Zitter, Dept. Plant Pathology Ithaca, NY (JAN 2013)

Systemic fungicides are in BOLD, Protectants are listed first. Fungicides are for use on all cucurbits unless otherwise noted.

Protectants/Mixing Partners (Diseases listed on label or by 2ee)

- M5 *chlorothalonil*[0] (limits see labels) [Bravo WS & Ultrex (**Plectosporium 2ee**), Equus DF, Echo 720] (these are given first since they have the most complete labels for all vegetables); also Bravo Zn, Chloro. 720, Initiate 720 & Zn; Equus 720 & Zn; Echo 90DF (**An, Alt LB, DM, GSB, Scab, PM**)
  M3 *mancozeb*[5] (limits see labels) Dithane M45, DF, F-45; Manzate Pro-Stick, Penncozeb 4FL, 75DF, 80WP **(An, Alt LB, DM, GSB, Scab)**
- M1 *fixed copper*[0] (see limits now set on newer labels) Badge SC, Badge X_2 OMRI, Basic Copper Sulfate & 53 OMRI, Champ WG OMRI **&** Dry Prill & Formula 2, C-O-C-S, Cueva OMRI, Cuprofix, Kentan DF, Kocide 101, 2000, 3000, Mastercop, Nordox 75WG, OMRI, Nu-Cop 50WP OMRI, 3L, HB, **(AngLS, An, Alt, DM, PM, GSB, Scab per label, and by 2ee PhyBlt).** Also ManKocide (limit 24 lb) **(for AngLS, AltLS, DM, PM, GSB, Scab, 2ee PhyBlt)**
- Bio *Bacillus subtilis*[0] = Serenade MAX **(PM, GSB, DM), or** Rhapsody AS[0], **both OMRI**
- Bio *Bacillus pumilus*[0, OMRI] = Sonata **(PM, DM)**
- M *K bicarbonate*[0or1, OMRI] = Armicarb, MilStop, Kaligreen[1] **(PM)**
- M2 *sulfur*[0] = Kumulus OMRI, Micro Sulf OMRI, Microthiol Disperss OMRI, Sulfur 6L, That F Sulfur **(PM)**

Group 11 Strobilurins and others (*Strobilurins*=Translaminar, *are no longer effective for *PM*, because of widespread resistance, and should not be relied upon for *DM* or *GSB**)

- 11 Quadris[1](limit 92.3 fl oz) (*azoxystrobin*) **(Plecto)** 11+M5 Quadris Opti[1] (limits see label) (*azoxystrobin + chlorothalonil*), 11+3 Quadris Top[1] (azoxystrobin + difenoconazole) (limit 56 fl oz) **(Alt L Blt, Anth, Belly rot, Plecto, *PM*, *DM*, *GSB*)**
- 11 Flint[0] (*trifloxystrobin*) (limit 16 oz) **(*PM*, *DM*, Plectosporium)**
- 11 Cabrio[0] (*pyraclostrobin*) (limit 64 oz) **(Alt L Blight, Anth, Plectosporium, *PM*, *DM* *GSB*)**
- 11 Sovran[0] (*kresoxim-methyl*) (limit 4 appl.) **(*PM*, *GSB*)**
- *† 11 Reason[14] (*fenamidone*) (limit 22 fl oz) **(Alt LB, *DM*)**
- 11 + 27 Tanos[3] **(***famoxadone + cymoxanil***)** (limit 72 oz) **(Alt L. Blt., Anth, DM)**
- 11 + 7 Pristine[0] (*pyraclostrobin + boscalid*) (limit 74 oz) **(Alt L. Blt, Anth, *PM* *DM*, *GSB*)**

PM Preferred Sprays – "USED Preventatively"

- 13 Quintec[3] **(***quinoxyfen***)** (see label limits fl oz) **(Winter squash, Pumpkin, Gourds, Melons , Wmelons only) (for PM only)**
- 3 **Rally**[0] **(***myclobutanil***)** (limit 1.5 lb) **(*PM* *Resistance concern, use highest rate*)**
- *3 **Procure**[0] **(***triflumizole***)** (limit 40 fl oz) **(*PM* *Resistance concern, use highest rate*)**
- M2 *Sulfurs*[0] (limits) (Kumulus OMRI, Microthiol Disperss OMRI, Micro Sulf OMRI Sulfur 6L, That) **(PM)**
- M Armicarb[0], MilStop[0, OMRI], Kaligreen[1, OMRI] **(PM)**
- M Trilogy[0, OMRI] (*neem oil*), **(PM)**
- M Mineral oils[0] (JMS Stylet Oil OMRI) **(PM)**

PM Alternative Sprays & Multiple Disease Control

- 3+9 **Inspire Super**[7] **(***difenoconazole + cyprodinil***)** (limit 80 fl oz) **(PM, Alt, GSB, Septoria, Anthrac, Plectosporium)**
- 9 + 12 † **Switch 62.5WG**[1] **(***cyprodinil + fludioxonil***)** (limit 56 oz) **(Not on LI; only there for Onions and Strawberries) (Alt LB, GSB, PM)**
- 7 Endura[0] (*boscalid*) (limit 26 oz) (Alt LB, GSB, Res PM)
- 7 Fontelis[1] (*penthiopyrad*) (limit 67 fl oz) (PM, Altn, GSG, Sclerotinia stem rot)
- 7+3 Luna Experience[7] (*fluopyram + tebuconazole*) (limit 34 fl oz) (PM, Altern LS, GSB, Belly rot, Anthracnose)
- 7 Luna Privilege[0] (*fluopyram*) (limit 13.7 fl oz) (PM, GSB, Gray mold, Altern LS)
- 7+11 Luna Sensation[0] (*fluopyram + trifloxystrobin*) (limit 27.1 fl oz) (PM, Gray mold, Altern. LS, Anth)
- 1+ Prot **Topsin M**[1] (OLP) (limits 2 lbs.) tank-mix with protect. (*PM*, *GSB*, Anth, Belly rots (Rhiz and Fus)

DM and Phytophthora Options (# = DM used "preventatively" or &=use "after disease is present")

- *22 + M3 #Gavel[5] (limit 16 lbs.) (*zoxamide + mancozeb*)**, (DM, Phytoph) (not P or WS)**
- 11 + 27 #& **Tanos**[3] **(***famoxadone + cymoxanil***)** (limit 72 oz) **(Alt LB, An, DM, Phytoph blt)**
- *28 #& **Previcur Flex**[2] (limit 6 pts) **(***propamocarb* **+ protectant), (DM, Pythium root rots)**
- 21 #& Ranman[0] (limit 16.5 fl oz) **(***cyazofamid***), (DM, Phytoph.)**
- *43 #& **Presidio**[2] (limit 12 fl oz) **(***fluopicolide***) (DM, Phytoph. Blt)**

Others listed for DM and Phytophthora

- 27 **Curzate 60DF**[3] **with protectant (DM)**
- M5 + 33 Catamaran [1] **(***phosphoric acid + chlorothalonil***)** (limit 50 pts.) **(An, DM, GSB, Altern LS, Scab)**
- 40 Revus[0] (*mandipropamid*) (limit 32 fl oz) (Suppression only for both DM and Phytop blight)
- 40 **Forum**[0] **(***dimethomorph***) (limit 30 fl oz), (DM, Phytoph)**
- 33 **Aliette**[12hrs] **(***fosetyl-Al***) (limit 7 applic) (DM, Phytoph)**
- *† 11 Reason[14] (*fenamidone*), (limit 22 fl oz) **(*DM* only)**
- 4 + M5 **Ridomil Gold** Bravo[0]) (limit see label) **(*DM* resistance concern)**
- 33 Agri-Fos[0], *Fosphite; Fungi-Phite, *Kphite, Phostrol, ProPhyt, Rampart, *Resist 57 (*phosphorous acid*) (limits see labels) (DM, Phytophthora)
- M Prev-Am[0] (*borax*) (DM)

SCAB Products on labels

- M5 Bravo[0] or OLP (limits see labels)
- M1 some coppers[0, OMRI], ManKocide (limit 24 lb)
- M3 mancozeb[5] (limits see labels)
- 4 + M5 **Ridomil Gold** Bravo[0] (limits see label)

OTHER Products (Pythium)

- 4 **Ridomil Gold**[0], 4 **Twist**[0], **Ultra Flourish (***mefenoxam***)** (see limits on label)**; (Pythium root rot)**
- Bio Contans[0] (*Coniothyrium*) (White mold)

GREENHOUSE Usage (Specified on label)

- Bio Actinovate SP[0 OMRI] (*S. lydicus*) Gr Hs drench or foliar application (Soilborne fungi and foliar fungi); Bio Actino-Iron OMRI (for soilborne fungi in Gr. Hs. potting mix)
- *28 **Previcur Flex**[0] **(***propamocarb* + protectant**), (***Pythium, Phytoph* **see label)**
- 3 **Procure** [0] **(***triflumizole***) (all) PM**
- 17 Decree[0] (*fenhexamid*) (Cucumber only) (Gray mold)
- Bio Serenade MAX[0, OMRI] **(PM, GSB, DM)**
- Bio Sonata[0, OMRI] **(PM, DM)**
- Bio Rhapsody AS[0, OMRI] **(PM)**
- M Armicarb[0], Milstop[0, OMRI] Kaligreen[1, OMRI] **(PM)**
- M M-Pede[0], OMRI (*K salts of fatty acids*), **(PM)**
- M1 Badge SC, Badge X_2 OMRI, Champ WG OMRI, also Dry Prill & Formula 2F (assorted dis.), C-O-C-S WDG, Cueva, Cuprofix Ultra, Kentan DF, Kocide (assorted dis.), Nordox 75WB, Nu-Cop 50WP OMRI.
- Bio PlantShield[0. OMRI] (*T. harzianum*), (soil fungi); RootShield Granules OMRI Hydroponic Cucumber.
- M JMS Stylet Oil[0, OMRI] **(PM, insects)**

Current OMRI Listed Products & Reg. In NYS

- Bio Actinovate AG, SP[0] (*Steptomyces lydicus*) Soilborne: (*Pythium, Rhizoctonia, Phytophthora, Fusarium, Verticillium*); Foliar: (PM, *Botrytis, Alternaria*)
- Bio Actino-Iron[0] (*S. lydicus*) Biological soil additive
- M1 Badge X_2[0], Basic Copper 53 (Scab), Champ WG, Cueva Nordox 75WG, Nu Cop 50WP (*coppers*)
- Bio Mycostop[0] (*S. griseoviridis*) **(root dis.)**
- SAR Regalia EC[0] (*Reynoutria*), **(PM)**
- M M-Pede[0] (*soap*, PM); Trilogy[0] (*neem*), (PM, DM)
- M MilStop[0], Kaligreen[1] (*K bicarbonate*) (PM)
- M2 Micro Sulf[0], Kumulus DF, Microthiol Dis (all for PM) (*sulfur*)
- M Oxidate[0] (*hydrogen peroxide*)
- Bio Rhapsody AS[0]; Serenade ASO and MAX, Cease (*Bacillus subtilis*), Sonata (*Bacillus pumilus*)
- M Organic JMS Stylet Oil[0] **(***mineral oil,* **PM, white flies)**
- Bio T-22 HC PlantShield[0], RootShield **(***Trichoderma***)**
- Bio Contans[0] **(***Coniothyrium***) (White mold)**

KEY: Orange = Sulfurs; Violet = Group 11 strobilurins; Blue = phosphorous acid salts; Silver = chlorothalonils; Green = fixed coppers; * Restricted to registered applicators; †Not for use on Long Island. Every effort has been made to provide correct, complete, and up-to-date information at the time of this presentation/publication. Trade names used are for convenience only. No endorsement of products intended, nor is criticism of unnamed products implied. These recommendations are not a substitute for pesticide labeling. Always read the product label before applying any pesticide.