

DISEASE PREVENTION PROGRAM FOR CERTAIN VEGETABLE CROPS

David B. Langston, Jr.
Extension Plant Pathologist - Vegetables
University of Georgia

BEANS: (Snap & Pole)

1. Plant following rye or other grain crop.
2. Bottom plow using cover boards to place litter in bottom of furrow.
3. Use nematicide if needed.
 - a. Fumigants:
 1. Telone II @ 4.5 - 15 gals injected beneath the row.
 - * 2. Vapam @ 40 - 100 gals soil incorporated.
 - * 3. Telone C-17 @ 12 - 20 gals injected beneath the row.
 - * Multipurpose fumigants
 - b. Non-Fumigants:
 1. Mocap 10G @ 20 - 30 lbs. (Row)
 2. Mocap EC @ 1 - 1 ½ qts. to 2 qts. (Row)
4. If a multipurpose fumigant is not used, use an in-furrow fungicide:
 - a. Ridomil Gold PC (Apply 10 lbs. of Ridomil Gold PC per 13,000 linear feet of row at planting. Adjust the delivery tube so the granules are mixed with the soil surrounding the seed).
 - b. Terraclor 10G @ 10 - 15 lbs./8,340 ft. pole or 14,500 ft. bush.
 - c. Terraclor 75WP @ 2 lbs./10 gals./8,430 ft. pole or 14,500 ft. bush.
5. Avoid dirtng cultivations during hot periods that may promote ashy stem blight.
6. Spray for rust and Alternaria pod stippling with foliar fungicide when 1st trifoliates fully expand, or by 1st flower, **depending on weather conditions and disease pressure. We rarely have problems on snap beans but pole beans do get rust.**
 - a. chlorothalonil 720 @ 1 3/8 - 3 pts./A.
7. Nova @ 4.0 - 5.0 oz can be used when pods begin to develop for rust or Rhizoctonia tip blight (see label).
8. Apply Sclerotinia white mold materials at 25-50% bloom **depending on weather conditions and disease pressure.**
 - a. Rovral 4F @ 1.5-2.0 pts/A
 - b. Topsin-M 70W @ 1.0-1.5 lbs/A
9. Don't confuse Sclerotinia white mold with Pythium pod blight. Pythium occurs during the summer months when temperatures are relatively high 77-86° F while Sclerotinia white mold is favored by cooler temps (<68° F).

CABBAGE:

1. Purchase disease-free seed and transplants. Inspect plants for black rot.
2. Three-year rotation with any crucifer crop (cabbage, collards, turnips, etc.). Do not plant to field where wild mustard and turnips exist.
3. Incorporate Nematicur 15G @ 12 - 20 lb/A (38-40" row spacing) or use Telone II @ 10 - 15 gal/A for nematodes.
4. Use Terraclor 75WP in transplant water for summer and fall plantings @ 2 lbs./100 gals. water for clubroot and 15 - 20 lbs./100 gals for wirestem as soil drench at or immediately after seeding. Ridomil Gold EC @ 1.0 - 2.0 pts/A can be used to prevent *Pythium*.
5. Use 1500 lb/A hydrated lime in clubroot infested fields low in pH.
6. Spray with chlorothalonil 720 @ 1 ½ pts./A. or Maneb (see label) alternated with Ridomil Gold/Bravo @ 1 ½ lbs for Alternaria and downy mildew.
7. Quadris @ 6.2 - 15.4 fl oz may now be used for Alternaria and wirestem and should be rotated with either chlorothalonil, Maneb or Ridomil Gold Bravo for Alternaria.
8. Aliette @ 2 - 5 lbs. is registered for downy mildew. (Do not mix with copper fungicides).
9. Avoid working fields when foliage is wet to inhibit black rot spread. Copper materials are labeled for black rot but will only serve to limit the spread of disease.
10. Rotate or deep turn for *Sclerotinia* (Raisin Head) control.

CANTALOUPE:

1. Do not follow cucurbit crops (cucumber, cantaloupe, watermelon, & etc.).
2. Destroy litter from previous crop & deep turn.
3. Treat for nematodes with Telone II or methyl bromide.
4. Purchase disease free transplants (see Bacterial Fruit Blotch Guidelines).
5. Spray as soon as true leaves fully expand with Topsin M @ 8 ozs. + Maneb or Mancozeb (see label) alternated with chlorothalonil (1.5 -2 pt/acre) or Ridomil Gold/Bravo @ 1 ½ - 2 lbs./A. Spray every 7-14 days based on disease pressure.
6. Quadris @ 11- 15.4 oz/Acre for gummy stem blight, powdery mildew, anthracnose and Alternaria. Gummy stem blight resistance to Quadris is widespread in Georgia therefore Quadris should not be relied on for control of gummy stem blight.
7. Flint @ 1.5 - 2.0 oz/Acre or Nova @ 4.0 - 5.0 oz/A for powdery mildew. You may wish to tank-mix Nova with chlorothalonil or mancozeb to broaden disease control spectrum. Sulfur is also effective on powdery mildew but may cause foliar burn.

NOTE: ALWAYS ROTATE TO EITHER CHLOROTHALONIL OR MANEB/MANCOZEB PRODUCTS FOLLOWING NO MORE THAN TWO SPRAYS OF QUADRIS, FLINT OR NOVA.

8. Ridomil Gold products are the only labeled materials that may be effective on crown rot (*Phytophthora capsici*).

CARROTS:

1. Plant on well drained soil.
2. Use a good rotation (do not plant following tobacco).
3. Deep turn soil.
4. Treat for nematodes:
 - Telone II @ 9-12 gals/acre,
 - Telone C-17 @ 10.3 to 17.1 gals/Acre, OR
 - Metam Sodium @ 37.5-75 gals/Acre
5. Soil disease control:
 - Ridomil Gold EC @ 1 to 2 pts incorporated in top 2 inches for *Pythium*.
6. Spray for foliage diseases, if they occur:
 - chlorothalonil @ 1 ½ to 2 pts/Acre

(Alternaria + Cercospora)

 - Quadris @ 9.2 - 20.3 fl oz (Alternaria + Cercospora)
 - Rovral @ 1 to 2 pts/Acre (Alternaria)
 - Ridomil Gold/Bravo @ 1 ½ to 2 lbs/Acre (Alternaria, Pythium, Cercospora)
7. Bacterial leaf blight is very similar in appearance to Alternaria leaf blight but will not respond to fungicide sprays.

COLLARDS AND KALE:

1. Do not plant following other crucifer crops or land where wild turnips are present. (Use a three year rotation).
2. If transplanting, make sure the plants are free of black rot.
3. Bottom plow using coverboards to direct litter to the bottom of the furrow.
4. Use 15 - 20 lbs./100 gals of Terraclor 75WP as soil drench at or immediately after seeding for wirestem.
5. Begin spray program as soon as leaves are about the size of a dime.
6. Use copper containing materials to reduce the spread of black rot.
7. Maneb 80W and Maneb 75DF are labeled for collards and kale for foliar disease control (see supplemental label).
8. Do not irrigate from a water source where field drainage from a previous crucifer crop was grown the year before.
9. Aliette is registered for downy mildew at 2 - 5 lbs./A. (Do not mix with copper fungicides).
10. Quadris @ 6.2 - 15.4 fl oz may now be used for Alternaria leaf spot and should be rotated with Maneb.

CUCUMBERS:

1. Do not follow cucurbit crops (cucumber, cantaloupe, watermelon, & etc.).
2. Destroy litter from previous crop and deep turn.
3. Treat for nematodes, if root-knot or reniform are present.
 - a. Fumigants (Telone II, 4.5 - 15 gals.) Row.
 - b. Non-fumigants (Mocap 10G, Mocap EC).
4. Shape beds for good drainage.
5. Spray program should begin as soon as 1st true leaves fully expand.
6. Spray seedlings and bed surface after last cultivation and just before vines start to run with Quadris @ 12-15 oz/acre for belly rot.
7. Spray every 7 to 10 days with Topsin M @ 8 ozs. + Maneb or Mancozeb (see label) alternated with chlorothalonil (1.5 - 2.0 pt/acre) or Ridomil Gold/Bravo @ 1 ½ - 2 lbs./A.
8. Quadris @ 11- 15.4 oz/Acre for gummy stem blight, powdery mildew, anthracnose, and Alternaria. Gummy stem blight resistance to Quadris is widespread in Georgia therefore Quadris should not be relied on for control of gummy stem blight.
9. Flint @ 1.5 - 2.0 oz/Acre or Nova @ 4.0 - 5.0 oz for powdery mildew. You may wish to tank-mix Nova with chlorothalonil or mancozeb to broaden disease control spectrum. Sulfur is also effective on powdery mildew but may cause foliar burn.

NOTE: ALWAYS ROTATE TO EITHER CHLOROTHALONIL OR MANEB/MANCOZEB PRODUCTS FOLLOWING NO MORE THAN TWO SPRAYS OF QUADRIIS, FLINT OR NOVA.

10. Ridomil Gold products are the only labeled materials that may be effective on crown rot (*Phytophthora capsici*).

EGGPLANT:

1. Treat with Nematicur 15G @ 13.4 lbs./A (36" rows) or Telone products for nematodes
2. Drench with Captan 50W (3lbs/100 gals) in plant beds before transplanting.
3. Avoid areas where southern blight has been a problem.
4. Several copper compounds are available for use on eggplant to suppress foliar pathogens. Check the GA Pest Control Handbook for specific materials and rates.
5. Maneb and Manex are also registered for use on eggplant. Use 1.5-2.0 lb/Acre of Maneb and 1.2-1.6 qt/Acre of Manex. These may be tank mixed with copper compounds for broad spectrum disease management. An example which is often used is 2.0 lbs Maneb mixed with 2.0 lbs Kocide 101 per acre. Maneb and Manex have a 5 day pre-harvest interval.
6. The label for copper and Maneb and Manex sprays indicates to begin

applications prior to disease development and maintain a spray schedule of 7-10 days. I would recommend a 7 day schedule during periods of cool, wet, overcast weather. A 10 day schedule may be used under very hot, dry conditions.

7. Quadris @ 6.2-15.4 fl oz/A is now labeled for powdery mildew and Anthracnose. Rotate Quadris with Maneb or Manex for resistance management.

LIMA BEAN:

1. Plant following rye or other grain crop. Avoid following other legumes.
2. Bottom plow using cover boards to place litter in bottom of furrow.
3. Use nematicides if needed.
4. Apply Ridomil Gold EC @ 1.0 - 2.0 pt/A for Pythium.
5. Foliar sprays of Top Cop at 1.0 - 1.5 lb/A are labeled for most foliar diseases and may be initiated when plants are 5 inches tall.
6. Topsin M @ 1.0 - 2.0 lb/A may be used to control *Sclerotinia*, *Botrytis*, and anthracnose while Rovral 4F @ 1.0 - 2.0 pt/A is mainly for *Sclerotinia* and *Botrytis*. Begin sprays at 25 - 50% bloom and/or when conditions are favorable for disease development. Spray every 7 - 14 days depending on weather and disease severity.

ONIONS: (Direct Seeded & Transplants)

1. Plant following rye or other grain crop. Use a 3-year rotation.
2. Bottom plow using coverboards to direct litter to bottom of furrow.
3. Treat for nematodes if root-knot or sting are present. Use Telone II @ 9 - 15 gals./A or Telone C-17 @ 10.3 to 17.1 gals/Acre (Broadcast injection).
NOTE: Observe the 3-week waiting period.
4. Use Telone C-17 @ 10.3 to 17.1 gals/Acre (Broadcast injection) or metam sodium @ 37.5 - 75 gals/A (soil incorporated or chemigated) for pink root.
5. Direct seed from a reliable seed source (beds or field).
6. Spray beds or rows with Ridomil Gold EC preplant to reduce damping-off if Pythium may be a problem, specifically if you don't fumigate.
7. Spray with chlorothalonil 720 as soon as 2 leaves are visible @ 2 - 3 pts./A (see label) in enough water to wet the plants. Alternate or mix chlorothalonil with Mancozeb and copper products **depending on disease pressure and presence of bacterial pathogens**. Use foliar sprays on a 7-10-14 day schedule depending on weather conditions and crop growth. Use Ronilan DF as per label (*Botrytis*). Use Rovral 50W as per label (purple blotch). Quadris @ 6.2 - 15.4 fl oz is now labeled for purple blotch.
8. Switch @ 11.0 - 14.0 oz/A is now labeled for control of *Botrytis* leaf blight and purple blotch. Please note the 12 month plant back restriction on the label.
9. Ridomil Gold/Bravo may be used when downy mildew is a threat.

PEPPER:

1. Purchase certified transplants or grow own from seeds which have been checked by the Georgia Department of Agriculture for bacterial spot.
2. TSWV resistant lines are now available if desired.
3. Plant following rye or other grain crop.
4. Deep turn soil.
5. Treat for nematodes if needed. Telone II for Bell and Non-Bell and Nemacur 15G @ 9 - 13.3 lbs. (36 inch rows) for Non-Bell.
6. Use Terraclor 75WP in transplant water @ 3 lbs./100 gals for stem rot.
7. Spray with copper tank mixed with Maneb 75 DF or 80 WP (see label) immediately following transplanting for bacterial spot or use bacterial spot resistant cultivars.
8. Spray every 7 to 10 days throughout the growing season.
9. Quadris is now labeled for both bell and non-bell pepper for control of Anthracnose and powdery mildew. Rotate Quadris with Maneb products for resistance management.
10. For *Phytophthora capsici*, spray 3-4 applications of Ridomil Gold Copper 2.5 lbs. every 10-14 days. Ridomil Gold EC may be applied to the soil. See label. Pepper lines resistant to *Phytophthora capsici* have shown promise in North Carolina ('Paladin', 'Consul', 'Reinger' and some Harris Moran numbered varieties).

PUMPKINS:

1. Do not follow cucurbit crops (cucumber, cantaloupe, watermelon, and etc.).
2. Destroy litter from previous crop and deep turn.
3. Treat for nematodes. Fumigant (Telone II, 4.5 - 15 gal. row).
4. Shape beds for good drainage.
5. Spray program should begin as soon as 1st true leaves fully expand.
6. Spray every 7 to 10 days with Topsin M @ 8 ozs. per acre plus Maneb (see label). Alternate with chlorothalonil (1.5 - 2.0 pt/acre) Ridomil Gold/Bravo @ 1 ½ - 2 lbs. per acre every 14 days for Downy mildew.
7. Quadris @ 11- 15.4 oz/Acre for gummy stem blight, powdery mildew, anthracnose, and Alternaria. Gummy stem blight resistance to Quadris is widespread in Georgia therefore Quadris should not be relied on for control of gummy stem blight.
8. Flint @ 1.5 - 2.0 oz/Acre or Nova @ 4.0 - 5.0 oz for powdery mildew. You may wish to tank-mix Nova with chlorothalonil or mancozeb to broaden disease control spectrum. Sulfur is also effective on powdery mildew but may cause foliar burn.

NOTE: ALWAYS ROTATE TO EITHER CHLOROTHALONIL OR MANEB/MANCOZEB PRODUCTS FOLLOWING NO MORE THAN TWO SPRAYS OF QUADRIIS, FLINT OR NOVA.

9. Ridomil Gold products are the only labeled materials that may be effective on crown rot (*Phytophthora capsici*).

SOUTHERN PEAS:

1. Plant behind corn or other grain crop.
2. Deep turn using coverboards to bury litter.
3. Use fungicide/insecticide treated seeds.
4. Use Ridomil Gold PC at seeding to prevent damping-off.
5. Purchase virus-resistant or virus-free seeds.
6. Treat for nematodes. (Telone II at same rate for beans.)
7. Spray with Top Cop with Sulfur @ 2 qts. if leaf diseases appear.

SQUASH:

1. Purchase western grown seeds.
2. Treat for nematodes.
3. Plant as early as possible to avoid large aphid populations that vector .
4. Use one large field rather than several small fields to reduce hedge row or wooded exposure.
5. Use stylet oil for virus prevention in the fall. Apply as soon as leaves emerge and spray 2 - 3 times a week with 75 GPA @ 200+ psi until harvest.
6. Use Admire @ 16 - 24 oz/A (soil applied) or Provado @ 3.75 oz/A (foliar) to suppress whitefly which causes silverleaf.
7. Use chlorothalonil 720 @ 1 - 3 pts./A. every 7 to 10 days and alternate with Ridomil Gold/Bravo for downy mildew only if disease pressure is high..
8. Quadris @ 11- 15.4 oz/Acre for gummy stem blight, powdery mildew, anthracnose, and Alternaria. Gummy stem blight resistance to Quadris is widespread in Georgia therefore Quadris should not be relied on for control of gummy stem blight.
9. Sulfur, Flint @ 1.5 - 2.0 oz/Acre or Nova @ 4.0 - 5.0 oz/Acre for powdery mildew. You may wish to tank-mix Nova with chlorothalonil or mancozeb to broaden disease control spectrum. Sulfur may cause foliar burn under some conditions.

NOTE: ALWAYS ROTATE TO EITHER CHLOROTHALONIL OR MANEB/MANCOZEB PRODUCTS FOLLOWING NO MORE THAN TWO SPRAYS OF QUADRIIS, FLINT OR NOVA.

10. Ridomil Gold products are the only labeled materials that may be effective on crown rot (*Phytophthora capsici*).

SWEET CORN

1. Leaf blights including Helminthosporium and Rust. EBDC examples: Dithane, Penncozeb. Chlorothalonil products = Bravo, Echo and Equus. Tilt is a DMI fungicide which is recommended for control of corn foliar diseases. Quadris @ 6.2 - 9.2 fl oz/Acre is labeled for rust.

TOMATO

1. Purchase certified seed or transplants.
2. Use TSWV resistant varieties if appropriate (BHN 444 spring, BHN 555 fall)
3. Plant tomatoes behind grain crops such as corn, wheat or rye if possible.
4. Avoid fields with a history of bacterial wilt.
5. Treat for nematodes if needed.
6. Use 3 -5 lbs. of Terraclor 75WP per 100 gallons of water to suppress southern blight (*Sclerotium rolfsii*).
7. Do not prune or string tomatoes when plants are wet.
8. Fungal and bacterial diseases may be managed with the following compounds given that the spray delivery system provides good coverage.
 - A) Chlorothalonil - Bravo, Echo, Equus
 - B) Terranil Cu - chlorothalonil and copper premix
 - C) Ridomil Gold Copper - Ridomil Gold+ copper
 - D) EBDC's - Dithane, Manzate, Maneb, Mancozeb, Pencozeb
 - E) ManKocide - Mancozeb + copper (primarily bacterial spot, speck)
 - F) Quadris - mainly controls Early Blight, Late Blight, Septoria
 - G) Ridomil Gold MZ - (primarily for Late Blight)
 - H) Ridomil Gold/ Bravo - Ridomil Gold + chlorothalonil**(See Pest Control Handbook for more complete fungicide/bactericide options)**
9. Use fungicides every 7-10 days depending on disease pressure, weather conditions and plant growth rate.
10. Avoid transmitting Tobacco Mosaic Virus (TMV) to tomatoes by not using tobacco products in or near tomato fields.
11. Isolate fields from crops that harbor white flies which can transmit Tomato Yellow Leaf Curl Virus (TYLCV) and other gemini viruses. If TYLCV is identified, rogue all infected plants to reduce secondary spread. Examples of whitefly harboring crops: cherry tomato, cabbage, cucurbits, and potatoes.
12. Use calcium and boron sprays to help prevent blossom end rot.
13. Control insects which may cause physical damage and transmit virus diseases. Examples: Aphids, thrips, whiteflies.

TURNIPS AND MUSTARD:

1. Do not plant following other crucifer crops. (Use a three year rotation).
2. Bottom plow using coverboards to direct litter to the bottom of the furrow.

3. Begin spray program as soon as leaves reach about the size of a dime.
4. Aliette may be used on mustard for downy mildew. (Do not mix with copper fungicide).
5. Maneb 80W and Maneb 75DF are labeled for turnips and mustard (see supplemental label).
6. Quadris @ 6.2 - 15.4 fl oz may now be used for Alternaria and should be rotated with Maneb.

WATERMELON:

1. Plant to "new ground" if possible; if not, use:
 - a. Pasture - 1st choice
 - b. Grain - 2nd choice
 - c. Soybeans -
 3rd choice
 - d. Peanuts - 4th choice
 - e. Melons - 5th choice
2. Purchase western grown seeds.
3. Purchase disease free transplants with resistance to anthracnose and Fusarium wilt.
4. Deep turn soil.
5. Treat for nematodes (if needed).
6. Begin spray program when first true leaves expand and continue every 10 to 14 days:
 - 1st Spray - 8 ozs. Topsin M + Maneb or Mancozeb (see label)
 - 2nd Spray - chlorothalonil 720 @ 2 - 3 pts. (may burn rind if applied within 21 days of harvest)
 - 3rd Spray - Topsin M + Maneb or Mancozeb
 - 4th Spray - chlorothalonil 720

Can also use chlorothalonil alone for the first four sprays.
7. Fruit Blotch prevention: (see fruit blotch guidelines)
 - a. Inspect transplants before transplanting into field.
 - b. Spray with copper fungicide at first flower followed by 3 additional applications 7 days apart (½ rate) or 14 days part (full rate).
8. Quadris @ 11 - 15.4 oz/Acre for gummy stem blight, powdery mildew, anthracnose, and Alternaria. Gummy stem blight resistance to Quadris is widespread in Georgia therefore Quadris should not be relied on for control of gummy stem blight.
9. Flint @ 1.5 - 2.0 oz/Acre or Nova @ 4.0 - 5.0 oz/Acre for powdery mildew. You may wish to tank-mix Nova with chlorothalonil or mancozeb to broaden disease control spectrum. Sulfur is also effective on powdery mildew but may cause foliar burn.

NOTE: ALWAYS ROTATE TO EITHER CHLOROTHALONIL OR MANEB/MANCOZEB PRODUCTS FOLLOWING NO MORE THAN TWO

SPRAYS OF QUADRIS, FLINT OR NOVA.

10. Ridomil Gold products are the only labeled materials that may be effective on crown rot (*Phytophthora capsici*).

NOTE: Use Ridomil Gold/Bravo only if downy mildew is a threat!
Continue spray program season long.

ATTENTION! Pesticide Precautions

1. Observe all directions, restrictions and precautions on pesticide labels. It is dangerous, wasteful and illegal to do otherwise.
2. Store all pesticides in original containers with labels intact and behind locked doors. "KEEP PESTICIDES OUT OF THE REACH OF CHILDREN."
3. Use pesticides at correct label dosage and intervals to avoid illegal residues or injury to plants and animals.
4. Apply pesticides carefully to avoid drift or contamination of non-target areas.
5. Surplus pesticides and containers should be disposed of in accordance with label instructions so that contamination of water and other hazards will not result.
6. Follow directions on the pesticide label regarding restrictions as required by State or Federal Laws and Regulations.
7. Avoid any action that may threaten an Endangered Species or its habitat. Your County Extension Agent can inform you of Endangered Species in your area, help you identify them, and through the Fish and Wildlife Service identify actions that may threaten Endangered Species or their habitat.

Trade and brand names are used only for information. The Cooperative Extension Service, University of Georgia College of Agriculture does not guarantee or warrant published standards of any product mentioned; neither does the use of a trade or brand name imply approval of any product to the exclusion of others which may also be suitable.

The Cooperative Extension Service, The University of Georgia College of Agriculture offers educational programs, assistance and materials to all people without regard to race, color, or national origin.

AN EQUAL OPPORTUNITY EMPLOYER Plant Pathology-1

issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, The University of Georgia College of Agriculture and the U.S. Department of Agriculture cooperating.

Revised January 2002