

# Crop Profile for Green Peppers in Delaware

Prepared: August, 2000

Revised: July, 2006

Revised: 2007

## Production Facts (1)

- Production information for fresh market sweet peppers is combined with other vegetables (asparagus, beets, lima beans, broccoli, cauliflower, green peas, greens, hot peppers, sweet potatoes, kale, snap beans, squash, and turnips) in Delaware to avoid disclosure of individual producers. In 2005, 770 acres of "Other Vegetables" were planted and harvested in the state. The value of production was \$1,836,000.
- Production information for processing sweet green peppers is combined with other vegetables (carrots, cauliflower, cucumbers, hot peppers, snap beans, spinach, tomatoes and zucchini) in Delaware to avoid disclosure of individual producers. In 2005, 8,410 acres of "Other Vegetables" were planted and 8,390 were harvested. Total production was 24,480 tons and the value of production was \$5,812.

## Production Regions

Most green pepper production takes place in Sussex county and most is for fresh market (2).

## Cultural Practices (3, 4)

Green peppers are warm-season vegetables that require a long, frost-free season. Common varieties are: Keystone Resistant Giant, Yolo, Paladin, and +R3 Camelot. Green peppers are transplanted from greenhouse seedlings.

### Seed Treatment

To minimize the occurrence of bacterial leaf spot, dip seed in a solution containing 1 quart of Clorox and 4 quarts of water plus ½ teaspoon of surfactant for 1 minute. Provide constant agitation. Use at the rate of 1 gallon of solution per pound of seed. Prepare a fresh solution for each batch of seed. Wash seed in running water for 5 minutes and dry seed thoroughly. Dust or slurry with 1 teaspoon of thiram 75WP per pound of seed.

### Planting and Spacing

Transplant into the field May 1 to May 30 for summer harvest. Space rows 4 to 5 feet apart. Set plants 12 to 18 inches apart in the row. Select fields with good drainage. Plant on raised, dome-shaped beds to aid in disease control. To

minimize sunscald when growing peppers on sandy soils and on plastic mulch without drip irrigation, plant varieties that have excellent fruit cover.

### **Drip/Trickle Fertilization**

Before mulching, adjust soil pH to around 6.5 and then apply enough farm-grade fertilizer to supply 50 pounds per acre of N, P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O and then thoroughly incorporate into the soil. If the soil tests medium or less in soil potassium, apply a fertilizer with a ratio of 1-1-2 or 1-1-3 carrying 50 pounds of nitrogen per acre.

After mulching and installing the trickle irrigation system, apply completely soluble fertilizers to supply 30 pounds of N, P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O per fertilized-mulched acre during each application. On soils testing low and low to medium in boron, also include 0.25 pound of actual boron per fertilized-mulched acre in each soluble fertilizer application.

The first soluble fertilizer application should be applied through the trickle irrigation system within 1 week after field transplanting peppers. The same rate of soluble fertilizer should be applied about every 3 weeks during the growing season for a total of 6 applications through the trickle irrigation system. The soluble fertilizer may be delivered in 12 equally timed applications through the growing season, provided the soluble nutrients are applied at half the above suggested rates per application so that the total seasonal rates of N, P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O and B are the same. The number of fertilizer applications can be reduced for late plantings and in areas where the growing season is short. These rates were developed on sandy loam soils with a cation exchange capacity (CEC) of 3 to 5. If soil has a lower CEC, increase the total seasonal soluble fertilizer nutrient rates by at least one-third. On very coarse, very low CEC soils, it may be profitable to increase the total seasonal soluble fertilizer nutrient rates two-thirds over the first suggestion. On the heavier textured soils with CEC above 3 to 5, decrease the total seasonal soluble fertilizer nutrients by one-half to three-quarters. When farming very heavy soils with high CEC, apply all the total seasonal plant nutrient requirements (according to soil test) preplant before mulching and installing the trickle irrigation system and then just apply water through the trickle irrigation through the growing season.

### **Mulching**

Peppers need to be maintained as weed-free as possible. Hoeing, cultivating, straw mulches and black plastic mulches can be used. Adequate irrigation will ensure good yields. The use of black plastic mulch with drip irrigation and double rows can greatly increase yields and percentage of No. 1 sized peppers. Use opaque, white plastic when planting in the summer for fall harvest. Plant on raised, dome-shaped beds to aid in disease control. Plant double rows 12 to 15 inches apart with plants staggered 12 to 18 inches apart in each of the double rows. Use 5-foot wide plastic for double rows and 4-foot wide plastic for single row peppers. Do not use plastic mulch without trickle irrigation on sandy soils.

## **Staking**

Staking peppers helps protect fruit from sunburn by holding the plants in an upright position. Use 2- to 2½-foot long by 1¼ x 1½-inch Honduran pine stakes (half length tomato stakes). Drive stakes 6 to 8 inches into the soil every 4 to 5 feet in the plant row. Tie plants with polyethylene string that is used for staked tomatoes. Tie the first string 7 to 9 inches above the soil when plants are 10 to 12 inches tall or at first fruit set. For single row peppers, run the string on one side of the row, looping and tightening string around each stake for about 100 feet. Then run the string back on the opposite side of the plant row using the same procedure. Allow 3- to 4-foot untied breaks every 100 feet to make harvesting easier. For double rows of peppers, use one row of stakes in each row of peppers. Tie each row separately as described above for single row peppers. A second tie should be made at 6 to 8 inches above the first string and before peppers enlarge and fall over the first string. Use the same procedure described above. An alternate method for applying the second string in single and double rows is to run a single string in the center of the plant canopy of each row, allowing the branches to grow up through the string and be caught and supported by the string. Consider the cost of staking versus reduction in losses and increases in quality and price received when making a decision about staking peppers. The higher price offered for red peppers increases the potential for profit when staking for the red compared to the green market.

Green peppers will produce throughout the summer and into fall until frost. It usually takes 75 days from transplanting until the first peppers are picked. They should be picked when they reach 3-1/2 to 4 inches in size and are still firm and green in color.

### Worker Activities & timing (2)

Green peppers are planted no earlier than May 1. Workers transplant the green pepper plants into the field at the start of the growing season. Because most farms rely on herbicides and black plastic for weed control, workers do minimal hand weeding. Workers may tie plants off later in the season to ensure that plants do not lodge. Irrigation is done by trickle irrigation, thus workers are not required to move irrigation equipment. Workers hand pick green peppers at harvest. The Delaware Department of Agriculture reports that they are not aware of any problems with workers in pepper fields. Possible pesticide exposure would be to hands and arms during tying-off and hand harvesting.

## **Weeds**

### **For Weed Control Under Plastic Mulch**

Black plastic mulch effectively controls most annual weeds by preventing light from reaching the germinated seedling. Herbicides are used under plastic mulch to control weeds around the planting hole, and under the mulch when clear plastic is used. Trickle irrigation tube left on the soil surface may cause weed problems by leaching herbicide away at the emitters. The problem is most

serious when clear plastic mulch is used. Bury the trickle tube several inches deep in the bed to reduce this problem.

1. Complete soil tillage, and form raised beds, if desired, prior to applying herbicide(s). Do not apply residual herbicides before forming beds, or herbicide rate and depth of incorporation may be increased, raising the risk of crop injury. When beds are formed and plastic mulch laid in a single pass, the herbicide should be applied after the bed is formed, as a part of the same operation.
2. Apply herbicide(s) recommended for use under plastic mulch in a band as wide as the mulch. Condensation that forms on the underside of the mulch will activate the herbicide. Use the trickle irrigation to provide moisture if the soil is too dry for condensation to form on the underside of the mulch.
3. Complete by laying the plastic mulch and trickle irrigation tubing, if used, immediately after the herbicide application. Delay punching the planting holes until seeding or transplanting.

**Note.** All herbicide rate recommendations are made for spraying a broadcast acre (43,560 ft<sup>2</sup>).

### **Transplants**

S-metolachlor--0.63-0.95 lb/A. A Special Local-Needs Label 24(c) has been approved for the use of Dual Magnum 7.62E to control weeds in transplanted bell peppers in Delaware. The use of this product is legal ONLY if a waiver of liability provided by the local growers association has been signed by the grower, all fees have been paid, and a label has been provided by the association. Apply 0.67 to 1 pints per acre Dual Magnum 7.62E to control annual grasses, yellow nutsedge, galinsoga, and certain other broadleaf weeds. Use as a surface-applied pretransplant spray before laying the plastic mulch, or as a directed basal spray after establishment. DO NOT preplant incorporate Dual Magnum. Make only one application during the growing season. DO NOT apply within 65 days of harvest.

### **Seeded and Transplants**

Clomazone--0.25-0.5 lb/A. Apply 0.66 to 1.33 pints per acre Command 3ME pretransplant before laying plastic mulch. Use the lower rate on fields with coarse-textured soils low in organic matter, when weed pressure is light, or to minimize herbicide carryover that could affect subsequent crops or a winter crop. Use higher rates on fields with fine textured soils and those with high organic matter, or to improve control of certain weeds, including common cocklebur. Command is an excellent broad-spectrum herbicide that will control annual grasses and most broadleaf weeds, except pigweed sp., carpetweed, morningglory sp., and yellow nutsedge. Combine with Devrinol or Dual Magnum (transplants only) to improve the control of carpetweed and pigweed sp. Labeled for use on all varieties including bell, hot, pimento, and sweet (except banana).

**WARNING:** Command spray or vapor drift may injure sensitive crops and other vegetation up to several hundred yards from the point of application. Immediate

incorporation will reduce or eliminate vapor drift. Do not apply when wind or weather conditions favor herbicide drift. Do not apply to fields adjacent to horticultural, fruit, vegetable, or other sensitive crops. Drift injury from offsite Command movement is extremely apparent; therefore, do not use Command on fields near sensitive locations. Herbicide residues may limit subsequent cropping options when Command is used preplant incorporated for weed control in peppers.

Napropamide--1-2 lb/A. Apply 2 to 4 pounds per acre Devrinol 50DF preemergence in a band under the plastic, immediately before laying the mulch. Condensation that forms on the underside of the mulch will activate the herbicide. Annual grasses and certain annual broadleaf weeds will be suppressed or controlled under the mulch and around the plant hole. Use lower rate on coarse-textured or sandy soil. Devrinol may reduce stand and yield of fall grains. Moldboard plowing will reduce the risk of injury to a small grain follow crop.

### **Soil Strips Between Rows of Plastic Mulch (Directed and Shielded Band Applications)**

Use the following land preparation, treatment, planting sequences, and herbicides labeled for the crop to treat Soil Strips Between Rows of Plastic Mulch, or crop injury and/or poor weed control may result.

1. Complete soil preparation, apply herbicide(s) under the mulch (see above), and lay plastic and trickle irrigation (optional) before herbicide application between the rows.
2. Spray preemergence herbicide(s), registered and recommended for use on the crop in bands onto the soil and the shoulders of the plastic mulch before planting and weeds germinate, OR apply after planting as a shielded spray combined with a postemergence herbicide to control emerged weeds. DO NOT broadcast spray over the plastic mulch at any time!
3. Incorporate preemergence herbicide into the soil with ½ to 1 inch of rainfall or overhead irrigation within 48 hours of application.
4. Apply Gramoxone in bands to the soil strips between the plastic mulch before the crop emerges or is transplanted, AND/OR as a shielded spray postemergence to control emerged weeds. Use in combination with residual herbicides that are registered for use. Note. All herbicide rate recommendations are made for spraying a broadcast acre (43,560 ft<sup>2</sup>).

### **Preplant (surface applied) Transplants**

S-metolachlor--0.63-0.95 lb/A. A Special Local-Needs Label 24(c) has been approved for the use of Dual Magnum 7.62E to control weeds in transplanted bell peppers in Delaware. The use of this product is legal ONLY if a waiver of liability provided by the local growers association has been signed by the grower, all fees have been paid, and a label has been provided by the association. Apply

0.67 to 1 pints per acre Dual Magnum 7.62E to control annual grasses, yellow nutsedge, galinsoga, and certain other broadleaf weeds. Use as a surface-applied banded directed shielded spray, preemergence to the weeds. Posttransplant banded directed shielded sprays should be applied to weed-free soil. Dual Magnum will not control emerged weeds. Control emerged weeds with Graomoxone added to the shielded and directed banded herbicide spray. Make only one application during the growing season. DO NOT apply within 65 days of harvest.

### **Seeded and Transplants**

Clomazone--0.25-0.75 lb/A. Apply 0.66 to 2 pints per acre Command 3ME pretransplant as a banded directed shielded spray. Use the lower rate on fields with coarse-textured soils low in organic matter, when weed pressure is light, or to minimize herbicide carryover that could affect subsequent crops or a winter crop. Use higher rates on fields with fine-textured soils and those with high organic matter, or to improve control of certain weeds, including common cocklebur. Command is an excellent broad-spectrum herbicide that will control annual grasses and most broadleaf weeds, except pigweed sp., carpetweed, morningglory sp., and yellow nutsedge. Combine with Devrinol or Treflan (transplants only) to improve the control of carpetweed and pigweed sp. Labeled for use on all varieties including bell, hot, pimento, and sweet (except banana). **WARNING:** Command spray or vapor drift may injure sensitive crops and other vegetation up to several hundred yards from the point of application. Immediate incorporation will reduce or eliminate vapor drift. Do not apply when wind or weather conditions favor herbicide drift. Do not apply to fields adjacent to horticultural, fruit, vegetable, or other sensitive crops. Drift injury from offsite Command movement is extremely apparent; therefore, do not use Command on fields near sensitive locations. Herbicide residues may limit subsequent cropping options when Command is used preplant incorporated for weed control.

Napropamide--1-2 lb/A. Apply 2 to 4 pounds per acre Devrinol 50DF as a banded directed shielded spray and activate with one-half inch of rainfall or sprinkler irrigation within 48 hours of application to control most annual grasses and certain broadleaf weeds. Use the lower rate on coarse-textured or sandy soils. May reduce stand of and yield of fall grains. Mold-board plowing will reduce the risk of injury.

### **Postemergence**

DCPA--6-10.5 lb/A. Apply 8 to 14 pints per acre Dacthal 6F 4 to 6 weeks after transplanting for preemergence weed control. Emerged weeds will not be controlled. Dacthal will not injure crop foliage. Spray broadcast when crop is grown without plastic mulch or band between the rows when plastic mulch is used. Controls late season annual grasses, common purslane, and other broadleaf weeds.

Halosulfuron--0.023-0.047 lb/A. Apply 0.5 to 1.0 dry ounce Sandea 75WG as a

banded directed shielded spray to the soil strips of peppers grown on plastic mulch ONLY to suppress or control yellow nutsedge and broadleaf weeds including common cocklebur, redroot pigweed, smooth pigweed, ragweed species, and galinsoga. Sandea applied postemergence will not control common lambsquarter or eastern black nightshade. Add nonionic surfactant to be 0.25 percent of the spray solution (1 quart per 100 gallons of spray solution). DO NOT use oil concentrate. Susceptible broadleaf weeds usually exhibit injury symptoms within 1 to 2 weeks of treatment. Typical symptoms begin as yellowing in the growing point that spreads to the entire plant and is followed by death of the weed. Injury symptoms are similar when yellow nutsedge is treated but may require 2 to 3 weeks to become evident and up to a month for the weed to die. Sandea is an ALS inhibitor. Herbicides with this mode of action have a single site of activity in susceptible weeds. The risk of the development of resistant weed populations is high when herbicides with this mode of action are used continuously and exclusively to control a weed species for several years or in consecutive crops in a rotation. Integrate mechanical methods of control and use herbicides with a different mode of action to control the target broadleaf weeds when growing other crops in the rotation. DO NOT apply Sandea to crops treated with a soil applied organophosphate (OP) insecticide, or use a foliar applied organophosphate (OP) insecticide within 21 days before or 7 days after a Sandea application. DO NOT exceed total of 0.094 pounds per acre, equal to 2.0 dry ounces of Sandea per crop-cycle. DO NOT exceed a total of 0.094 pound per acre, equal to 2 dry ounces of Sandea applied in one year.

Paraquat--0.6 lb/A. Apply 2.4 pints per acre Gramoxone Inteon 2SC as a banded directed shielded spray between the rows ONLY, to control emerged grass and broadleaf weed seedlings. Do not allow spray to contact plants as injury or residues may result. Use shields to prevent spray contact with crop plants. Do not exceed a spray pressure of 30 psi. Add wetting agent as per label.

Clethodim--0.094-0.125 lb/A. Apply 6 to 8 fluid ounces per acre Select 2EC with oil concentrate to be 1 percent of the spray solution (1 gallon per 100 gallons of spray solution) or 12 to 16 fluid ounces of Selectmax 0.97EC with nonionic surfactant to be 0.25% of the spray solution (1 quart per 100 gallons of spray solution) postemergence to control many annual and certain perennial grasses, including annual bluegrass. Select 2EC will not consistently control goosegrass. The use of oil concentrate with Select 2EC may increase the risk of crop injury when hot or humid conditions prevail. To reduce the risk of crop injury, omit additives or switch to nonionic surfactant when grasses are small and soil moisture is adequate. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. For best results, treat annual grasses when they are actively growing and before tillers are present. Repeated applications may be needed to control certain perennial grasses. Yellow nutsedge, wild onion, or broadleaf weeds will not be controlled. Do not tank-mix with or apply within 2 to 3 days of any other pesticide unless labeled as the risk of crop injury may be increased, or reduced control of grasses may result. Observe a minimum

preharvest interval of 20 days.

Sethoxydim--0.2-0.3 lb/A. Apply 1 to 1.5 pints per acre Poast 1.5EC with oil concentrate to be 1 percent of the spray solution (1 gallon per 100 gallons of spray solution) postemergence as a banded directed shielded spray to control annual grasses and certain perennial grasses. The use of oil concentrate may increase the risk of crop injury when hot or humid conditions prevail. To reduce the risk of crop injury, omit additives or switch to nonionic surfactant when grasses are small and soil moisture is adequate. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. For best results, treat annual grasses when they are actively growing and before tillers are present. Repeated applications may be needed to control certain perennial grasses. Yellow nutsedge, wild onion, or broadleaf weeds will not be controlled. Do not tank-mix with or apply within 2 to 3 days of any other pesticide unless labeled, as the risk of crop injury may be increased, or reduced control of grasses may result. Observe a minimum preharvest interval of 20 days and apply no more than 4.5 pints per acre in one season.

### **For Transplanting Into Soil Without Plastic Mulch (Broadcast Applications)**

Use the following land preparation, treatment, planting sequences, and herbicides labeled for the crop when Planting into Soil Without Plastic Mulch, or crop injury and/or poor weed control may result.

1. Complete soil tillage, apply preplant incorporated herbicide(s), and incorporate. Use a finishing disk or field cultivator that sweeps at least 100% of the soil surface twice, at right angles, operated at a minimum of 7 miles per hour (mph), OR a PTO driven implement once, operated at less than 2 miles per hour (mph).
2. Seed and apply preemergence herbicide(s) immediately after completing soil tillage, and mechanical incorporation of preplant herbicides. Irrigate if rainfall does not occur, to move the herbicide into the soil and improve availability to germinating weed seeds within 2 days of when the field was last tilled, or plan to control escaped weeds by other methods. Note. All herbicide rate recommendations are made for spraying a broadcast acre (43,560 ft<sup>2</sup>).

### **Preplant Incorporated Transplants**

Trifluralin--0.5-1 lb/A. Apply 1 to 2 pints per acre Treflan 4E. Incorporate into 2 to 3 inches of soil within 8 hours after application. Slight stunting may result if weather is cool and damp.

### **Seeded and Transplants**

Napropamide--1-2 lb/A. Apply 2 to 4 pounds per acre Devrinol 50DF before planting and incorporate 1 to 2 inches deep with power-driven rotary cultivators to control most annual grasses and certain broadleaf weeds. Use lower rate on coarse-textured or sandy soil. Devrinol may reduce stand and yield of fall grains.

Moldboard plowing will reduce the risk of injury to a small grain follow crop.

### **Preplant (soil surface applied)**

#### **Transplants**

S-metolachlor--0.63-0.95 lb/A. A Special Local-Needs Label 24(c) has been approved for the use of Dual Magnum 7.62E to control weeds in transplanted bell peppers in Delaware. The use of this product is legal ONLY if a waiver of liability provided by the local growers association has been signed by the grower, all fees have been paid, and a label has been provided by the association. Apply 0.67 to 1 pints per acre Dual Magnum 7.62E to control annual grasses, yellow nutsedge, galinsoga, and certain other broadleaf weeds. Use as a surface-applied pretransplant spray, or as a directed basal spray after establishment. DO NOT preplant incorporate Dual Magnum. Posttransplant directed sprays should be applied to weed-free soil. Dual Magnum will not control emerged weeds. Cultivate and/or hoe to control emerged weeds before treatment. Make only one application during the growing season. DO NOT apply within 65 days of harvest.

#### **Seeded and Transplants**

Clomazone--0.25-0.75 lb/A. Apply 0.66 to 2 pints per acre Command 3ME pretransplant. Use the lower rate on fields with coarse-textured soils low in organic matter, when weed pressure is light, or to minimize herbicide carryover that could affect subsequent crops or a winter crop. Use higher rates on fields with fine-textured soils and those with high organic matter, or to improve control of certain weeds, including common cocklebur. Command is an excellent broad-spectrum herbicide that will control annual grasses and most broadleaf weeds, except pigweed sp., carpetweed, morningglory sp., and yellow nutsedge. Combine with Devrinol or Treflan (transplants only) to improve the control of carpetweed and pigweed sp. Labeled for use on all varieties including bell, hot, pimento, and sweet (except banana).

**WARNING:** Command spray or vapor drift may injure sensitive crops and other vegetation up to several hundred yards from the point of application. Immediate incorporation will reduce or eliminate vapor drift. Do not apply when wind or weather conditions favor herbicide drift. Do not apply to fields adjacent to horticultural, fruit, vegetable, or other sensitive crops. Drift injury from offsite Command movement is extremely apparent; therefore, do not use Command on fields near sensitive locations. Herbicide residues may limit subsequent cropping options when Command is used preplant incorporated for weed control in peppers.

Napropamide--1-2 lb/A. Apply 2 to 4 pounds per acre Devrinol 50DF prior to transplanting or seeding. Incorporate with one-half inch of sprinkler irrigation within 48 hours of application to control most annual grasses and certain broadleaf weeds. Use the lower rate on coarse-textured or sandy soils. May reduce stand of and yield of fall grains. Mold-board plowing will reduce the risk of injury.

## **Postemergence**

DCPA--6-10.5 lb/A. Apply 8 to 14 pints per acre Dacthal 6F 4 to 6 weeks after transplanting for preemergence weed control. Emerged weeds will not be controlled. Dacthal will not injure crop foliage. Controls late season annual grasses, common purslane, and other broadleaf weeds.

Clethodim--0.094-0.125 lb/A. Apply 6 to 8 fluid ounces per acre Select 2EC with oil concentrate to be 1 percent of the spray solution (1 gallon per 100 gallons of spray solution) or 12 to 16 fluid ounces of Selectmax 0.97EC with nonionic surfactant to be 0.25% of the spray solution (1 quart per 100 gallons of spray solution) postemergence to control many annual and certain perennial grasses, including annual bluegrass. Select 2EC will not consistently control goosegrass. The use of oil concentrate with Select 2EC may increase the risk of crop injury when hot or humid conditions prevail. To reduce the risk of crop injury, omit additives or switch to nonionic surfactant when grasses are small and soil moisture is adequate. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. For best results, treat annual grasses when they are actively growing and before tillers are present. Repeated applications may be needed to control certain perennial grasses. Yellow nutsedge, wild onion, or broadleaf weeds will not be controlled. Do not tank-mix with or apply within 2 to 3 days of any other pesticide unless labeled as the risk of crop injury may be increased, or reduced control of grasses may result. Observe a minimum preharvest interval of 20 days.

Sethoxydim--0.2-0.3 lb/A. Apply 1 to 1.5 pints per acre Poast 1.5EC with oil concentrate to be 1 percent of the spray solution (1 gallon per 100 gallons of spray solution) postemergence to control annual grasses and certain perennial grasses. The use of oil concentrate may increase the risk of crop injury when hot or humid conditions prevail. To reduce the risk of crop injury, omit additives or switch to nonionic surfactant when grasses are small and soil moisture is adequate. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. For best results, treat annual grasses when they are actively growing and before tillers are present. Repeated applications may be needed to control certain perennial grasses. Yellow nutsedge, wild onion, or broadleaf weeds will not be controlled. Do not tank-mix with or apply within 2 to 3 days of any other pesticide unless labeled, as the risk of crop injury may be increased, or reduced control of grasses may result. Observe a minimum preharvest interval of 20 days and apply no more than 4.5 pints per acre in one season.

## **Postharvest**

### **With or Without Plastic Mulch**

Paraquat--0.6 lb/A. A Special Local-Needs 24(c) label has been approved for the use of Gramoxone Inteon 2SC for postharvest desiccation of the crop in Delaware. Apply 2.4 pints per acre Gramoxone Inteon 2SC as a broadcast spray after the last harvest. Add nonionic surfactant. Use to prepare plastic mulch for replanting, or to aid in the removal of the mulch.

**Note.** All herbicide rate recommendations are made for spraying a broadcast acre (43,560 sq. ft).

## **Insect Pests**

In Delaware, the primary insect pests attacking peppers include the European corn borer (ECB), pepper maggot, green peach aphid, corn earworm (CEW), fall armyworm (FAW), beet armyworm (BAW) and thrips. The ECB, pepper maggot, CEW, FAW and BAW all cause direct damage to the fruit. Green peach is the most common and destructive secondary pest. Thrips are important because they vector the tomato spotted wilt virus.

### **European Corn Borer (ECB)**

**Biology and Life History:** Two to three generations occur each year in the Mid Atlantic region. Corn borers overwinter as fully grown larvae; pupate in late April to early May, emerging as adults in May to early June and again in late July through September. Eggs are laid in masses on the undersides of leaves. Larvae hatch in 4-7 days. The young larvae generally feed on the foliage for a week before boring into stems and developing pepper fruit.

**Damage:** The European corn borer is the major pest of peppers in Delaware, causing losses from direct damage to fruit and stems as well as contamination problems. Larvae generally bore into the fruit under the cap. If corn is planted late or there is no corn in the area, first generation damage can cause significant plant lodging and stem breakage. Initially, damage is difficult to detect because the only external sign is a pinhole and some sawdust-like excrement near the cap. Once inside the fruit, larvae feed on the seed core and become fully developed inside the fruit. Damaged fruit ripens prematurely. The most significant damage occurs when diseases enter the feeding holes causing the fruit to rot.

**Monitoring and Decision Making:** Once peppers are infested with ECB, no control measures can be taken to reduce the problem. Direct sampling for eggs and larvae is impractical due to the low damage tolerance. Therefore, sampling must be done with the use of blacklight or pheromone traps. If using blacklight traps, sprays should be applied within 5-7 days after the first corn borer moth is captured and fruit are at least 1/2 inch in diameter. If a pheromone trap is used,

applications should be made within one week after trap catches reach seven per week.

### **Controls:**

**Biological:** Although there are many general predators that feed on corn borer eggs and small larvae, the low damage tolerance makes it impractical to rely on these predators. Recent research in New York and Virginia indicates that the use of *Trichogramma nubilalis* may provide good corn borer control in peppers. Evaluation of the economics and effectiveness in commercial situations is still needed.

**Cultural:** A number of cultural practices have been used in field corn to reduce corn borer infestations including plowing under corn stalks, keeping fields free of weeds to ensure better spray coverage and keeping a good mineral balance in the soil. However, none of these practices have been evaluated in a pepper system.

### **Chemical:**

#### **(I) Pyrethroids**

Asana XL--5.8-9.6 fl oz 0.66EC/A. Treat every 5 to 7 days, or  
Baythroid XL--1.6-2.8 fl oz /A, or  
bifenthrin (Capture; generics available)--2.1-6.4 fl oz 2E/A, or  
Mustang MAX--2.24-4.0 fl oz/A, or  
permethrin (sweet, bell-type only)--8 fl oz 3.2EC/A. Treat every 5 to 7 days, or  
lambda-cyhalothrin (Warrior; generics available)--2.56-3.84 fl oz/A

#### **(II) Organophosphates**

Orthene--0.75-1.0 lb 97S/A (Bell Pepper only), or

#### **(III) Carbamates**

Avaunt--3.5 oz 30 WDG/A (Bell Pepper only), or  
Lannate--3 pt LV/A or OLF. Treat every 5 to 7 days, or

#### **(IV) Other**

Confirm--8-16 fl oz 2F/A, or  
Entrust--1.0-2.0 oz 80W/A, or  
Intrepid--4-8 fl oz 2F/A (early season), 8-16 fl oz/A (late season), or  
Proaxis--2.56-3.84 fl oz/A, or  
SpinTor--3-6 fl oz /A, or

## Pepper Maggot

**Biology and Life History:** This insect overwinters in the soil in the pupal stage. Flies begin to emerge in mid- late June, emerging over a 10-14 day period and surviving less than one month. Female flies insert eggs under the skin and into the flesh of the pepper. The eggs hatch in 8 to 14 days and the maggots mature in 2-3 weeks. There is one generation per year.

**Damage:** The elliptical egg punctures are the first sign of an infestation. Maggots feed within the core of the fruit but generally emerge and drop to the ground to pupate before peppers are harvested.

As infested peppers enlarge, the egg punctures become shallow depressions in the fruit. If the fruit is green, damage is hard to detect.. Damaged peppers turn red prematurely and rot.

**Monitoring and Decision Making:** Although pepper maggot fly can be baited with yellow sticky-traps baited with ammonia, they must be suspended at a height of 20 feet within the canopy of a maple tree. This is the only reliable method to detect low population levels. A perimeter of indicator of cherry-pepper plants can be used to monitor flies by examining fruit for feeding scars every 3-4 days for a 3 week period. If using traps to monitor populations, two - three sprays will be needed at 5-day intervals as soon as the first fly is caught. If using indicator plants, sprays should be applied as soon as scars are observed on indicator plants.

### Controls:

**Biological:** Although general predators can reduce adult and pupal populations, they will not provide commercial control.

**Cultural:** The elimination of alternative hosts, like horsenettle, can help reduce populations but will not eliminate the problem. The use of a cherry-pepper trap crop can help with bell peppers only.

### **Chemical:**

#### **(I) Pyrethroids**

Mustang MAX--2.24-4.0 fl oz/A, or

#### **(II) Organophosphates**

dimethoate--0.5-0.67 pt 4EC/A, or

**Note.** Use of Orthene for borer control will reduce pepper maggot infestations.

### **(III) Other**

Thionex--1-2 lb 50WP/A

### **Green Peach Aphid (GPA)**

**Biology and Life History:** There are a number of aphids that can be found on peppers; however, the green peach aphid is the most common and important one. GPA can attack plants throughout the season; however, the greatest injury occurs late summer through early fall. During most of the season, aphids give birth to live young, usually wingless females. Under warm conditions, the young mature in less than 9 days. Many generations occur in one season.

**Damage:** Aphids can cause cosmetic problems on peppers as a result of the "honeydew" left on leaves and fruit. At extreme populations, aphids can feed on plant sap resulting in plant chlorosis, curling and distortion which may reduce yields. At low levels, aphids can also transmit viruses

**Monitoring and Decision Making:** Monitor for aphids by checking the undersides of leaves in late June. Check for aphids on two upper and two lower leaves on 25 plants per field to determine the number of aphids per leaf. A treatment is needed prior to fruit set if you find 5-10 aphids per week for 2 consecutive weeks. After fruit set, a spray should be applied if the population averages 1-2 per leaf and beneficial activity is low. For best green peach aphid control during periods of drought, apply insecticide 2 to 3 days after irrigation. Thorough spray coverage beneath leaves is important when foliar sprays are used.

### **Controls:**

**Biological:** Naturally occurring predators and parasites usually provide season long suppression. If continuous pyrethroid programs are used, they can kill beneficials as well as repel certain parasites resulting in an aphid explosion.

**Cultural:** The use of reflective mulches has been shown to delay or reduce aphid colonization of pepper fields but does not eliminate the damage. Other strategies that can lower aphid populations include weed control, removal of perennial hosts and avoiding excessive nitrogen fertilization.

### **Chemical:**

#### **(I) Organophosphate**

Metasystox-R--2 pt 2SC/A, or  
Orthene--0.5-1.0 lb 97S/A (Bell Peppers); 0.5 lb 97S/A(nonbells), or

#### **(II) Carbamate**

Lannate--1.5-3 pt LV/A, or

### **(III) Other**

Actara--2-3 oz 25WDG/A, or

Admire Pro--7-14 fl oz 4.6F/A, or

imidacloprid (Admire; generics available)--10-24 fl oz 2F/A, or

Assail--2-4 oz 30SG/A, or

Fulfill--2.75 oz 50WDG/A, or

Platinum--5-8 fl oz 2SC/A, or

imidacloprid (foliar-Provado; generics available)--3.75 fl oz 1.6F/A, or

Thionex--1-2 lb 50WP/A, or

Venom--5-6 oz (soil); 1-4 oz (foliar) 70SG/A

### **Corn Earworm (CEW)**

**Biology and Life History:** This insect overwinters in Delaware; however, moth activity (overwintering and migratory ) is heaviest from mid-August to early October as corn is mature and moths are attracted to peppers. Eggs are laid singly on buds and terminal leaflets close to flowers and small fruit. Eggs hatch in 3-4 days and small larvae move directly to fruit at egg hatch. Individual larvae complete their development inside the fruit before pupating. Complete larval development can take place in 14 days at temperatures of 82 degrees.

**Damage:** Larvae begin feeding near the stem end of fruit. They feed inside the fruit and create a watery cavity filled with caste skins and excrement. As larvae mature, they often leave the fruit and move into another fruit. Older larvae enter the fruit anywhere, leaving a large hole in the side of the fruit. Damaged fruit becomes infected with diseases and injured fruit often rots before harvest. Contamination is a serious problem for processing peppers because one small hole may be the only evidence of an infestation.

**Monitoring and Decision Making:** Once small green pepper fruit are present, sampling should begin for corn earworm. Examine the foliage and at least 20 fruit from randomly picked plants in at least 5 locations per field for the presence of small larvae. Although blacklight and pheromone traps are not reliable for timing insecticide applications, moth catches greater than 20 per night indicate the potential for problems. Control CEW beginning in mid-July

### **Controls:**

**Biological:** Although there are many general predators that feed on corn earworm eggs and small larvae , the low damage tolerance makes it impractical to rely on these predators.

**Cultural:** None available

## **Chemical:**

### **(I) Pyrethroids**

Asana XL--5.8-9.6 fl oz 0.66EC/A (CEW only), or  
Baythroid XL--1.6-2.8 fl oz /A, or  
bifenthrin (Capture; generics available)--2.1-6.4 fl oz 2E/A (CEW only), or  
Mustang MAX--2.24-4.0 fl oz/A, or  
lambda-cyhalothrin (Warrior; generics available)--2.56-3.84 fl oz/A

### **(II) Carbamates**

Sevin--1.5-2.5 lb 80S/A, or

### **(IV) Other**

Entrust--1-2 oz 80W, or  
Proaxis--2.56-3.84 fl oz/A, or  
Proclaim--2.4-4.8 oz 5 SG/A, or  
SpinTor--3-6 fl oz 2SC/A, or  
Thionex--1.33-2.67 pt 3EC/A (HW only), or

## **Fall Armyworm (FAW)**

**Biology and Life History:** This insect migrates to Delaware in late June to early July. Moth activity in peppers is heaviest from late August to early October. Eggs are laid in a mass on the undersides of leaves. Eggs hatch in 2- 10 days and larvae mature in approximately 20-28 days.

**Damage:** Young larvae enter the fruit under the cap, similar to corn borer; however, the damage is more extensive as larvae mature. Older larvae move from fruit to fruit destroying more than they consume. Injury is easier to detect compared to CEW so contamination is rarely a problem. Damage fruit often drop or rot. Unlike CEW, they also feed extensively on the foliage.

**Monitoring and Decision Making:** Pheromone traps can be used to monitor moth activity and to determine when moths are actively laying eggs. A green unitrap should be placed within the plant canopy. Field should also be examined for the presence of egg masses. Pheromone trap catches of greater than 10-20 per night in combination with the presence of egg masses indicates the potential for a problem.

### **Controls:**

**Biological:** None available.

**Cultural:** None available

**Chemical:**

**(I) Pyrethroids**

Mustang MAX--3.2-4.0 fl oz/A, or  
lambda-cyhalothrin (Warrior; generics available)--2.56-3.84 fl oz/A

**(II) Carbamates**

**Fall Armyworm**

Avaunt--3.5 oz 30WDG/A, or  
Lannate--1.5-3.0 pt LV/A, or

**(III) Other**

Confirm--8-16 fl oz 2F/A, or  
Entrust--1.25-2.5 oz 80W/A, or  
Intrepid--4-8 fl oz 2F/A (early season), 8-16 fl oz/A (late season), or  
Proaxis--2.56-3.84 fl oz/A, or  
Proclaim--2.4-4.8 oz 5SG/A, or  
SpinTor--4-8 fl oz 2SC/A, or

**Beet Armyworm (BAW)**

**Biology and Life History:** This insect migrates to Delaware in mid-late July. Moth activity in peppers is heaviest from mid-August to early October. Eggs are laid in a mass on the undersides of leaves. Eggs hatch in 3-4 days and larvae mature in approximately 2-3 weeks. One generation can be produced in 3 weeks.

**Damage:** Small larvae spin webs and feed in groups on the foliage, often skeletonizing the plants. As larvae develop, they encounter fruit and take bites on the surface, bore under the cap or enter the side of the fruit.

**Monitoring and Decision Making:** Pheromone traps can be used to monitor moth activity and to estimate population levels. A green unitrap should be placed within the plant canopy. Use one trap per field and position lures at the top of the plant canopy. Intensify field scouting when catches reach 20 moths per night. Fields should also be checked twice a week for egg masses and small larvae. Fields should be treated if 5% of the plants are infested with small larvae or you find one egg mass per 100 leaves.

**Controls:**

**Biological:** None available.

**Cultural:** None available

**Chemical:**

**(I) Carbamates**

Avaunt--3.5 oz 30WDG/A, or  
Lannate--1.5 pt LV/A, or

**(II) Other**

Confirm--8-16 fl oz 2F/A, or  
Entrust--1.25-2.5 oz 80W/A, or  
Intrepid--4-8 fl oz 2F/A (early season), 8-16 fl oz/A (late season), or  
Proclaim--2.4-4.8 oz 5 SG/A, or  
SpinTor--4-8 fl oz 2SC/A

## Thrips

**Biology and Life History:** This insect overwinters as adults on weed hosts. Adults move to host plants and eggs are produced sexually or asexually. Wingless nymphs can develop into winged adults in 2 weeks. Populations explode under warm, dry weather. In some cases, thrips can be brought north on southern transplants.

**Damage:** The most significant damage occurs when thrips vector the Tomato Spotted Wilt virus. Transmission can occur in the greenhouse or on transplants outside the greenhouse just before transplanting in the field. Thrips can also directly damage peppers by extracting sap from leaves and fruit. This results in distorted leaves and fruit with silver or brown lesions on the surface. Damage occurs near the cap or where two or more fruit contact each other.

**Monitoring and Decision Making:** Examine 5 plants in 10 locations for the presence of thrips on leaves and fruit. Although no exact thresholds have been established, a treatment may be needed if 10% of the leaves or fruit are infested with thrips. Plants showing virus symptoms should be rogued out of the field to prevent virus spread.

**Controls:**

**Biological:** None available.

**Cultural:** None available

## **Chemical:**

### **(I) Pyrethroids**

Baythroid XL--2.1-2.8 fl oz /A, or  
bifenthrin (Capture; generics available)--2.1-6.4 fl oz 2E/A, or  
lambda-cyhalothrin (Warrior; generics available)--2.56-3.84 fl oz/A, or

### **(II) Carbamate**

Vydate--2-4 pt 2L/A, or

### **(III) Other Chemistry**

abamectin (Agri-mek; generics available)--8-16 fl oz 0.15 EC/A, or  
Assail--4 oz 30SG/A  
Entrust--1.25-2.5 oz 80W/A, or  
Proaxis--2.56-3.84 fl oz/A, or  
SpinTor--4-8 fl oz 2SC/A, or  
Venom--5-6 oz (soil); 1-4 oz (foliar) 70SG/A,

## **Spider Mites**

**Biology and Life History:** This arthropod pest overwinters as females on debris and is capable of reproducing sexually or asexually. Eggs are laid on the undersurface of leaves or on protected plant parts. Under hot, dry conditions, eggs hatch in 3 days. Immature mites molt 3 times and can reach adulthood in less than one week

**Damage:** Nymphs and adults puncture leaf tissue and extract plant juices. Leaf injury first appears as white stippling or small white blotches which fuse together into larger yellow patches. Under heavy infestations, leaves dry out, turn brown and are tied together by webbing. Mites can develop quickly and severely stunt the growth of plants. Mites can also feed on the fruit causing a roughened appearance of the fruit and rendering it unmarketable.

**Monitoring and Decision Making:** Examine 5 plants in 10 locations for the presence of mites on 2 leaves and 2 fruit per plant. Although no exact thresholds have been established, a treatment may be needed if 10% of the leaves or fruit are infested with mites.

### **Controls:**

**Biological:** Although natural enemies and fungal pathogens can help to crash populations, they often can not be relied upon to provide economic control.

**Cultural:** None available

**Chemical:**

**(I) Pyrethroids (excessive use for other insects can cause spider mite outbreaks)**

bifenthrin (Capture; generics available)--5.12-6.4 fl oz 2E/A, or

**(II) Other Chemistry**

Acramite--0.75-1.0 oz 50 WS/A, or

abamectin (Agri-mek; generics available)--8-16 fl oz 0.15EC/A, or

Kelthane MF--0.75-1.5 pt EC/A, or

Oberon--7.0-8.5 fl oz 2SC/A

**Pepper Weevil**

This insect can come north on southern transplants; however, it has not been a problem in Delaware. Last saw it in NJ in 1992. The small reddish-brown to black beetle with a curved beak can be transported on plants with well developed flowers and flower buds. Larvae are a white legless grub with a brown head and can complete their life cycle in 3 weeks. Larvae cause damage by chewing holes in leaves as well as buds and small fruit. Damage can be detected by puncture wounds on the buds and/ or premature dropping of flowers, bud and small pods

Best management practice is to avoid southern transplants, especially ones with well developed flowers and buds. If you suspect pepper weevil, check for puncture wounds on 25-50 bud clusters once a week and count cluster damaged if one or more flower buds have holes. A treatment is recommended if 5% of the clusters are damaged. Two - three weekly pyrethroid sprays needed for control

**(I) Pyrethroids**

bifenthrin (Capture; generics available)--2.1-6.4 fl oz 2E/A, or

Mustang MAX--2.24-4.0 fl oz/A or

permethrin--4-8 fl oz 3.2EC/A, or

lambda-cyhalothrin (Warrior; generics available)--2.56-3.84 fl oz/A

**(II) Carbamate**

Vydate--2-4 pt 2L/A, or

**(III) Other Chemistry**

Actara--3-4 oz 25 WDG/A, or

Assail--4 oz 30SG/A, or  
Kryocide--10-12 lb 96W/A, or  
Proaxis--2.56-3.84 fl oz/A, or

## Diseases

### Damping-Off

Use a disease-free planting mix. Consideration should be given to using soilless mixes containing microorganisms that suppress damping-off fungi. Use of the following will assist in control:

SoilGard 12G--1-1.5 lb/cu yd of soilless mix

SoilGard is a naturally occurring soil fungus that is an antagonist to plant pathogenic fungi. Uniformly add SoilGard 12G when soilless mixes are being blended by mechanical devices. After one day of incubation (keep at room temperature), seed or transplants can be added to the treated mix. Where planting mix is not used, pretreat seedbeds with metam-sodium (Vapam HL) at 0.75 quart per 100 square feet.

### Bacterial Leaf Spot

Plant varieties (X3R Aladin Aristotle, Revolution, X3R Wizard, and Enterprise) that have resistance to all three races of the pathogen that occur in the region. When producing transplants, be sure to use Clorox seed treatment. Use disease-free seeds and a 2-year rotation in the seedbed and field. Apply streptomycin (Agri-Mycin 17, Agri-Strep) sprays (1 pound per 100 gallons, 1¼ teaspoons per gallon) when first true leaves appear and continue every 4 to 5 days until transplanting. Streptomycin cannot be used on transplants after they are field-planted. In some years, there can be a high risk of developing Bacterial leaf spot when using southern-produced transplants. Be sure to use only certified transplants. Loss from bacterial spot may be reduced by maintaining a high level of fertility. Maintaining high fertility levels will stimulate additional leaf formation to replace those lost from bacterial spot infections. However, sufficient restraint must be used to ensure that plants do not become overly vegetative, or fruit set may be severely reduced. Where disease is present or anticipated, do not work in fields when plant surfaces are wet. Disk field as soon as possible after the growing season. This will hasten breakdown of the crop debris that is harboring the bacteria and minimize overwintering of the bacteria in the field.

**Field sprays to reduce spread:** Applying fixed coppers at labeled rates plus maneb at 1.5 lb 75DF/A, or fixed copper (at labeled rates) or maneb at 1.5 lb 75D/A plus Tanos at 8 – 10 oz 50WDG/A are of value in suppressing spread. Begin shortly after transplanting and repeat every 7 to 10 days.

### Anthracnose Fruit Rot

Beginning at flowering:

**Alternate:**

maneb--1.5-3 lb 75DF/A every 7-10 days

**With:**

one of the following:

azoxystrobin (Quadris--6.2–15.4 fl oz 2.08F/A or

Amistar--2-5 oz 80WDG/A), or

Cabrio--8-12 oz 20EG/A, or

Flint--3-4 oz 50WDG/A, or

Tanos--8–10 oz 50WDG/A

**Bacterial Soft Rot**

During periods of humid weather, the stem ends of harvested peppers develop this disease and turn brown. Pack peppers dry without washing to minimize this disease. If peppers must be washed, then maintain 25 ppm of chlorine (1 tablespoon of Clorox per 8 gallons of water) in the wash water. Avoid washing peppers with water more than 10oF (6oC) cooler than the fruit temperature to prevent movement of bacteria into the stem end of the fruit.

**Phytophthora Blight**

Plant loss can be severe with all pepper types. The disease develops in low areas of the field after heavy rains and can spread throughout the entire field during favorable conditions. Planting on a ridge or raised, dome-shaped bed will assist in control by providing better soil drainage. Use disease-free seed and a 3-year rotation with crops other than peppers, cucurbits, eggplants, or tomatoes. In Phytophthora infested fields or fields with low-lying areas present, plant Phytophthora tolerant or resistant varieties, such as Paladin, Aristotle, or Revolution.

**For control of the crown rot phase of blight, apply:**

mefenoxam--1 pt Ridomil Gold 4E/A or 1 qt Ultra Flourish 2E/A. Apply broadcast prior to planting or in a 12- to 16-inch band over the row before or after transplanting.

Make two additional postplanting directed applications at 1 pint Ridomil Gold 4E or 1 qt Ultra Flourish 2E per acre to 6 to 10 inches of soil on either side of the plants at 30-day intervals.

When using polyethylene mulch, apply Ridomil Gold 4E at the above rates and timing by injection through the trickle irrigation system. Dilute Ridomil Gold 4E prior to injecting to prevent damage to injector pump.

**For prevention of the stem and fruit rot phase of blight, apply the following on a 7- to 10-day schedule:**

copper, fixed--at labeled rates, or

Ridomil Gold Copper--2.5 lb 65WP/A. Make three to four applications at 10- to 14-day intervals. (Only apply Ridomil Gold 4E at planting and 30 days later. The third application of Ridomil Gold 4E cannot be made when Ridomil Gold Copper is applied.)

The following materials are labeled for Phytophthora on peppers, but there is little information on efficacy in the Mid-Atlantic region. For best results tank mix with a

copper containing fungicide.  
Forum --6.0 oz 4.18SC/A, or  
Tanos--8-10 oz 50WDG/A

### **Blossom End Rot**

This physiological disorder is caused by reduced calcium uptake and calcium movement into the fruit when soil moisture is low. To control blossom end rot, maintain proper soil calcium and nutrient balance. Avoid root pruning and damage. The most effective control is to maintain uniform, favorable soil moisture. This is especially important when using raised beds for *Phytophthora* control, since soil in raised beds dries more quickly than in flat culture.

### **Sunscald**

To reduce sunscald, select varieties with good foliage cover. Maintain vigorous vegetative growth by following recommended fertilizer (especially nitrogen) program and timely irrigation. Harvest carefully to avoid damaging stems, branches and foliage.

### **Southern Blight (*Sclerotium*)**

High soil moisture and temperature favor disease development. Long crop rotations with corn and small grains help reduce disease incidence. Additionally, use the following in the transplant water.

Terraclor--3 lb 75WP/100 gal of water and apply 0.5 pint per plant.

### **Verticillium Wilt**

The verticillium fungus can attack and reproduce on a number of plants (eggplants, tomatoes, peppers, potatoes, and strawberries for example), and can survive in the soil for many years. Therefore, provide as long a rotation as possible. DO NOT grow tomato, potato, strawberries, or eggplant as an alternate crop. DO NOT plant other solanaceous crops, such as eggplants or tomatoes between pepper plantings.

### **Viruses**

*Tobacco mosaic virus (TMV)*: TMV is transmitted mechanically. Use resistant varieties to control TMV. *Aphid-transmitted viruses (PVX, CMV, TEV, PVY, and AMV)*: These virus diseases of pepper cannot adequately be controlled with insecticide applications, but symptom expression can be delayed through their use. Since aphids transmit the virus, growers may wish to use yellow trap pans containing water to determine when mass flights of winged aphids occur. Repeated applications of a contact aphicide at those times are most beneficial. *Thrips-transmitted virus (Tomato Spotted Wilt Virus, TSWV, and Impatiens Necrotic Spot Virus, INSV)*: Resistant varieties available. TSWV can be severe on peppers during both greenhouse production of transplants and during field production of the crop. INSV causes similar symptoms on peppers as TSWV; however, the virus is not as severe and does not limit production to the same extent as TSWV. The virus is spread to peppers by thrips. During transplant

production, thrips transmit the virus from infected ornamental plants (flowers). Be sure not to grow any ornamental bedding plants in the same greenhouse as pepper transplants. Monitor greenhouses and scout fields for thrips. Begin an insecticide program once observed. When observed in the field, treat with an insecticide to control thrips and rogue out TSWV infected plants.

## Contacts

Primary Contact:

**Susan Whitney King**

[swhitney@udel.edu](mailto:swhitney@udel.edu)

302-831-8886(voice); 302-831-8889 (fax);

Department of Entomology and Wildlife Ecology,

University of Delaware Cooperative Extension, Newark, DE 19716-2160.

Subject matter contacts and authors at the University of Delaware, College of Agriculture and Natural Resources:

**Joanne Whalen** - Insects

[jwhalen@UDel.Edu](mailto:jwhalen@UDel.Edu)

302-831-2526 (voice); 302-831-8889 (fax);

Department of Entomology and Wildlife Ecology,

University of Delaware, Newark DE 19716-2160

**Bob Mulrooney** - Plant Diseases

[bobmul@udel.edu](mailto:bobmul@udel.edu)

302-831-4865 (voice)

Department of Plant and Soil Science,

University of Delaware, Newark DE 19717

**Mark Van Gessel** - Weeds

[mjv@UDel.Edu](mailto:mjv@UDel.Edu)

301-856-7303 (voice)

UD Research and Education Center,

Georgetown, DE 1947

**Ed Kee** - Vegetable Specialist

[kee@UDel.Edu](mailto:kee@UDel.Edu)

301-856-7303 (voice)

UD Research and Education Center,

Georgetown, DE 1947

**Susan Whitney King** - General Information

## References

1. Scuse, Michael T., and Chris Cadwallader. 2006. Delaware Agricultural Statistics 2005-2006. DDA and USDA/ NASS.  
<http://www.nass.usda.gov/de/agstat.htm>
2. Stayton, H. Grier, Administrator, and David Pyne, Pesticide Inspector, Delaware Department of Agriculture Pesticide Compliance Section.
3. Kee, Ed, and Dewey M. Caron. Revision date: 5/6/2004. Peppers. HG-19. University of Delaware Cooperative Extension Fact Sheet.  
<http://ag.udel.edu/extension/information/hg/hg-19.htm>
4. Commercial Vegetable Production Recommendations. 2007. Delaware Cooperative Extension.