Apply one of the following when disease threatens and repeat every 7 to 10 days.

***Rotate one of the following FRAC code 11 fungicides:***
Quadris--9.0–15.5 fl oz 2.08SC/A, or
Cabrio--8.0-12.0 oz 20EG/A, or
Headline—9.0-12.0 fl oz 2.09EC/A

***With:***
fixed copper at labeled rates

Do not make more than two sequential applications of Cabrio or Quadris before alternating with a copper fungicide.

### Pocket Rot (Rhizoctonia)
Quadris--0.40–0.80 fl oz 2.08SC/1000 row ft

### Black Spot
Can be caused by boron deficiency. Apply boron at planting according to soil test results.

## Harvesting
Market beets are hand-harvested when 1-3/4 to 2 inches in diameter.

| Pesticide | Use Category[1] | Hours to Reentry[2] | Days to Harvest |
|---|---|---|---|
| **INSECTICIDE** | | | |
| *Bacillus thuringiensis* | G | 4 | 0 |
| beta-cyfluthrin | R | 12 | 0 |
| carbaryl | G | 12 | 7 |
| cyfluthrin | R | 12 | 0 |
| imidacloprid (soil/foliar) | G | 12 | 21/7 |
| methoxyfenozide | G | 4 | 14 |
| spinetoram | G | 4 | 7 |
| spinosad | G | 4 | 3 |
| **FUNGICIDE (FRAC code)** | | | |
| Cabrio (Group 11) | G | 12 | 0 |
| copper, fixed (Group M1) | G | 12,24,48 | 0 |
| MetaStar (Group 4) | G | 48 | 14 |
| Quadris (Group 11) | G | 4 | 0 |
| Ridomil Gold (Group 4) | G | 48 | 0 |
| Ultra Flourish (Group 4) | G | 48 | 0 |

See Table 3.

[1] G = general, R = restricted

[2] Chemicals with multiple designations are based on product and/or formulation differences. CONSULT LABEL.

# BROCCOLI, BRUSSELS SPROUTS, CABBAGE, CAULIFLOWER, COLLARDS, KALE, AND KOHLRABI

## Varieties

| Varieties[1] | DE | MD | NJ | PA | VA | WV |
|---|---|---|---|---|---|---|
| **Broccoli** | | | | | | |
| Captain* | D | | N | | V | WV |
| Major* | D | | N | | V | WV |
| Everest* | | | N | P | V | WV |
| Barbados* | | | N | P | | |
| Durango* | D | | N | | | |

*(table continued)*

## Varieties *(continued)*

| Varieties[1] | DE | MD | NJ | PA | VA | WV |
|---|---|---|---|---|---|---|
| Belstar* | | | N | | V | |
| Arcadia* | | | N | P | V | WV |
| Lucky* | D | | N | | V | |
| Laguna* | | M | N | P | V | |
| Gypsy* | | | N | | V | WV |
| **Broccoli** *(continued)* | | | | | | |
| Fiesta* | | | N | | | |
| Pinnacle* | | | N | P | | WV |
| Eureka* (fall production) | | | N | P | | WV |
| Packman | | | | P | | WV |
| Liberty* | D | | N | P | V | WV |
| CMS Liberty (trial) | | | | | V | |
| Sultan* | | | N | P | | WV |
| Diplomat* | | | N | P | | WV |
| Windsor* | | | N | P | | WV |
| **Brussels Sprouts** | | | | | | |
| Oliver* | | | N | P | | |
| Jade Cross E* | D | M | N | P | V | WV |
| Prince Marvel* | D | M | N | P | V | WV |
| Franklin | | | N | P | | |
| Vancouver | | | N | P | | |
| **Cabbage: Early-Midseason** | | | | | | |
| Early Thunder | | | | | V | |
| Charmant* (YR) | | M | N | | V | WV |
| Morris* (YR) | | | N | P | | |
| Blue Gem* (YR,BRT) | | | N | P | | |
| Dynamo* (small head) (SpR) | | | N | | V | |
| Blue Vantage* (YR) | | | N | P | | |
| Green Cup* (YR) | D | | N | P | | |
| Quisto* | | | N | | | |
| Emblem* (SpR) | | | N | | | |
| Platinum Dynasty* (SpR) | | | | | V | |
| Charm Dynasty* | | | | | V | |
| Bronco* | | | N | P | V | WV |
| Thunderhead | | | | | V | |
| Bravo* (YR, BRR) | D | | N | P | V | WV |
| Blue Thunder* (SpR) | D | | | P | V | |
| Constana* | | | N | | V | |
| Platinum Dynasty* | | | N | P | | |
| Blue Dynasty (SpR)* | | | N | P | | |
| Green Laker (SpR)* | | | | P | | |
| Cheers (SpR)* | | | | P | | |
| Blue Thunder (SpR)* | | | N | P | | |
| Superstar (SpR)* | | | N | P | | |
| Bobcat (SpR)* | | | N | P | | |
| **Cabbage: Red** | | | | | | |
| Ruby Ball* | | M | | P | V | WV |
| Red Head* | D | M | N | P | V | WV |
| Red Dynasty (SpR)* | | | N | P | V | |
| Super Red 80 (SpR)* | | | N | P | V | WV |
| Super Red 90 (SpR)* | | | N | | | |
| Cario (SpR)* | | | N | P | | |
| **Cabbage: Savoy** | | | | | | |
| Savoy Express (early trial) | | | | P | V | WV |
| Savoy Ace* | | | N | P | V | WV |
| Chieftain | D | | N | | V | |
| **Cabbage: Chinese** | | | | | | |
| Blues* (Napa type) | D | | N | P | | |
| Jade Pagoda* | D | M | N | P | V | WV |
| Michihli | D | M | N | | V | WV |
| Mount (SpR) | | | N | P | | |
| Yuki | | | | | | WV |

*(table continued on next page)*

## Varieties *(continued)*

| Varieties[1] | DE | MD | NJ | PA | VA | WV |
|---|---|---|---|---|---|---|
| **Pak Choi** | | | | | | |
| Joi Choi* (white, flat petiole) | D | M | | P | | WV |
| Mei Quing Choi* (green, flat petiole) | D | M | | P | | WV |
| Prize Choi* (white,round petiole) | D | | | P | | |
| **Cauliflower** | | | | | | |
| Snow Crown* (spring or fall) | D | M | N | P | V | WV |
| Icon* | | | N | | | |
| Cheddar* (bright orange) | | | N | P | V | WV |
| Amazing* | | | N | P | V | |
| Majestic* | | | N | | | |
| Violet Queen | | | | | | WV |
| Apex* | | | N | P | | |
| Cassius* | D | | N | | | |
| Fremont* | D | | | P | | WV |
| Candid Charm* | | D | N | P | V | |
| Rushmore* | | | N | | | |
| White Sails* | | | N | | | |
| Cashmere* | | | | P | | |
| Panther* | | | | P | | |
| Wentworth* | | | N | P | V | WV |
| Concert* | | | N | | | |
| Graffiti* (lavender-purple) | | | | P | | WV |
| **Collards** | | | | | | |
| Top Bunch* | | | N | P | | WV |
| Top Pick | | | | | V | |
| Flash* | | | N | P | | |
| Blue Max | | | | P | | |
| Champion | D | M | N | P | V | WV |
| **Kale** | | | | | | |
| Dwarf Blue Curled (Vates strain) | D | M | N | P | V | WV |
| Dwarf Siberian (overwinter) | D | M | N | | | WV |
| Red Russian | | | | | | WV |
| Winterbor | | | | | | WV |
| **Kohlrabi** | | | | | | |
| Grand Duke* | | | | P | | WV |
| Purple Danube* | | | | P | | WV |
| Kohlribi (lilac purple) | | | | P | | WV |

[1] Varieties listed by maturity, earliest first. *Indicates hybrid varieties. Letters in parentheses indicate disease resistance possessed by varieties. See the "Abbreviations" section in front portion of this publication.

## Recommended Nutrients Based on Soil Tests

**Before using the table below, refer to important notes in Plant Nutrient Recommendations in Section B, Soil And Nutrient Information. These notes provide additional suggestions to adjust rate, timing and placement of nutrients depending on soil type cation exchange capacity and existing fertility levels.**

| Crop | Nitrogen (N) Pounds per Acre | Soil Phosphorus Level | | | Soil Potassium Level | | |
|---|---|---|---|---|---|---|---|
| | | Low | Med | Opt. | Low | Med | Opt. |
| | | Pounds $P_2 0_5$ per Acre | | | Pounds $K_2 0$ per Acre | | |
| Broccoli | | | | | | | |
| | 150-200[1] | 200[1] | 100[1] | 50[1] | 200[1] | 100[1] | 50[1] |
| | 50-100[2] | 150[2] | 100[2] | 50[2] | 150[2] | 100[2] | 50[2] |
| | 50[3] | 50[3] | 0 | 0 | 50[3] | 0 | 0 |
| | 50[4] | 0 | 0 | 0 | 0 | 0 | 0 |

*table continued*

| Crop | Nitrogen (N) Pounds per Acre | Soil Phosphorus Level | | | Soil Potassium Level | | |
|---|---|---|---|---|---|---|---|
| | | Low | Med | Opt. | Low | Med | Opt. |
| | | Pounds $P_2 0_5$ per Acre | | | Pounds $K_2 0$ per Acre | | |
| Brussels Sprouts, | 100-150[1] | 200[1] | 100[1] | 40[1] | 200[1] | 100[1] | 50[1] |
| Cabbage, and | 50-75[2] | 200[2] | 100[2] | 50[2] | 200[2] | 100[2] | 50[2] |
| Cauliflower | 25-50[3] | 0 | 0 | 0 | 0 | 0 | 0 |
| | 25-50[5] | 0 | 0 | 0 | 0 | 0 | 0 |

[1] Total amount nutrient recommended
[2] Broadcast and disk-in
[3] Sidedress 2-3 weeks after planting
[4] Sidedress 4-6 weeks after planting
[5] Sidedress if needed, according to weather

Apply 1 ½-3 pounds of boron (B) per acre in mixed fertilizer for **broccoli only.** Apply 1 ½-3 pounds of boron (B) per acre and 0.2 pound molybdenum (Mo) applied as 0.5 pound sodium molybdate per acre with broadcast fertilizer for **Brussels sprouts, cabbage, and cauliflower**.

See Table B-10 for more specific boron recommendations.

## Seed Treatment

Check with seedsman to determine if seed is hotwater-treated for blackrot. If not, soak seed at 122°F (50°C). Use a 20-minute soak for broccoli, cauliflower, collards, kale, and Chinese cabbage. Soak brussels sprouts and cabbage for 25 minutes.

**Note**. Hot water seed treatment may reduce seed germination. An alternative to hot water seed treatment is to use 1 part Alcide (sodium chlorite), 1 part lactic acid, and 18 parts water as a seed soak. Treat seed for 1 to 2 minutes and rinse for 5 minutes in running water.

Following either treatment above, dry the seed, then dust with captan 50WP or thiram 75WP at 1 level teaspoon per pound of seed (3 ounces per 100 pounds).

## Planting and Spacing

**Broccoli.** *Field seeding*: Rows 36 inches apart; plants 12 to 18 inches apart in row; seed: 1/2 to 1 pound per acre; time: June 20 to July 20 (June 20 to July 5 in Pennsylvania and northern New Jersey). *Transplants*: Sow 10 seeds per foot of row in rows 12 to 18 inches apart. Set transplants 12 to 18 inches apart in rows 36 inches apart (14,520 plants per acre). *High population for bunched broccoli*: 2 to 4 rows per bed, rows 18 to 20 inches apart, plants 9 to 10 inches in row (27,000 to 32,000 plants per acre); time: seed June 25 to July 10; transplant July 20 to August 15, depending on location.

For fall plasticulture double cropping, remove previous crop debris and set broccoli transplants 12-21 inches apart in double rows 10-12 inches apart. For larger heads allow greater in-row spacing. Set plants in late July through mid-August, depending on variety maturity and location.

**Brussels Sprouts.** *Transplants*: Rows 3 feet apart; plants 15 inches apart in row. Start planting transplants June 20. Start field seeding July 1.

**Cabbage.** The early cabbage crop is grown from transplants seeded at the rate of 1 ounce for 3,000 plants. Transplants are ready for field planting 4 to 6 weeks after seeding. Storage of pulled, field-grown cabbage transplants should not exceed 9 days at 32°F (0°C) or 5 days at 66°F (19°C) prior to planting in the field. Precision seeders can be

used for direct seeding. However, seed should be sown 15 to 20 days in advance of the normal transplant date for the same maturity date. Early varieties require 85 to 90 days from seeding to harvest, and main-season crops require 110 to 115 days. Transplants are set in rows 2 to 3 feet apart and 9 to 15 inches apart in the row for early plantings and 9 to 18 inches apart for late plantings, depending on variety, fertility, and market use.

**Cauliflower.** Start seed in greenhouse or protected frames 4 to 6 weeks before planting. Use 1 ounce of seed for 3,000 plants. Transplants are set in rows 3 to 4 feet apart, and plants are set 18 to 24 inches apart in the row. Make successive plantings in the field between July 15 and August 20, depending on location.

**Note**. In Pennsylvania and other cool areas, Snow Crown, Snow Grace, and White Cloud can be grown in the spring. Transplant to the field in early April.

**Collards.** Seed at the rate of 2 pounds per acre if field-seeded or 4 ounces per acre for transplants. Seed 3 to 4 weeks before transplanting. Transplants are set in rows 16 to 24 inches apart and 6 inches apart in the row. Collards for spring and early summer harvest can be transplanted or seeded starting April 1 in Virginia and warmer, southern areas and April 20 in Pennsylvania and normally cooler areas. Collards can be seeded starting in mid-July through late August for fall harvest.

**Kale**. Usually seeded directly in the field, but it can be grown in frames and transplanted. Sow seed at 3 pounds per acre in rows spaced 16 to 24 inches apart. Thin to 4 to 5 inches apart in the row. Seed kale at the same time as indicated for collards.

**Kohlrabi**. Transplants may be used for a spring crop. Seed 6 weeks before expected transplant date. Plant in the field at the same time as broccoli or cabbage. Fall crops can be established by direct-seeding between June 25 and July 15. Seed open-pollinated varieties at the rate of 2 to 3 pounds per acre and thin to 6 to 8 inches between plants in the row. Precision seed hybrid varieties. Set transplants July 20 to August 15. Space rows 18 to 24 inches apart.

## Bolting

Bolting in cabbage, collards and kale, and buttoning in cauliflower can occur if the early planted crop is subjected to10 or more continuous days of temperatures between 35$^{o}$ to 50$^{o}$F (1.67$^{o}$ to 10$^{o}$C). However, the sensitivity to bolting depends upon the variety.

## Weed Control

Identify the weeds in each field and select recommended herbicides that control those weeds. See Tables E-2 and E-3.

Match preplant incorporated and preemergence herbicide rates to soil type and percent organic matter in each field.

## Seeded and Transplanted

### Preplant Incorporated

Trifluralin--*Seeded*: 0.5-0.75 lb/A. Use 1 to 1.5 pints per acre Treflan 4E. *Transplants*: 0.5-1 lb/A. Use 1 to 2 pints per acre Treflan 4E. Incorporate 2 to 3 inches into soil by double-disking within 8 hours after application. **Labeled for broccoli, brussels sprouts, cabbage, cauliflower, collards, and kale only**.

### Preplant Incorporated or Preemergence

Bensulide--5-6 lb/A. Apply 5 to 6 quarts per acre Prefar 4E before planting and incorporate 1 to 2 inches deep with power-driven rotary cultivators, or apply preemergence and activate with one-half inch of sprinkler irrigation within 36 hours to control most annual grasses. Use the maximum recommended rate preemergence, followed by irrigation to suppress certain annual broadleaf weeds including common lambsquarter, smooth pigweed, and common purslane.

### Preemergence or Post-Transplant

DCPA--6-10.5 lb/A. Apply 8 to 14 pints per acre Dacthal 6F. Apply after seeding or transplanting to a clean, weed-free soil. Use good agitation in tank. Dacthal controls annual grasses, common purslane, and lambsquarter, and suppresses or controls certain other annual broadleaf weeds. Preplant incorporate Treflan to improve control of prostrate pigweed, or use in combination with Dual Magnum to control galinsoga.

S-metolachlor--0.48-1.27 lb/A. **A Special Local-Needs Label 24(c) has been approved for the use of Dual Magnum 7.62E in Delaware, Maryland, New Jersey, Pennsylvania, and Virginia. 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 0.5 to 1.33 pints per acre Dual Magnum 7.62E before weeds emerge, to control annual grasses, yellow nutsedge, and certain broadleaf weeds, including galinsoga. Dual Magnum will NOT control emerged weeds. Use the lower rate on coarse-textured soils low in organic matter, and the higher rate on fine-textured soils with high organic matter. Treat **direct-seeded** cabbage postemergence, after three to four leaves have developed. Emerged weeds should be controlled by cultivation, hoeing, or postemergence herbicides prior to Dual Magnum application. Treat **transplanted** cabbage with either a pretransplant, surface- applied application or spray post-transplant within 2 days of planting. Read and follow all notes and precautions on the label. DO NOT incorporate Dual Magnum prior to planting. DO NOT apply to direct-seeded cabbage prior to the three- to four-leaf growth stage or the risk of crop injury may be increased. Certain varieties may be more sensitive to injury. **Other generic versions of metolachlor and s-metolachlor may be available, and may or may not be labeled for use in the crop. Labeled for cabbage ONLY!**

### Postemergence

Clopyralid--0.047-0.188 lb/A. Apply 2 to 8 fluid ounces of Stinger 3A per acre in one or two applications to control certain annual and perennial broadleaf weeds. Do not exceed 8 fluid ounces in one year. Stinger controls weeds in the Composite and Legume plant families. Common annuals controlled include galinsoga, ragweed species, common cocklebur, groundsel, pineappleweed, clover, and vetch. Perennials controlled include Canada thistle, goldenrod species, aster species, and mugwort (wild chrysanthemum). Stinger is very effective on small seedling annual and

emerging perennial weeds less than 2 to 4 inches tall, but is less effective and takes longer to work when weeds are larger. Use 2 to 4 fluid ounces to control annual weeds less than 2 inches tall. Increase the rate to 4 to 8 fluid ounces to control larger annual weeds. Apply the maximum rate of 8 fluid ounces to suppress or control perennial weeds. Spray additives are not needed or required by the label, and are not recommended. Observe a minimum preharvest interval (PHI) of 30 days. Stinger is a postemergence herbicide with residual soil activity. Observe follow-crop restrictions, or injury may occur from herbicide carryover.

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 Select Max 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 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 30 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 30 days and apply no more than 3 pints per acre in one season. **Labeled for broccoli, cabbage, and cauliflower only**.

S-metolachlor--0.48-1.27 lb/A. **A Special Local-Needs Label 24(c) has been approved for the use of Dual Magnum 7.62E in Delaware, Maryland, New Jersey, Pennsylvania, and Virginia. 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 0.5 to 1.33 pints per acre Dual Magnum 7.62E before weeds emerge, to control annual grasses, yellow nutsedge, and certain broadleaf weeds, including galinsoga. Dual Magnum will NOT control emerged weeds. Use the lower rate on coarse-textured soils low in organic matter, and the higher rate on fine-textured soils with high organic matter. Treat **direct-seeded** cabbage postemergence, after three to four leaves have developed. Emerged weeds should be controlled by cultivation, hoeing, or postemergence herbicides prior to Dual Magnum application. Treat **transplanted** cabbage with either a pretransplant, surface-applied application or spray posttransplant within 2 days of planting. Read and follow all notes and precautions on the label. DO NOT incorporate Dual Magnum prior to planting. DO NOT apply to direct-seeded cabbage prior to the three- to four-leaf growth stage or the risk of crop injury may be increased. Certain varieties may be more sensitive to injury. **Other generic versions of metolachlor and s-metolachlor may be available, and may or may not be labeled for use in the crop. Labeled for cabbage ONLY!**

Napropamide--1 lb/A. Apply 2 pounds per acre Devrinol 50DF preplant incorporated before seeding or transplanting. Primarily controls annual grasses and certain broadleaf weeds. Tank-mix with minimum recommended rate of Treflan 4EC to improve the spectrum of broadleaf weeds controlled. Use only on fine-textured soils such as silt or clay loams with more than 2 percent organic matter. Crop injury has occurred when used on coarse-textured soils low in organic matter. **Labeled for broccoli, Brussels sprouts, cabbage, and cauliflower. Recommended in Pennsylvania ONLY!**

### Transplanted Only

Oxyfluorfen--0.2-0.5 lb/A. Apply 0.8 to 2 pints per acre Goal 2XL or Galigan 2E, or 0.8 to 1 pint per acre GoalTender 4FL before transplanting and transplant through the herbicide on the soil surface to control broadleaf weeds including common lambsquarter, common purslane, common ragweed, pigweed sp., and galinsoga. Use lower rates on coarse-textured soils low in organic matter. Cold, wet conditions in early spring may increase the risk of temporary crop injury which could delay maturity. Annual grasses will not be adequately controlled by Goal. Use Dacthal posttransplant or Poast 1.5EC postemergence to control grasses. Treflan or Dual Magnum may increase the potential for crop injury, especially when conditions are cold and wet, and it is not recommended for use prior to Goal application. Delay cultivation after Goal application, when possible, to reduce deactivation of the Goal by incorporation. **Labeled for broccoli, cabbage, and cauliflower only**.

### Postharvest

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, New Jersey and Virginia**. Apply 2.4 pints per acre Gramoxone Inteon 2SC as a broadcast spray after the last harvest. Add nonionic surfactant according to the labeled instructions. See the label for additional information and warnings.

## Insect Control

**NOTE**: Copies of specific insecticide product labels can be downloaded by visiting websites www.CDMS.org or www.Greenbook.org. Also, specific labels can be obtained via web search engines.

**Note:** Not all pesticides are labeled for each crop in this section. Refer to Days to Harvest Table at the end of the Broccoli, Brussels Sprouts, Cabbage, Cauliflower, Collards, Kale, and Kohlrabi Section and/or pesticide label to determine which pesticide are labeled on specific crops.

### Cabbage Maggot

chlorpyrifos (Lorsban 4E or OLF)--Apply in a 4-inch band across the seed row behind the planter shoe and ahead of the press wheel, or apply as a water based spray directed to the base of plants immediately after setting. Do not apply as a foliage application.
diazinon (Diazinon 4E or OLF)--Apply as a preplant broadcast or as a transplant solution.

**Note.** When yellow-rocket (mustard family) first blooms, cabbage maggot adults (flies) begin laying eggs on roots or soil near roots.

### Cutworms

(Also see the "Cutworms" section in Soil Pests-Their Detection and Control.)

beta-cyfluthrin (Baythroid XL )
bifenthrin (Brigade EC, Sniper, or OLF)
carbaryl (Sevin 80S, Sevin 5%Bait or OLF)
chlorpyrifos (Lorsban 4E or OLF)
cyfluthrin (Renounce 20WP , Tombstone or OLF)
diazinon (Diazinon 4E or OLF)
esfenvalerate (Asana XL)
gamma-cyhalothrin (Proaxis)
lambda-cyhalothrin (Lambda-Cy, LambdaT, Silencer, Warrior, Warrior II, or OLF)
methomyl (Lannate LV or OLF)
zeta-cypermethrin (Mustang MAX, Respect or OLF)

### Thrips

Field observations indicate that the variety Market Prize may be more attractive to thrips than other varieties.

acetamiprid (Assail 30SG or OLF)
beta-cyfluthrin (Baythroid XL )
bifenthrin (Brigade EC, Sniper, or OLF)
cyfluthrin (Renounce 20WP, Tombstone or OLF)
gamma-cyhalothrin (ProAxis)
imidacloprid (soil-Admire 2F, Admire PRO, foliar-Nuprid 1.6F, Provado 1.6F or OLF)
lambda-cyhalothrin (Lambda-Cy, LambdaT, Silencer, Warrior, Warrior II, OLF)
permethrin (Perm-UP 3.2EC, Pounce 3.2EC or OLF)
spinetoram (Radiant 2SC)
spinosad (Entrust 80W, SpinTor 2SC or OLF)
thiamethoxam (Actara 25WDG)
zeta-cypermethrin (Mustang MAX, Respect)

### Aphids

acephate **(Brussels sprouts and cauliflower only)** (Orthene 97S OLF)
acetamiprid (Assail 30SG or OLF)
diazinon (Diazinon 4E or OLF)
dinotefuran (soil/foliar-Venom 70SG or OLF)
flonicamid (Beleaf 50SG or OLF)
imidacloprid (soil-Admire 2F, Admire PRO; foliar-Nuprid 1.6F, Provado 1.6F or OLF)
pymetrozine (Fulfill 50W)
spirotetramat (Movento)
thiamethoxam (Actara 25WDG)

### Flea Beetles (FB), Harlequin Bugs

Treat for flea beetles if population reaches 1 beetle per transplant or 5 beetle per 10 plants during cotyledon stage.

acetamiprid (Assail 30SG)
beta-cyfluthrin (Baythroid XL)
bifenthrin (Brigade EC, Sniper, or OLF)
carbaryl (Sevin 80S or OLF)
cyfluthrin (Renounce 20WP, Tombstone or OLF)
endosulfan (Thionex 3EC or OLF)
esfenvalerate (Asana XL) **(FB only)**
gamma-cyhalothrin (Proaxis)
imidacloprid (soil-Admire 2F, Admire PRO; foliar-Nuprid 1.6F, Provado 1.6F or OLF)
lambda-cyhalothrin (Lambda-Cy, LambdaT, Silencer, Warrior, Warrior II or OLF)
thiamethoxam (Actara 25WDG) (**FB only**)
zeta-cypermethrin (Mustang MAX, Respect)

### Worm Pests

Cole crops may require multiple treatments per season. Rotation of insecticides with different modes of action is recommended to reduce the development of resistance.

Treat cabbage when 20 percent or more of the plants are infested with any species before heading. Once heads are formed, treat when 5 percent of the plants are infested.

**Note.** Underleaf spray coverage is essential to control newly hatched worms. With boom-type rigs, apply spray with at least 3 nozzles per row--one directed downward and one directed toward each side. Evaluate effectiveness to consider need for further treatment.

### Cabbage Looper (CL), Imported Cabbageworm (ICW) and other miscellaneous caterpillar pests

acephate **(Brussels sprouts and cauliflower only)** (Orthene 97S or OLF)
*Bacillus thuringiensis* (Biobit, Dipel, Dipel 2X, Javelin, XenTari or OLF)
beta-cyfluthrin (Baythroid XL or OLF)
bifenthrin (Brigade EC, Sniper or OLF)
chlorantraniliprole (Coragen 1.67SC )
cyfluthrin (Renounce 20WP, Tombstone or OLF)
emamectin (Proclaim 5SG)
esfenvalerate (Asana XL)
fenpropathrin (Danitol 2.4EC)
flubendiamide (Synapse WG)
gamma-cyhalothrin (Proaxis)
indoxacarb (Avaunt 30WDG or OLF)
lambda-cyhalothrin (Lambda-Cy, LambdaT, Silencer, Warrior, Warrior II or OLF)
methomyl **(Fresh-market collards only)** (Lannate LV or OLF)
**Note: DO NOT apply to collards when minimum daily temperatures are <50 degrees F or when plants are <10" tall.**
methoxyfenozide (Intrepid 2F)
novaluron (Rimon 0.83EC)
spinetoram (Radiant 2SC)
spinosad (Entrust 80W, SpinTor 2SC or OLF).
tebufenozide (Confirm 2F)
thiodicarb (Larvin 3.2F)
zeta-cypermethrin (Mustang MAX, Respect)

### Diamondback Moth (DBM)

**Note.** Several of these insecticides may no longer be effective in certain areas due to DBM resistance. Consult your local county Extension office for most effective control.

acephate **(Brussels sprouts and cauliflower only)** (Orthene 80S or OLF)
*Bacillus thuringiensis* (Biobit, Dipel, Dipel 2X, Javelin, XenTari or OLF)
beta-cyfluthrin (Baythroid XL)
bifenthrin (Brigade EC, Sniper, or OLF)
chlorantraniliprole (Coragen 1.67SC)
cyfluthrin (Renounce 20WP, Tombstone or OLF)
emamectin (Proclaim 5SG)
esfenvalerate (Asana XL)
fenpropathrin (Danitol 2.4EC)
flubendiamide (Synapse WG)
gamma-cyhalothrin (Proaxis)
indoxacarb (Avaunt 30WDG)
lambda-cyhalothrin (Lambda-Cy, LambdaT, Silencer, Warrior, Warrior II or OLF)
methomyl (Lannate LV or OLF)
methoxyfenozide (Intrepid 2F)
novaluron (Rimon 0.83EC)
spinetoram (Radiant 2SC)
spinosad (Entrust 80WP, SpinTor 2F or OLF).
tebufenozide (Confirm 2F)
thiodicarb (Larvin 3.2F)

### Beet Armyworm (BAW), Fall Armyworm (FAW, Yellow Striped Armyworm (YSAW)

*Bacillus thuringiensis* (Biobit, Dipel, Dipel 2X, Javelin, XenTari or OLF)
chlorantraniliprole (Coragen 1.67SC)
emamectin benzoate (Proclaim 5SG)
flubendiamide (Synapse WG)
indoxacarb (Avaunt 30WDG)
methomyl (Lannate LV or OLF)
methoxyfenozide (Intrepid 2F)
spinosad (Entrust 80WP, SpinTor 2SC or OLF)
tebufenozide (Confirm 2F)
thiodicarb (Larvin 3.2F)

### Cabbage Webworm (CWW), Cross-Striped Cabbageworm (CSCW)

beta-cyfluthrin (Baythroid XL ) (**CWW only**)
chlorantraniliprole (Coragen 1.67SC)
cyfluthrin (Renounce 20WP, Tombstone or OLF)
emamectin (Proclaim 5SG)
gamma-cyhalothrin (Proaxis) **(CWW only**)
indoxacarb (Avaunt 30WDG)
lambda-cyhalothrin (Lambda-Cy, LambdaT, Silencer, Warrior, Warrior II or OLF) **(CWW only**)
novaluron (Rimon 0.83EC) **(CWW only**)
tebufenozide (Confirm 2F)
zeta-cypermethrin (Mustang MAX, Respect) (**CWW only**)

## Nematode Control

See "Nematodes" section of Soil Pests-Their Detection and Control. Use fumigants listed in the "Soil Fumigation" section or Nemacur 15G at 30 pounds per acre broadcast or 10 pounds per acre in a 12-inch band over the row. Incorporate 2 to 6 inches before seeding or transplanting.

## Disease Control

### Damping-Off

Use the following as a banded application after seeding. See label for banded rates based on row spacing. Apply the following in a band up to 7 inches wide:

mefenoxam (Ridomil Gold--1.0-2.0 pt 4EC/A), or
Quadris--0.4-0.8 fl oz 2.08SC/1000 row ft, or
mefenoxam (Ridomil Gold--1.0-2.0 pt 4EC/A) *plus* Quadris--0.4-0.8 fl oz 2.08SC/1000 row ft.

### Black Rot and Blackleg

Use resistant varieties and hot water seed treatment. Select field not previously planted to crucifers for seedbeds. (See the "Disease Control in Plantbeds" section.) Rotate to allow 2 years between cole crop plantings for black rot control and 4 years between cole crop plantings for blackleg control.

For blackleg control in broccoli only, use iprodione at 2.0 lb/A or OLF immediately after thinning as a directed spray to the base of the plant and adjacent soil surface. A second application may be made up to the day of harvest.

For black rot control, fixed copper sprays (1.0 lb active ingredient/A) will aid in reducing spread of black rot if treatments are started when disease first becomes evident. Bravo and Blue Gem are cabbage varieties with field resistance to black rot.

### Bacterial Head Rot

Bacterial head rot is a problem on broccoli. The only effective control strategy is to use tolerant varieties.

### Clubroot

Use of irrigation water containing spores of this fungus is the principal way the disease is spread into new fields. If clubroot occurs, clean and disinfest any equipment to be used in other fields to prevent spread. Adjust soil pH with hydrated lime to as close to 7.0 as possible. Improve the drainage in the field and grow the crop on raised beds. Use Terraclor 75WP in one of the following ways. Do NOT use the Terraclor 2EC formulation.

1. Use 30.0 lb/A or 37.0 oz/1000 ft of row. Apply in a 12 to 15-inch band and incorporate 4 to 6 inches deep before planting, or
2. Use 40.0 lb/A acre broadcast and incorporate 4 to 6 inches deep before planting, or
3. Use 2.0 lb per 100 gallons of solution and 0.5 pint per plant as a transplant solution.

### Downy Mildew and Alternaria

Use one of the following at the first sign of disease and continue every 7 to 10 days (Refer to the pesticide table for this section to determine which fungicide is labeled for each specific cole crop.):

Quadris--6.0-15.5 fl oz 2.08SC/A, or
chlorothalonil--1.5 pt 6F/A or OLF, or
Cabrio--12.0-16.0 oz 20EG/A, or
Endura--6.0-9.0 oz 70WG/A (Alternaria only), or
maneb--1.5-2.0 lb 75DF/A or OLF, or
Ridomil Gold Bravo--1.5 lb 76.5WP/A (14-day schedule), or
Switch--11.0-14.0 oz 62.5WG/A (Alternaria only)

Materials with different modes of action (FRAC code) should be rotated.

**For downy mildew only, use:**

Actigard--1.0 oz 50WG/A. (Begin applications 7-10 days after thinning and reapply every 7 days for a total of 4 applications per season), or

Aliette--3.0-5.0 lb 80WDG/A (14-day schedule)

### White Mold

The following biological fungicide has been tested in some states; however, limited information is available on effectiveness in the mid-Atlantic region. Apply 3 to 4 months prior to the onset of disease to allow the active agent to reduce inoculum levels of sclerotia in the soil. Following application, incorporate to a depth of 1 to 2 inches but **do not plow** before seeding cole crops to avoid untreated sclerotia in lower soil layers from infesting the upper soil layer.

Contans--2.0-4.0 lb 5.3WG/A

Alternatively, during seasons when soils remain wet for extended periods of time apply the following preventatively:

Endura--6.0-9.0 oz 70WG/A (Do not make more than two applications per season.)

### Yellows (*Fusarium*)

Use resistant varieties when possible and practice long crop rotations.

## Harvesting and Storage

Cauliflower is harvested while the heads are pure white and before the curds become loose and ricey. Heads are blanched (for varieties that are not self-blanching) by tying outer leaves over the heads when heads are 3 to 4 inches in diameter. Blanching takes about 1 week in hot weather and 2 weeks in cooler weather.

The late plantings of Danish Ballhead strains are stored at 32$^{o}$ to 34$^{o}$F (O$^{o}$ to 1.11$^{o}$C) and 90 to 95 percent relative humidity.

Kale is harvested by cutting off entire plant near ground level, or lower leaves may be stripped from plant. Collards may be harvested at any stage of growth.

| Pesticide | Use Category[2] | Hours to Reentry[3] | Days to Harvest[1] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Broc-coli | Brus. Sprt. | Cab-bage | Cab.[4] (Chin.) | Cauli-flower | Col-lards | Kale | Kohl-rabi |
| **INSECTICIDE** | | | | | | | | | | |
| acephate | G | 24 | -- | 14 | -- | -- | 14 | -- | -- | -- |
| acetamiprid | G | 12 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| *Bacillus thuringiensis* | G | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| beta-cyfluthrin | R | 12 | 0 | 0 | 0 | 0 | 0 | -- | -- | 0 |
| bifenthrin | R | 12 | 7 | 7 | 7 | 7 | 7 | -- | -- | 7 |
| carbaryl | G | 12 | 3 | 3 | 3 | -- | 3 | 14 | 14 | 3 |
| chlorantraniliprole | G | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| chlorpyrifos (Lorsban 15G) | R(NJ),G | 24 | AP | AP | AP | AP | AP | AP | AP | AP |
| (Lorsban 4E, 75WG) | R,G | 24 | 21 | 21 | 21 | -- | 21 | 21 | 21 | 21 |
| cyfluthrin | R | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| diazinon | R | 24 | 7 | 7 | 21 | 10 | 5 | 10 | 10 | -- |
| dimethoate | R,G | 48 | 7 | -- | 7 | -- | 7 | 14 | 14 | -- |
| dinotefuran (soil/foliar) | G | 12 | 21/1 | 21/1 | 21/1 | 21/1 | 21/1 | -- | -- | 21/1 |
| emamectin | R | 48 | 7 | 7 | 7 | 7 | 7 | 14 | 14 | 7 |
| endosulfan | R | 24 | 7 | 14 | 7 | -- | 14 | 21 | 21 | -- |
| esfenvalerate | R | 12 | 3 | -- | 3 | 3 | 3 | 7 | -- | 3 |
| fenpropathrin | R | 24 | 7 | 7 | 7 | 7 | 7 | -- | -- | 7 |
| flonicamid | G | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| flubendiamide | G | 12 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| gamma-cyhalothrin | R | 24 | 1 | 1 | 1 | 1 | 1 | -- | -- | 1 |
| imidacloprid (soil/foiliar) | G | 12 | 21/7 | 21/7 | 21/7 | 21/7 | 21/7 | 21/7 | 21/7 | 21/7 |
| indoxacarb | G | 12 | 3 | 3 | 3 | 3 | 3 | -- | -- | 3 |
| lambda-cyhalothrin | R | 24 | 1 | 1 | 1 | 1 | 1 | -- | -- | 1 |
| methomyl | R | 48 | 3 | 3 | 1 | 10 | 3 | 10 | 10 | -- |
| methoxyfenozide | G | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| novaluron | R | 12 | 7 | 7 | 7 | 7 | 7 | -- | -- | 7 |
| permethrin | R | 12 | 1 | 1 | 1 | 1 | 1 | 1 | -- | 1 |
| pymetrozine | G | 12 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| spinetoram | G | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| spinosad | G | 4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| tebufenozide | G | 4 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| thiamethoxam | G | 12 | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 7 |
| thiodicarb | R | 48 | 7 | -- | 7 | -- | 7 | -- | -- | -- |
| zeta-cypermethrin | R | 12 | 1- | 1 | 1 | 1 | 1 | 1 | -- | -- |
| **FUNGICIDE (FRAC code)** | | | | | | | | | | |
| Actigard (Group P1) | G | 12 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Aliette (Group 33) | G | 12,24 | 3 | -- | 3 | 3 | 3 | 3 | 3 | 3 |
| Cabrio (Group 11) | G | 12 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| chlorothalonil (Group M5) | G | 12 | 0 | 0 | 0 | 7 | 0 | -- | -- | -- |
| Contans WG (biological) | G | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Endura (Group 7) | G | 12 | 0,14[5] | 0 | 0 | 0,14[5] | 0 | 14 | 14 | 0 |
| iprodione (Group 2) | G | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| maneb (Group M3) | G | 24 | 7 | 7 | 7 | 7 | 7 | -- | 10 | 7 |
| Quadris (Group 11) | G | 4 | -- | -- | -- | 0 | -- | 0 | 0 | -- |
| Ridomil Gold (Group 4) | G | 48 | AP | AP | AP | AP | AP | AP | AP | AP |
| Ridomil Gold Bravo (Groups 4 + M5) | G | 48 | 7 | 7 | 7 | 7 | 7 | -- | -- | -- |
| Switch (Groups 9 + 12) | G | 12 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Terraclor (Group 14) | G | 12 | AP | AP | AP | AP | AP | AP | AP | AP |

[1] AP = At-planting time only

[2] G = general, R = restricted

[3] Chemicals with multiple designations are based on product and/or formulation differences. CONSULT LABEL.

[4] Tight-heading varieties of Chinese cabbage

[5] See label for specific recommendations

Dash (-) in table indicates pesticide is **not** labeled for that crop