

**2026/2027**

**Mid-Atlantic Commercial Vegetable**

**Production Recommendations**



## F. Commodity Recommendations

### Pesticide Use Disclaimer

#### **THE LABEL IS THE LAW**

**A pesticide applicator is legally bound by the labeling found on and with the pesticide container in their possession. Before using a pesticide, check and always follow the labeling distributed with the product at the point of sale for legally enforceable rates and use restrictions and precautions.**

Although labels are available on the Internet from electronic label services such as Proagrica's CDMS (<https://www.cdms.net/>), Greenbook (<https://www.greenbook.net/>), or Agworld DBX powered by Agrian (<https://www.agrian.com/labelcenter/results.cfm>) the information contained in these electronic labels may not be identical to the labeling distributed with the product. **Please be advised that these electronic label services provide use disclaimers, and in some cases legally binding *User Agreements* assigning ALL liability to user of service.** (See section D 3.1. Labels and Labeling for more detail.)

#### **Guide to the Recommended Pesticide Tables in the Following Crop Sections:**

1. Pesticides are listed by **group number or code based on chemical structure and mechanism of action**, as classified by the Herbicide Resistance Action Committee (HRAC, <https://hracglobal.com>) for herbicides, the Insecticide Resistance Action Committee (IRAC, <https://irac-online.org>) for insecticides, and the Fungicide Resistance Action Committee (FRAC, <https://www.frac.info/>) for fungicides. **In this guide, if the group number or code is in bold font, there are resistance concerns for the product.**
2. **Restricted use pesticides** are marked with a \* in the Tables. These products may only be used by certified and/or licensed pesticide applicators, and when stated on the label, those making applications under their direct supervision. Some labels may restrict use solely to certified and/or licensed applicators. (See section D 3.2.1 Restricted Use Classification Statement for more detail).
3. **In addition to the pesticide products listed in the Commodity Recommendations below, other formulations or brands with the same active ingredient(s) may be commercially available. ALWAYS CHECK THE LABELING ON THE PRODUCT CONTAINER ITSELF:**
  - a) to ensure a pesticide is labeled for the same intended use,
  - b) to ensure the pesticide is labeled for the desired crop,
  - c) for differences in application rates and % active ingredient(s), and
  - d) additional restrictions.
4. All pesticide recommendations contained in this document are prescribed for spray applications to a **broadcast area of 1 acre** (43,560 square feet). **Adjust the rate accordingly for banded applications** (See section E 1.3. Calibrating Granular Applicators) **or for chemigation** (check labels for amounts per 1,000 feet).
5. Check the physical product label for and do not exceed the maximum amount of pesticide *per application* and the maximum number of applications *per year*.
6. **Bee Toxicity Rating (Bee TR):** N=nontoxic; L=minimum impact on bees; M=moderately toxic, can be used if dosage, timing, and method of application are correct, but should NOT be applied directly to the crop if bees are present; H=highly toxic, severe losses expected, -- = data not available.
7. In accordance with the USDA National Organic Program, the Organic Materials Research Institute (OMRI) maintains a directory of all products that OMRI has determined are allowed for use in organic production, processing, and handling. These products are catalogued online in the **OMRI Products List** (see <https://www.omri.org/omri-lists>).

If you are having a **medical emergency** after using pesticides, always **call 911** immediately.



**In Case of an Accident**

- Remove the person from exposure
- Get away from the treated or contaminated area immediately
- Remove contaminated clothing
- Wash with soap and clean water
- Call a physician and/or the National Poison Control Center (1-800-222-1222).  
Your call will be routed to your State Poison Control Center.
- Have the pesticide label with you!
- Be prepared to give the EPA registration number to the responding center/agency

# Cole Crops: Broccoli, Brussels Sprouts, Cabbage, Cauliflower, Collards, Kale, and Kohlrabi

**Recommended Varieties - For all Cole Crops, varieties are listed alphabetically.**

| Crop            | Variety                             | F1 <sup>1</sup> | Maturity <sup>2</sup> | BR <sup>3</sup> | DM <sup>3</sup> | HS <sup>3</sup> | Cold <sup>3</sup> | Heat <sup>3</sup> | S/F <sup>4</sup> |
|-----------------|-------------------------------------|-----------------|-----------------------|-----------------|-----------------|-----------------|-------------------|-------------------|------------------|
| <b>Broccoli</b> | Abrams                              | Yes             | Mid                   |                 |                 |                 |                   | X                 | S,F              |
|                 | Apollo (Sprouting) <sup>5</sup>     | Yes             | Mid                   |                 |                 |                 |                   |                   | S,F              |
|                 | Atlantis (Sprouting) <sup>5</sup>   | Yes             | Mid                   |                 |                 |                 |                   |                   | S,F              |
|                 | BC1611 (Sprouting) <sup>5</sup>     | Yes             | Early                 |                 |                 |                 |                   |                   | S,F              |
|                 | BC1764                              | Yes             | Early                 |                 |                 |                 |                   |                   | F                |
|                 | Burney                              | Yes             | Mid                   |                 |                 |                 |                   | X                 | S,F              |
|                 | DeCicco (Sprouting) <sup>5</sup>    | No              | Mid                   |                 |                 |                 | X                 |                   | F                |
|                 | Diamante                            | Yes             | Late                  |                 |                 |                 |                   |                   | F                |
|                 | Diplomat                            | Yes             | Early                 |                 | X               | X               | X                 | X                 | S,F              |
|                 | Eastern Crown                       | Yes             | Early-Mid             |                 |                 |                 |                   | X                 | S,F              |
|                 | Eastern Magic                       | Yes             | Mid                   |                 |                 |                 |                   | X                 | S,F              |
|                 | Emerald Crown                       | Yes             | Early-Mid             |                 |                 |                 | X                 |                   | F                |
|                 | Emerald Jewel                       | Yes             | Late                  |                 |                 |                 |                   |                   | F                |
|                 | Fiesta                              | Yes             | Early                 |                 |                 |                 | X                 |                   | F                |
|                 | Green Gold                          | Yes             | Mid                   |                 |                 |                 |                   |                   | S,F              |
|                 | Green Magic                         | Yes             | Early                 |                 |                 |                 |                   |                   | S,F              |
|                 | Gypsy                               | Yes             | Mid                   |                 | X               |                 | X                 |                   | F                |
|                 | Imperial                            | Yes             | Mid-Late              |                 |                 |                 |                   | X                 | S,F              |
|                 | Ironman                             | Yes             | Late                  |                 |                 | X               |                   |                   | F                |
|                 | Lieutenant                          | Yes             | Mid                   |                 |                 | X               |                   | X                 | S,F              |
|                 | Luna                                | Yes             | Mid                   |                 |                 |                 |                   |                   | S,F              |
|                 | Marathon                            | Yes             | Mid                   |                 |                 |                 | X                 |                   | F                |
|                 | Millennium                          | Yes             | Mid                   |                 |                 |                 |                   | X                 | S,F              |
|                 | Montebello (Sprouting) <sup>5</sup> | Yes             | Mid                   |                 |                 |                 |                   |                   | S,F              |
|                 | Spectre                             | Yes             | Early-Mid             |                 |                 |                 | X                 | X                 | S,F              |

<sup>1</sup>F1=Hybrid. <sup>2</sup>Early, Midseason (Mid), or Late. <sup>3</sup>X denotes some degree of resistance or tolerance to disease or environmental condition. BR=Black Rot, DM=Downy Mildew, HS=Hollow Stem. <sup>4</sup>Recommended for Spring (S) or Fall (F) production. <sup>5</sup>Sprouting types produce a loose head for spear production.

| Crop                    | Variety | Hybrid | Maturity  |
|-------------------------|---------|--------|-----------|
| <b>Brussels Sprouts</b> | Dagan   | Yes    | Midseason |
|                         | Gustus  | Yes    | Midseason |
|                         | Marte   | Yes    | Early     |
|                         | Silvia  | Yes    | Midseason |

| Crop                 | Variety       | F1 <sup>1</sup> | Maturity <sup>2</sup> | Lb   | Shape   | Use <sup>3</sup> | Y <sup>4</sup> | BR <sup>4</sup> | TB <sup>4</sup> | Thr <sup>4</sup> | SH <sup>4</sup> |
|----------------------|---------------|-----------------|-----------------------|------|---------|------------------|----------------|-----------------|-----------------|------------------|-----------------|
| <b>Green Cabbage</b> | Artost        | Yes             | Early                 | 3-6  | Round   | F,P              | H              |                 | H               |                  | H               |
|                      | Bajonet       | Yes             | Midseason             | 3-5  | Round   | F                | H              |                 |                 |                  |                 |
|                      | Blue Dynasty  | Yes             | Midseason             | 4    | Round   | F                | H              | H               |                 |                  | H               |
|                      | Blue Vantage  | Yes             | Midseason             | 4    | Round   | F                | H              | L               | H               | H                |                 |
|                      | Bravo         | Yes             | Late                  | 4-10 | Round   | F, P             | H              | H               |                 |                  |                 |
|                      | Bronco        | Yes             | Midseason             | 3-5  | Round   | F                | H              |                 | M               | M                |                 |
|                      | Bruno         | Yes             | Late                  | 4    | Round   | F                | H              | H               |                 |                  |                 |
|                      | Capture       | Yes             | Late                  | 3-6  | Round   | F, P             | H              | M               |                 |                  |                 |
|                      | Caraflex      | Yes             | Early                 | 2-3  | Pointed | F                | H              |                 |                 | H                |                 |
|                      | Charmant      | Yes             | Early                 | 3    | Round   | F                | H              | H               |                 | L                | H               |
|                      | Cheers        | Yes             | Midseason             | 5    | Round   | F                | H              | H               |                 | H                |                 |
|                      | Early Thunder | Yes             | Midseason             | 3-4  | Round   | F                | H              | M               | M               | H                |                 |
|                      | Farao         | Yes             | Early                 | 3    | Round   | F                |                |                 | M               |                  | H               |

*Cabbage - continued next page*

*Cabbage - continued*

| Crop                                | Variety          | F1 <sup>1</sup> | Maturity <sup>2</sup> | Lb    | Shape | Use <sup>3</sup> | Y <sup>4</sup> | BR <sup>4</sup> | TB <sup>4</sup> | Thr <sup>4</sup> | SH <sup>4</sup> |
|-------------------------------------|------------------|-----------------|-----------------------|-------|-------|------------------|----------------|-----------------|-----------------|------------------|-----------------|
| <b>Green Cabbage</b><br>(continued) | Grand Vantage    | Yes             | Midseason             | 5-6   | Round | F                | H              |                 |                 |                  |                 |
|                                     | Megaton          | Yes             | Late                  | 10-20 | Round | P                | H              |                 | H               |                  |                 |
|                                     | Padoc            | Yes             | Midseason             | 5-8   | Round | P                | H              |                 | H               |                  |                 |
|                                     | Platinum Dynasty | Yes             | Midseason             | 4-10  | Round | F, P             | H              | H               | H               |                  | H               |
|                                     | Primo Vantage    | Yes             | Midseason             | 4-5   | Round | F                | H              |                 |                 |                  |                 |
|                                     | Quick Start      | Yes             | Early                 | 3-4   | Round | F                | H              |                 | H               | M                |                 |
|                                     | Ramada           | Yes             | Late                  | 3-6   | Round | F                | H              | H               |                 |                  |                 |
|                                     | Royal Vantage    | Yes             | Midseason             | 3-5   | Round | F                | H              | H               | H               | H                |                 |
|                                     | Superstar        | Yes             | Late                  | 3-4   | Round | F                | H              | H               | H               | M                |                 |
|                                     | Thunderhead      | Yes             | Midseason             | 3-5   | Round | F                | H              | H               | H               | H                |                 |
|                                     | Tiara            | Yes             | Early                 | 1-2   | Round | F                |                |                 |                 |                  |                 |
|                                     | Vantage Point    | Yes             | Late                  | 5-6   | Round | F                | H              | H               | H               | H                |                 |
| <b>Green Savoy Cabbage</b>          | Alcosa           | Yes             | Early                 | 2-4   | Round | F                | H              |                 | H               |                  |                 |
|                                     | Clarissa         | Yes             | Midseason             | 2-3   | Round | F                | H              |                 | H               |                  |                 |
|                                     | Melissa          | Yes             | Midseason             | 2-4   | Round | F                | H              |                 | H               |                  |                 |
|                                     | Savoy Ace        | Yes             | Midseason             | 3-4   | Round | F                | M              |                 |                 |                  |                 |
|                                     | Savoy King       | Yes             | Midseason             | 4     | Round | F                |                |                 | H               |                  |                 |
| <b>Red Cabbage</b>                  | Azurro           | Yes             | Midseason             | 3-4   | Round | F                |                |                 | H               | H                |                 |
|                                     | Cairo            | Yes             | Late                  | 3-6   | Round | F                | M              |                 | H               | H                | H               |
|                                     | Red Dynasty      | Yes             | Midseason             | 5-12  | Round | F, P             |                |                 | H               |                  | H               |
|                                     | Red Jewel        | Yes             | Midseason             | 3-5   | Round | F                |                |                 | H               |                  |                 |
|                                     | Ruby Perfection  | Yes             | Late                  | 3-4   | Round | F                | M              | M               | M               | H                |                 |
| <b>Red Savoy Cabbage</b>            | Deadon           | Yes             | Late                  | 3-5   | Round | F                |                |                 |                 |                  |                 |

<sup>1</sup>F1=Hybrid. <sup>2</sup>Early, Midseason (Mid), or Late. <sup>3</sup>F=Fresh market, P=Processing (slaw, kraut). <sup>4</sup>Pest or Abiotic Stress Reaction: Y=Yellows, BR=Black rot, TB=Tip Burn, Thr=Thrips, SH=Split Head; M=Moderate or intermediate and H=high level of resistance or tolerance.

| Crop                   | Variety        | Shape/Color   | Hybrid | Days to maturity |
|------------------------|----------------|---------------|--------|------------------|
| <b>Chinese Cabbage</b> | Blues          | Napa (barrel) | Yes    | 57               |
|                        | China Express  | Napa (barrel) | Yes    | 62               |
|                        | China Gold     | Napa (barrel) | Yes    | 65               |
|                        | Emiko          | Napa (barrel) | Yes    | 55               |
|                        | Haku           | Napa (barrel) | Yes    | 55               |
|                        | Monument       | Narrow        | Yes    | 80               |
|                        | Spring Crisp   | Napa (barrel) | Yes    | 75               |
|                        | Yuki           | Napa (barrel) | Yes    | 67               |
| <b>Pak Choi</b>        | Black Summer   | Green petiole | Yes    | 45               |
|                        | Bopak          | White petiole | Yes    | 45               |
|                        | Joi Choi       | White petiole | Yes    | 50               |
|                        | Mei Quing Choi | Green petiole | Yes    | 40               |

| Crop               | Variety    | Hybrid | Color  | Maturity  | Season      | Self-Wrapping |
|--------------------|------------|--------|--------|-----------|-------------|---------------|
| <b>Cauliflower</b> | Absolute   | Yes    | White  | Midseason | Fall        | Yes           |
|                    | Alcala     | Yes    | White  | Mid-Late  | Fall        | Yes           |
|                    | Amazing    | No     | White  | Midseason | Fall        | Yes           |
|                    | Apex       | Yes    | White  | Midseason | Fall        | Yes           |
|                    | Aquarius   | Yes    | White  | Midseason | Fall        | Yes           |
|                    | Bermeo     | Yes    | White  | Early-Mid | Spring-Fall | Yes           |
|                    | Bishop     | Yes    | White  | Early     | Spring-Fall | Partial       |
|                    | Cheddar    | Yes    | Orange | Late      | Fall        | No            |
|                    | Denali     | Yes    | White  | Early     | Spring-Fall | Yes           |
|                    | Flamenco   | Yes    | White  | Midseason | Fall        | Yes           |
|                    | Flame Star | Yes    | Yellow | Early     | Fall        | No            |
|                    | Freedom    | Yes    | White  | Early     | Fall        | Yes           |
|                    | Graffiti   | Yes    | Purple | Late      | Fall        | No            |

*Cauliflower - continued next page*

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### *Cauliflower - continued*

| Crop                              | Variety                   | Hybrid | Color | Maturity  | Season      | Self-Wrapping |
|-----------------------------------|---------------------------|--------|-------|-----------|-------------|---------------|
| <b>Cauliflower</b><br>(continued) | Minuteman                 | Yes    | White | Early     | Spring-Fall | No            |
|                                   | Steady                    | Yes    | White | Early     | Fall        | Partial       |
|                                   | Symphony                  | Yes    | White | Late      | Fall        | Yes           |
|                                   | Synergy                   | Yes    | White | Midseason | Fall        | Yes           |
|                                   | Toledo                    | Yes    | White | Midseason | Fall        | Yes           |
|                                   | Twister                   | Yes    | White | Midseason | Fall        | Yes           |
|                                   | Vitaverde                 | Yes    | Green | Midseason | Fall        | No            |
|                                   | Puntoverde<br>(26-701 RZ) | Yes    | Green | Midseason | Fall        | No            |

| Crop            | Variety                   | Hybrid | Color            | Comments                                |
|-----------------|---------------------------|--------|------------------|-----------------------------------------|
| <b>Collards</b> | Champion                  | No     | Deep Green       | Flat to lightly waved leaves            |
|                 | Flash                     | Yes    | Deep Green       | Flat to lightly waved leaves            |
|                 | Hi-Crop                   | Yes    | Deep Green       | Semi-savoyed leaves                     |
|                 | Top Bunch                 | Yes    | Blue Green       | Lightly savoyed leaves                  |
|                 | Vates                     | No     | Deep Green       | Flat to lightly waved leaves            |
| <b>Kale</b>     | Black Magic               | No     | Dark Blue Green  | Broader leaved lance leaf type          |
|                 | Blue Ridge                | Yes    | Blue Green       | Very curled leaf                        |
|                 | Dwarf Blue Curled (Vates) | No     | Blue Green       | Curled leaf                             |
|                 | Dwarf Siberian            | No     | Green            | Light to medium curl, overwinters       |
|                 | Lacinato                  | No     | Blue Green       | Puckered strap-like lance leaf          |
|                 | Redbor                    | Yes    | Deep Red         | Curled leaf                             |
|                 | Red Russian               | No     | Blue Green-Red   | Flat toothed leaf green with red midrib |
|                 | Starbor                   | Yes    | Blue Green       | Curled leaf                             |
| <b>Kohlrabi</b> | Winterbor                 | Yes    | Dark Green       | Curled leaf                             |
|                 | Azur Star                 | No     | Deep Blue-Purple |                                         |
|                 | Kolibri                   | Yes    | Deep Purple      |                                         |
|                 | Konan                     | Yes    | Light Green      |                                         |
|                 | Quickstar                 | Yes    | Light Green      |                                         |
|                 | Terek                     | Yes    | Light Green      |                                         |
|                 | Winner                    | Yes    | Light Green      |                                         |

## Recommended Nutrients Based on Soil Tests

In addition to using the table below, check the suggestions on rate, timing, and placement of nutrients in your soil test report and Chapter B Soil and Nutrient Management. Your state's soil test report recommendations and/or your farm's nutrient management plan supersede the recommendations found below.

| Cole Crops <sup>1,2</sup>              |          | Soil Phosphorus Level                |     |            |                | Soil Potassium Level    |     |            |                | Nutrient Timing and Method                |
|----------------------------------------|----------|--------------------------------------|-----|------------|----------------|-------------------------|-----|------------|----------------|-------------------------------------------|
|                                        |          | Low                                  | Med | High (Opt) | Very High      | Low                     | Med | High (Opt) | Very High      |                                           |
|                                        | N (lb/A) | P <sub>2</sub> O <sub>5</sub> (lb/A) |     |            |                | K <sub>2</sub> O (lb/A) |     |            |                |                                           |
| Broccoli                               | 150-200  | 200                                  | 100 | 50         | 0 <sup>3</sup> | 200                     | 100 | 50         | 0 <sup>3</sup> | Total nutrient recommended                |
|                                        | 50-100   | 200                                  | 100 | 50         | 0 <sup>3</sup> | 200                     | 100 | 50         | 0 <sup>3</sup> | Broadcast and disk-in                     |
|                                        | 50       | 0                                    | 0   | 0          | 0              | 0                       | 0   | 0          | 0              | Sidedress 2-3 weeks after planting        |
|                                        | 50       | 0                                    | 0   | 0          | 0              | 0                       | 0   | 0          | 0              | Sidedress 4-6 weeks after planting        |
| Brussels Sprouts, Cabbage, Cauliflower | 100-150  | 200                                  | 100 | 50         | 0 <sup>3</sup> | 200                     | 100 | 50         | 0 <sup>3</sup> | Total nutrient recommended                |
|                                        | 50-75    | 200                                  | 100 | 50         | 0 <sup>3</sup> | 200                     | 100 | 50         | 0 <sup>3</sup> | Broadcast and disk-in                     |
|                                        | 25-50    | 0                                    | 0   | 0          | 0              | 0                       | 0   | 0          | 0              | Sidedress 2-3 weeks after planting        |
|                                        |          |                                      |     |            |                |                         |     |            |                |                                           |
| Kale, Collards                         | 100-200  | 200                                  | 100 | 50         | 0 <sup>3</sup> | 200                     | 100 | 50         | 0 <sup>3</sup> | Total nutrient recommended                |
|                                        | 50-100   | 200                                  | 100 | 50         | 0 <sup>3</sup> | 200                     | 100 | 50         | 0 <sup>3</sup> | Broadcast and disk-in                     |
|                                        | 25-50    | 0                                    | 0   | 0          | 0              | 0                       | 0   | 0          | 0              | Sidedress after each cutting or stripping |
| Kohlrabi                               | 25-50    | 0                                    | 0   | 0          | 0              | 0                       | 0   | 0          | 0              | Total nutrient recommended                |
|                                        | 25-50    | 0                                    | 0   | 0          | 0              | 0                       | 0   | 0          | 0              | Sidedress if needed according to weather  |

<sup>1</sup>For broccoli, apply 1.5-3 lb/A of boron (B). For Brussels sprouts, cabbage and cauliflower, apply 1.5-3 lb/A of B and 0.2 lb molybdenum (Mo) applied as 0.5 lb/A sodium molybdate with broadcast fertilizer; see also Table B-7. in Chapter B Soil and Nutrient Management.

<sup>2</sup>Include 25-40 lb/A of sulfur (S) in the fertilizer program for cole crops.

<sup>3</sup>In VA, crop replacement values of 25 lb/A of P<sub>2</sub>O<sub>5</sub> and 25 lb/A of K<sub>2</sub>O are recommended on soils testing Very High.

## Plant Tissue Testing

Plant tissue testing can be a valuable tool to assess crop nutrient status during the growing season to aid with in-season fertility programs or to evaluate potential deficiencies or toxicities. Critical cabbage tissue test values for most recently matured leaves 8 weeks after transplanting: N 3-6%, P 0.3-0.6 %, K 2.0-4.0 %, Ca 1.5-2.0%, Mg 0.25-0.6% and S 0.3%. For additional nutrients, other cole crops and other growth stages consult with a tissue testing laboratory or check the following University of Florida website: <https://edis.ifas.ufl.edu/publication/ep081>.

## Seed Treatment

Check with your seed company if seed is hot water-treated for Black Rot; see also Disease Control below.

## Planting and Spacing

All cole crops may be direct-seeded or transplanted.

### Direct Seeding:

Precision seeders are recommended. Sow 15-20 days before the normal transplant date for the same maturity date.

### Transplant Production and Handling for All Cole Crops:

Sow in 72-128 cell plug trays or in transplant production beds at 10 seeds/ft of row in rows 12-18 inches apart. Early transplant production will require heated greenhouse facilities or frames. Transplants for summer plantings may be produced in field beds. Transplants are ready in 4-6 weeks. Bare root transplants should be planted soon after lifting. 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.

### Broccoli - Fall Production

**Direct field seeding:** Rows 30-36 inches apart; seed: ½-1 lb/A so that plants are 12-18 inches apart in row. Make successive plantings June 20 to July 20 (June 20 to July 5 in PA and northern NJ).

**Transplants:** Successive plantings between July 15 and August 20, depending on location. Set transplants 12-18 inches apart in rows 36 inches apart (14,520 plants/A).

**High population planting for crown cut and bunched broccoli:** 2-4 rows per bed, rows 18-20 inches apart, plants 9-12 inches in row (27,000-32,000 plants/A). Seed June 25 to July 10; transplant July 20 to August 20, 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.

**Broccoli - Spring Production** Spring production of broccoli is successful in cooler areas of the region but is limited by heat in southern areas. Use heat tolerant varieties. For spring production transplant March 15-April 20.

**Brussels Sprouts** are a long season crop grown for fall production. Transplant rows 3 ft apart; plants 15 inches apart in row. Start planting transplants June 20. Start field seeding June 1.

**Cabbage** is planted from March through early August depending on location, variety, and intended harvest date. Early varieties require 85-90 days from seeding to harvest, and main-season crops require 110-115 days. Crops grown from transplants are 14-21 days earlier. Transplants are set in rows 2-3 ft apart and 9-15 inches apart in the row for early plantings and 9-18 inches apart for late plantings, depending on variety, fertility, and market use.

**Cauliflower** Transplants are set in rows 3-4 ft apart, and plants are set 18-24 inches apart in the row. Make successive plantings in the field between July 15 and August 20, depending on location. **Note.** In some areas, early maturing or heat tolerant cultivars can be grown in the spring. Transplant to the field in early April. Spring production in the southern part of the region is riskier.

**Collards** Direct-seeded: Seed at the rate of 2 lb/A. Transplanting: Transplants are set in rows 16-36 inches apart and 6-12 inches apart in the row. Use wider between-row and in-row spacing for multiple hand harvests by stripping leaves. Collards for spring and early summer harvest can be transplanted or seeded starting April 1 in VA and warmer, southern areas and April 20 in PA and normally cooler areas. Collards can be seeded starting in mid-July through late August for fall harvest. Collards for processing are planted in 4-6 row beds, 12-16 inches between rows at a rate of 10-16 seeds/ft of row.

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**Kale** Direct Seeding: Sow seed at 3-4 lb/A in rows spaced 16-36 inches apart. Thin seedlings to 4-5 inches apart in the row. Transplanting: Transplants are set in rows 16-36 inches apart and 6-12 inches apart in the row. Use wider between-row and in-row spacing for multiple hand harvests by stripping leaves. Kale for spring and early summer harvest can be transplanted or seeded starting April 1 in VA and warmer, southern areas and April 20 in PA and normally cooler areas. Kale can be seeded or transplanted starting in mid-July through late August for fall harvest. Kale for processing is planted in 4-6 row beds, 12-16 inches between rows at a rate of 10-16 seeds per foot of row.

**Kohlrabi** Transplants may be used for a spring crop. 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 2-3 lb/A and thin to 6-8 inches between plants in the row. Precision-seed hybrid varieties. Set transplants July 20 to August 15. Space rows 18-24 inches apart.

## No-Till / Conservation Tillage

Cabbage and broccoli have been successfully grown by transplanting into rolled or herbicide killed cover crops using a no-till planter.

## Irrigation and Water Use

All cole crops benefit from irrigation to achieve the highest yields and quality. Cole crops require a seasonal total of 10-15 inches of water. Amounts will depend on planting date, seasonal variation, variety, and number of times the field is harvested. For spring crops, the highest demand is near harvest. For fall crops, the highest demand is mid-season. Consistent soil moisture level is especially critical to achieve maximum quality in cauliflower. Any moisture stress, especially when plants reach the 6-7 leaf stage may cause cauliflower to button or form heads prematurely.

## Common Physiological Disorders

**Black Petiole in Cabbage** Black petiole or black midrib is an internal disorder of cabbage that has been observed in recent years. As heads approach maturity, the underside of the internal leaf petioles or midribs turn dark gray or black at or near the point where the midrib attaches to the main stem. It is believed that this disorder is associated with a potassium (K) -phosphorus (P) imbalance. Proper nutrient management and choice of cultivar will help minimize this condition.

**Bolting/Buttoning Due to Low Temperatures in Broccoli, Cabbage, Cauliflower, Collards and Kale** Bolting in cabbage, collards and kale, and “buttoning” in cauliflower can occur if early planted crops are subjected to low temperatures (between 35-50°F/2-10°C for 10 or more continuous days). Temperature-induced bolting responses depend on variety.

**Boron Deficiencies** Cole crops have a high boron requirement. Boron deficiency results in cracked and corky stems, petioles, and midribs for most cole crops. For broccoli, cabbage and cauliflower, stems can be hollow and sometimes discolored. Cauliflower curds become brown, and leaves may roll and curl, while cabbage heads may be small and yellow.

### Brown Floret (Bead) and Yellowing Floret in Broccoli

Brown Floret is thought to be caused by plant nutritional imbalances but also may be due to insect feeding damage (e.g., harlequin bugs). Areas of florets do not develop properly, die and lead to brown discolored areas.

**Yellowing florets** may be due to over-maturity at harvest, high storage temperatures and/or exposure to ethylene. Any development of yellow beads ends commercial marketability. Bead yellowing due to senescence should not be confused with the yellow to light-green color of areas of florets not exposed to light during growth, sometimes called “marginal yellowing”. Proper post-harvest handling and packaging will help minimize this problem.

**Curd Bracts in Cauliflower** Development of curd bracts or small green leaves between the segments of the curd in cauliflower is caused by high temperature or drought. Heat-resistant cultivars and proper water management can help minimize this condition.

**Edema on Cole Crop Leaves** Edema is water blistering on cole crop leaves. The most common cause of edema is the presence of abundant, warm soil water and a cool, moist atmosphere. Proper water management can help to minimize this condition.



**Hollow Stem in Broccoli and Cauliflower Not Caused by Boron Deficiency** This condition starts with gaps that develop in stem tissues. These gaps gradually enlarge to create a hollow stem. Ordinarily, there is no discoloration of the surface of these openings at harvest but both discoloration and tissue breakdown may develop soon after harvest. Some cultivars of hybrid cauliflower and broccoli may have openings from the stem into the head. Hollow stem increases with wider plant spacing and as the rate of nitrogen increases. The incidence of hollow stem can be greatly reduced by increasing the density of the plant population.

**Lack of Heads in Broccoli and Cauliflower** During periods of extremely warm weather, *i.e.*, days over 86°F (30°C) and nights over 77°F (25°C), broccoli and cauliflower can remain vegetative due to inadequate cold exposure. This can cause a problem in scheduling the maturation and marketing dates for these crops.

**Off-Colors in Cauliflower** Heads exposed to sunlight may develop a yellow and/or red to purple pigment. Certain varieties (*e.g.*, Snow Crown) are more predisposed to purple off-colors, especially in hot weather. Self-blanching varieties have been developed to reduce problems with curd yellowing. For open headed varieties, the usual method to exclude light is to tie the outer leaves when the curd is 8 cm in diameter. Leaves may also be broken over the curd to prevent yellowing. In hot weather, blanching may take 3-4 days, but in cool weather, 8-12 or more days may be required. Cauliflower fields scheduled to mature in cool weather (September and October) that are well supplied with water and planted with “self-blanching” cultivars do not require tying. Newer orange cauliflower and green broccoflower varieties are less susceptible to off-colors but can still turn purple under warm conditions.

**Premature Heading (Buttoning) in Broccoli and Cauliflower** Losses are usually most severe when transplants have gone past the juvenile stage before setting in the field. Stress factors such as low soil nitrogen, low soil moisture, disease, insects, or micronutrient deficiencies can also cause this problem. Some cultivars, particularly early ones, are more susceptible to buttoning than others.

**Ricing and Fuzziness in Cauliflower** “Riciness” and “fuzziness” in cauliflower heads occurs when plants experience high temperatures early in head formation, followed by low temperatures as the head develops. These conditions cause flower buds develop, elongate and separate, making the curd unmarketable. Some varieties are more susceptible to ricing/fuzziness than others.

**Splitting in Cabbage** Cabbage splitting mainly occurs in early cabbage when moisture stress is followed by heavy rain. Rapid growth associated with rain, high temperatures and high fertility can cause splitting. Proper irrigation and deep cultivation may help prevent splitting. There are significant differences between cultivars in their susceptibility to this problem.

**Tipburn in Cauliflower, Cabbage, and Brussels Sprouts** Tipburn is a breakdown of plant tissue inside the head of cabbage, individual sprouts in Brussels sprouts, and on the inner wrapper leaves of cauliflower. It is associated with an inadequate supply of calcium in the affected leaves, causing a collapse of the tissue and death of the cells. Calcium deficiency may occur where the soil calcium is low or where there is an imbalance of nutrients in the soil along with certain weather conditions (high humidity, low soil moisture, high potash and high nitrogen aggravate calcium availability). Secondary rots caused by bacteria can follow the onset of tipburn and heads of cauliflower can be severely affected. Some cabbage and cauliflower cultivars are relatively free of tipburn problems. This problem can cause severe economic losses.

## Harvest and Post-Harvest Considerations

### Broccoli

Broccoli should be harvested when heads have reached maximum diameter and flower buds (beads) are still tight. Bunched broccoli heads are tied together in groups of 3-4 with a rubber band. Broccoli should be hydrocooled or packed in ice immediately after harvest and stored at 32°F (0°C) and relative humidity of 95-100% to maintain salable condition. Under these conditions, broccoli should keep satisfactorily 10-14 days. For processing, broccoli has the potential to be machine harvested but due to uniformity differences at harvest, hand harvest produces the highest yields and best quality.

### Cabbage

Cabbage is harvested when heads are tight and have reached the desired size for the variety and spacing. The head is harvested by bending it to one side and cutting the base with a knife. Harvesting knives should be sharpened frequently. The stalk should be cut flat and as close to the head as possible, yet long enough to retain 2-4 wrapper

## F. Cole Crops

leaves. Extra leaves act as cushions during handling and may be desired in certain markets. Yellowed, damaged, or diseased wrapper leaves should be removed. Heads with insect damage and other defects should be discarded. It is important that unharvested immature heads are undamaged because fields will be harvested multiple times. Harvested cabbage can be placed in bags, boxes, wagons, or pallet bins, depending on the harvesting method. Holding cabbage too long past harvest maturity will result in head splitting. Store the harvested cabbage at 32°F (0°C) and a relative humidity of 98-100%. For processing, cabbage has the potential to be machine harvested but due to uniformity differences at harvest, hand harvest produces the highest yields and the best quality.

### Cauliflower

Cauliflower is harvested while the heads are pure white and before the curds become loose and ricey. Most varieties are self-blanching. For those that are not, blanching is achieved 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. Store the harvested cauliflower at 32°F (0°C) and a relative humidity of at least 95%. Avoid bruising heads in harvest, handling, and packing.

### Kale and Collards

Kale and Collards are harvested by cutting off entire plants near ground level. Whole plants are then bunched, or lower leaves may be stripped from plants and packed individually. For processing, kale and collards are machine cut 4-6 inches from the ground when full tonnage has been achieved but before petioles have elongated. Multiple harvests are possible. Because of their perishability, kale and collards should be held as close to 32°F (0°C) as possible. At this temperature, they can be held for 10-14 days. Relative humidity of at least 95% is desirable to prevent wilting. Air circulation should be adequate to remove heat of respiration, but excessive air circulation will speed transpiration and wilting. Satisfactory precooling is accomplished by vacuum cooling or hydrocooling. These leafy greens are commonly shipped with package and top ice to maintain freshness. Kale packed in polyethylene-lined crates and protected by crushed ice keeps in excellent condition for 3 weeks at 32°F (0°C).

### Kohlrabi

Kohlrabi is harvested when stems are full sized but before they begin to split.

## Weed Control

### THE LABEL IS THE LAW-see the Pesticide Use Disclaimer on the first page of Chapter F. Recommended Herbicides

1. Identify the weeds in each field and select recommended herbicides. More information is available in the "Herbicide Effectiveness on Common Weeds in Vegetables" (Table E-3) in Chapter E Pest Management.
2. Minimize herbicide resistance development. Identify the herbicide mode of action group number and follow recommended good management practices; **bolded group numbers in tables below are herbicides at higher risk for selecting resistant weed populations.** Include non-chemical weed control whenever possible.

| 1.a. Soil-Applied (Preplant Incorporated or Preemergence)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                      |                                                  |                    |                                                          |            |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|--------------------------------------------------|--------------------|----------------------------------------------------------|------------|------------|
| Group                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Product Name<br>(* = Restricted Use) | Product Rate                                     | Active Ingredient  | Active Ingredient Rate                                   | PHI<br>(d) | REI<br>(h) |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Treflan HFP                          | Seeded: 1 to 1.5 pt/A<br>Transplanted: to 2 pt/A | <b>trifluralin</b> | Seeded: 0.50 to 0.75 lb/A<br>Transplanted: 0.5 to 1 lb/A | --         | 12         |
| <b>-Labeled for broccoli, Brussels sprouts, cabbage, cauliflower, collards, and kale only.</b> Labeled seeded-crop as well as transplants.<br>-Apply only as preplant incorporated and incorporate into 2-3 inches of soil within 8 h after application.<br>-See label for incorporation equipment recommendations. Primarily controls annual grasses and a few broadleaf weeds.<br>- <b>Do not</b> use (or reduce the rate) used when cold, wet soil conditions are expected, or crop injury may result.<br>-Poor incorporation can reduce overall weed control. -Maximum application not addressed on label.                                                       |                                      |                                                  |                    |                                                          |            |            |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Prefar 4E                            | 5 to 6 qt/A                                      | <b>bensulide</b>   | 5 to 6 lb/A                                              | --         | 12         |
| <b>-Labeled for broccoli, Brussels sprouts, cabbage, cauliflower, collards, kale, and kohlrabi.</b><br>-Labeled for seeded-crop as well as transplants.<br>-Labeled for preplant incorporated or preemergence applications; <b>do not</b> incorporate more than 2 inches deep (1 inch is optimum).<br>-If applied preemergence, irrigate within 36 h of application with ½ inch of water; if not incorporated with irrigation or rainfall within 36 h, weed control maybe reduced. Provides control/suppression of some annual grass weeds and some broadleaves including pigweeds, purslane, and lambsquarters. <b>Do not</b> apply more than 6 lb ai/A per season. |                                      |                                                  |                    |                                                          |            |            |

1.a. Soil-Applied (Preplant Incorporated or Preemergence) - continued next page

**1.a. Soil-Applied (Preplant Incorporated or Preemergence) - continued**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                          |                              |                                  |                                           |    |    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|------------------------------|----------------------------------|-------------------------------------------|----|----|
| 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Goal 2XL or Galigan 2E<br>GoalTender 4F  | 1 to 2 pt/A<br>0.5 to 1 pt/A | oxyfluorfen                      | 0.25 to 0.5 lb/A                          | -- | 24 |
| <b>-Labeled for broccoli, cabbage, and cauliflower only.</b><br>-Labeled for transplanting only. Apply before transplanting and transplant through the herbicide on the soil surface<br>-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. Use of transplants less than 5 weeks old or use of succulent transplants grown in containers less than 1-inch square may increase severity of crop injury.<br>-Controls broadleaf weeds including common lambsquarters, common purslane, common ragweed, pigweed sp., and galinsoga.<br>-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.<br>-Delay cultivation after Goal application, when possible, to reduce deactivation of the Goal by incorporation.<br><b>-Do not apply more than 1 pt/A per season of GoalTender or more than 2 pt/A of Goal 2XL.</b> |                                          |                              |                                  |                                           |    |    |
| 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Spartan 4F<br>Zeus 4F                    | 2.25 to 12 fl oz/A           | sulfentrazone                    | 0.07 to 0.38 lb/A                         | -- | 12 |
| <b>-Spartan is labeled for transplanted processing cabbage only.</b><br><b>-Zeus is labeled for transplanted cabbage, transplanted Chinese cabbage, and transplanted NAPA.</b><br>-Refer to label for rates, rates vary by soil type and organic matter content. -Can be applied preplant, preplant incorporated, or surface applied up until transplanting. For preplant incorporated treatments do not incorporate more than 2 inches.<br>-Do not use on soils classified as sand with less than 1% organic matter.<br><b>-Do not make more than one application per year; do not apply more than 12 fl oz/A in a 12 month period.</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                                          |                              |                                  |                                           |    |    |
| 14+14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Spartan Charge 3.5F                      | 2.9 to 15.2 fl oz/A          | sulfentrazone +<br>carfentrazone | 0.075 to 0.39 lb/A<br>0.008 to 0.043 lb/A | 80 | 12 |
| <b>-Labeled for transplanted cabbage only.</b> -Refer to label for rates, rates vary by soil type and organic matter content.<br>-Can be applied preplant, preplant incorporated, or surface applied up until transplanting.<br>For preplant incorporated treatments do not incorporate more than 2 inches.<br>-Do not use on soils classified as sand with less than 1% organic matter.<br><b>-Do not make more than one application per year; do not apply more than 15.2 fl oz/A in a 12 month period.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                          |                              |                                  |                                           |    |    |
| 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Devrinol 2-XT 2EC<br>Devrinol DF-XT 50DF | 2 qt/A<br>2 lb/A             | napropamide                      | 1 lb/A                                    | -- | 24 |
| <b>-Labeled for broccoli, Brussels sprouts, cabbage, cauliflower, collards, and kale only. Recommended in PA ONLY!</b><br><b>-Labeled for direct-seeded-crops as well as transplants.</b><br>-Apply preplant incorporated or preemergence; if incorporated do not incorporate deeper than seeding depth; if surface applied then irrigate within 24-72 h with sufficient water to wet the soil to a depth of 4 to 8 inches. Controls annual grasses and certain broadleaf weeds.<br>-Tank mix with minimum recommended rate of Treflan 4EC to improve the spectrum of broadleaf weeds controlled.<br>-Use only on fine-textured soils such as silt or clay loams with more than 2% organic matter. Crop injury has occurred when used on coarse-textured soils low in organic matter.<br><b>-Do not exceed a maximum application rate of 2 qt/A (2-XT) or 2 lb/A (DF-XT) per crop cycle.</b>                                                                                                                                                                        |                                          |                              |                                  |                                           |    |    |
| 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Dual Magnum 7.62E                        | 0.5 to 1.33 pt/A             | s-metolachlor                    | 0.48 to 1.27 lb/A                         | 60 | 24 |
| <b>-Special Local Needs Label 24(c) for transplanted cabbage in DE, NJ, and PA ONLY! (expires in DE 12/31/2028; NJ 1/28/2027; PA 12/31/2027). The use of this product is legal ONLY if a waiver of liability has been completed (see: <a href="https://www.syngenta-us.com/labels/indemnified-label-login">https://www.syngenta-us.com/labels/indemnified-label-login</a>).</b><br>-Apply before transplanting. <b>Do not</b> mechanically incorporate Dual Magnum prior to transplanting.<br>-Risk of injury is less with post-transplanted applications than pre-transplant applications. Chinese cabbage varieties are more sensitive to Dual injury. Make only 1 application per crop and <b>do not</b> apply more than 1.33 pt/A.                                                                                                                                                                                                                                                                                                                              |                                          |                              |                                  |                                           |    |    |

**1.b. Post-Transplant Application / Preemergence Control**

| Group                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Product Name<br>(* = Restricted Use) | Product Rate     | Active Ingredient | Active Ingredient Rate | PHI<br>(d) | REI<br>(h) |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|------------------|-------------------|------------------------|------------|------------|
| 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Dual Magnum 7.62E                    | 0.5 to 1.33 pt/A | s-metolachlor     | 0.48 to 1.27 lb/A      | 60         | 24         |
| <b>-Special Local Needs Label 24(c) for the use of Dual Magnum 7.62E for transplanted cabbage or emerged cabbage ONLY in DE, NJ, and PA! (Expires in DE 12/31/2028; NJ 1/28/2027; PA 12/31/2027). The use of this product is legal ONLY if a waiver of liability has been completed (see: <a href="https://www.syngenta-us.com/labels/indemnified-label-login">https://www.syngenta-us.com/labels/indemnified-label-login</a>).</b><br>-Apply directly over the top of transplants within 48 h of transplanting.<br><b>-Do not</b> mechanically incorporate prior to transplanting. May be applied over the top of direct-seeded cabbage after cabbage has developed 3 to 4 leaves. <b>Do not</b> apply to direct-seeded cabbage prior to the 3 to 4-leaf growth stage or the risk of crop injury may be increased.<br>-Use of an adjuvant or another registered herbicide will increase the risk of injury from postemergence applications<br>-Risk of injury is less with post-transplanted applications than pre-transplant applications. -Chinese cabbage varieties are more sensitive to Dual injury.<br>-Dual Magnum will <b>not</b> control emerged weeds. Emerged weeds should be controlled by cultivation, hoeing, or postemergence herbicides prior to Dual Magnum application. -Make only 1 application per crop and <b>do not</b> apply more than 1.33 pt/A |                                      |                  |                   |                        |            |            |

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| 2. Postemergence                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                               |                                                        |                   |                        |            |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------------------------------|-------------------|------------------------|------------|------------|
| Group                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Product Name<br>(*Restricted Use)             | Product Rate                                           | Active Ingredient | Active Ingredient Rate | PHI<br>(d) | REI<br>(h) |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Shadow 3EC<br>Select 2EC<br>Select Max 0.97EC | 4 to 5.33 fl oz/A<br>6 to 8 fl oz/A<br>9 to 16 fl oz/A | clethodim         | 0.07 to 0.125 lb/A     | 30/14      | 24         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Poast 1.5EC                                   | 1 to 1.5 pt/A                                          | sethoxydim        | 0.2 to 0.3 lb/A        | 30         | 12         |
| <b>-Select 2EC:</b> use crop oil concentrate (COC) at 1% v/v (1 gal/100 gal of spray solution). <b>Select Max 0.97EC:</b> use nonionic surfactant (NIS) at 0.25% v/v (1 qt/100 gal of spray solution). <b>Shadow 3EC:</b> use crop oil concentrate (COC) at 1% v/v (1 gal/100 gal of spray solution) for large or stressed grasses; use nonionic surfactant (NIS) at 0.25% v/v (1 qt/100 gal of spray solution) when crop safety is a concern. <b>Poast 1.5EC:</b> use COC at 1% v/v.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                               |                                                        |                   |                        |            |            |
| <b>-General comments:</b> -The use of COC may increase the risk of crop injury when hot or humid conditions prevail. To reduce the risk of crop injury, switch to NIS when grasses are small and soil moisture is adequate. -Use lower labeled rates for annual grass control and higher labeled rates for perennial grass control. For best results, treat annual grasses when they are actively growing and before tillers are present. -Yellow nutsedge, wild onion, wild garlic, and broadleaf weeds will <b>not</b> be controlled with these herbicides. -These herbicides control many annual and certain perennial grasses. Clethodim is best on annual bluegrass; while Poast is preferred for goosegrass control. -Repeated applications may be necessary to control certain perennial grasses. If repeat applications are necessary, allow 14 days between applications. -Rainfastness 1 h. -PHI of Select, Select Max, and Shadow 3EC for broccoli, Brussel sprouts, cabbage, cauliflower, and kohlrabi is 30 d; PHI for collards and kale is 14 d. |                                               |                                                        |                   |                        |            |            |
| <b>-Do not</b> tank mix with or apply within 2 to 3 days of any other pesticide, unless labeled, as this may increase the risk of crop injury or reduce the control of grasses. <b>-Do not</b> apply more than 8 fl oz/A of Select 2EC in a single application and <b>do not</b> exceed 2 pt/A for the season; <b>do not</b> apply more than 16 fl oz/A of Select Max in a single application and <b>do not</b> exceed 4 pt/A for the season; <b>do not</b> apply more than 5.33 fl oz/A of Shadow 3EC in a single application and <b>do not</b> exceed 21.33 fl oz/A for the season.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                               |                                                        |                   |                        |            |            |
| <b>-Do not</b> apply more than 1.5 pt/A Poast in a single application and <b>do not</b> exceed 3 pt/A for the season.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                               |                                                        |                   |                        |            |            |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Stinger 3SL                                   | 4 to 8 fl oz/A                                         | clpyralid         | 0.094 to 0.188 lb/A    | 30         | 12         |
| <b>-Spray additives</b> are not required by the label and are not recommended.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                               |                                                        |                   |                        |            |            |
| <b>-Stinger</b> controls composite and legume weeds including galinsoga, ragweed species, common cocklebur, groundsel, pineappleweed, clover, and vetch. Perennials suppressed or controlled include Canada thistle, goldenrod species, aster species, and mugwort.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                               |                                                        |                   |                        |            |            |
| <b>-Stinger</b> is very effective on small seedling annual and emerging perennial weeds less than 2-4 inches tall but is less effective and takes longer to work when weeds are larger. Use 4 fl oz/A to control annual weeds less than 2 inches tall. Increase the rate to 4 to 8 fl oz/A to control larger annual weeds. Apply the maximum rate of 8 fl oz/A to suppress or control perennial weeds.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                               |                                                        |                   |                        |            |            |
| <b>-Observe</b> crop restrictions or injury may occur from herbicide carryover.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                               |                                                        |                   |                        |            |            |
| <b>-Rainfastness</b> is 6 h. Maximum Stinger applications per year is 2, but not to exceed a total of 8 fl oz/A per season.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                               |                                                        |                   |                        |            |            |
| 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | GoalTender 4F                                 | 4 to 6 fl oz/A                                         | oxyfluorfen       | 0.125 to 0.188 lb/A    | 35         | 24         |
| <b>-Special Local Needs Label 24(c) for broccoli, cabbage, and cauliflower for the use of GoalTender postemergence in DE, NJ, and PA ONLY! (expires in DE 12/31/2027; labels for NJ and PA have expired at the time of publication of these recommendations, check for updates.</b> -Apply after direct-seeded crops reach a minimum of 4 true leaves; for transplanted crops apply after a minimum of 2 weeks after transplanting. Expect some temporary crop injury (speckling and/or crinkling of foliage) after treatment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                               |                                                        |                   |                        |            |            |
| <b>-Do not</b> tank mix with any other pesticide or use any spray additive, or severe crop injury may result. <b>-Do not</b> use any oxyfluorfen formulation other than GoalTender 4F, or severe crop injury may result. -GoalTender will provide residual control, but <b>do not</b> cultivate after application, or the herbicide will be deactivated. Weeds controlled or suppressed include common groundsel, common lambsquarters, pigweeds, purslane, shepherdspurse, and annual sowthistle when applied to weeds with 1 to 4 true leaves. Rainfastness is not specified. -Maximum GoalTender per application is 8 fl oz/A; a pre-transplant application followed by a post-transplant application can be made but the combined amount may not exceed 16 fl oz/A per season.                                                                                                                                                                                                                                                                             |                                               |                                                        |                   |                        |            |            |
| 27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Optogen 1.67                                  | 3.5 fl oz/A                                            | bicyclopyrone     | 0.046 lb/A             | 14         | 24         |
| <b>-Labeled for broccoli only.</b> -Use nonionic surfactant (NIS) at 0.25% v/v (1 qt/100 gal of spray solution) or crop oil concentrate (COC) at 1% v/v (1 gal/100 gal of spray solution). Ammonium sulfate (AMS) at 8.5 to 17 lb/100 gal spray solution may be added for improved control of emerged weeds. -Apply after broccoli emergence or transplanting as either row middle treatment or as a directed spray. Hooded or shielded sprayers will reduce the risk of injury for row middle or directed sprays. <b>-Contact with broccoli foliage will cause injury.</b> -Apply to small weeds (less than 2" tall). Optogen provides control for only a few weed species and should be used in combination with other herbicides. -Rainfastness is not specified on the label. -Do not make more than one application per year.                                                                                                                                                                                                                             |                                               |                                                        |                   |                        |            |            |

| 3. Postharvest                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                   |               |                   |                        |            |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|---------------|-------------------|------------------------|------------|------------|
| Group                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Product Name<br>(*Restricted Use) | Product Rate  | Active Ingredient | Active Ingredient Rate | PHI<br>(d) | REI<br>(h) |
| 22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Gramoxone SL 3.0*                 | 1.5 to 2 pt/A | paraquat          | 0.56 to 0.75 lb/A      | --         | 24         |
| <p><b>-Supplemental Label in DE for postharvest application to desiccate the crop.</b> -Apply after the last harvest for bareground or plasticulture. Always include an adjuvant. -Spray coverage is essential for optimum effectiveness. See the label for additional information and warnings. -Rainfastness 30 min. -A maximum of 2 applications for crop desiccation are allowed.</p> <p><b>-Restricted-use pesticide.</b> Only certified applicators, who successfully complete the paraquat-specific training, can mix, load, or apply paraquat. Application of paraquat "under the direct supervision" of a certified applicator is no longer allowed. Required training link (<a href="https://campus.extension.org/enrol/index.php?id=2201">https://campus.extension.org/enrol/index.php?id=2201</a>); certified applicators must repeat training every three years.</p> |                                   |               |                   |                        |            |            |

| <b>4. Other Labeled Herbicides</b> These products are labeled but limited local data are available; and/or are labeled but not recommended in our region due to potential crop injury concerns. |                                           |                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------------------------------------|
| Group                                                                                                                                                                                           | Product Name<br>(* = Restricted Use)      | Active Ingredient                                                                         |
| 3                                                                                                                                                                                               | Prowl H2O                                 | pendimethalin (broccoli, Brussel sprouts, cabbage, cauliflower)                           |
| 3                                                                                                                                                                                               | Satellite Hydrocap                        | pendimethalin (broccoli, Brussel sprouts, cabbage, cauliflower, collards, kohlrabi)       |
| 13                                                                                                                                                                                              | Command                                   | clomazone (broccoli)                                                                      |
| 14                                                                                                                                                                                              | Aim (hooded or directed application only) | carfentrazone (broccoli, Brussel sprouts, cabbage, cauliflower, collards, kale, kohlrabi) |
| 14                                                                                                                                                                                              | Vida                                      | pyraflufen (broccoli, Brussel sprouts, cabbage, cauliflower, collards, kale, kohlrabi)    |

## Insect Control

### THE LABEL IS THE LAW-see the Pesticide Use Disclaimer on the first page of Chapter F. Recommended Insecticides

**Note:** For **premises**, the group number (representing the mode of action) and active ingredient that contributes the most to control is generally listed first. In some cases, only one ingredient in a premix provides control.

### Soil Pests

**Cabbage Maggots** Overwintered adults (flies) emerge from pupae when yellow rocket (mustard) first blooms, then begin laying eggs on roots or soil near roots. Eggs hatch within 3-7 days. Infested plants wilt, become severely stunted, or die outright. This pest has 3-4 generations per growing season, although the first generation is often the most economically damaging. The last larval generation is in October, particularly in warmer years. Chemical treatments should be applied preplant or at planting, depending on the product used, as injury will only become apparent after economic damage is already done. It is important to remember that 100% control even with the best products is not usually possible. Expect some level of damage, although well-timed well-placed products should improve control. For maximum efficacy, band insecticides at the base of the plant where flies lay eggs. Row covers can give the most complete protection by excluding flies. Prompt and complete destruction of crop residue and avoiding brassica cover crops is also helpful.

| Apply one of the following formulations: |                                                                                                      |                                                                                      |                                                                                         |            |            |           |
|------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|------------|------------|-----------|
| Group                                    | Product Name<br>(* = Restricted Use)                                                                 | Product Rate                                                                         | Active Ingredient(s)<br>and Crop Restrictions                                           | PHI<br>(d) | REI<br>(h) | Bee<br>TR |
| 1B                                       | Diazinon AG500*                                                                                      | 2.0 to 3.0 qt/A preplant broadcast<br>OR<br>4.0 to 8.0 fl oz/50 gal transplant water | diazinon - <b>not labeled for cabbage maggot control on collards, kale, or kohlrabi</b> | AP         | 96         | H         |
| 3A                                       | Pyrethroid insecticides registered for use on Cole Crops: see table at the end of Insect Control.    |                                                                                      |                                                                                         |            |            |           |
| 4A                                       | Neonicotinoid insecticides registered for use on Cole Crops: see table at the end of Insect Control. |                                                                                      |                                                                                         |            |            |           |
| 21A                                      | Torac                                                                                                | 21.0 fl oz/A                                                                         | tolfenpyrad - <b>soil</b>                                                               | 1          | 12         | H         |
| 28                                       | Verimark                                                                                             | 10.0 to 13.5 fl oz/A                                                                 | cyantraniliprole                                                                        | AP         | 4          | H         |

[Insecticides with Suppression Only on the label: Entrust SC (OMRI), Radiant (for cabbage maggot)]

### Cutworms See also section E 3.1. Soil Pests - Detection and Control.

Cutworms are moth larvae (caterpillars) that typically live in the soil and feed on plant roots and stems. There are several species that can cause injury to young plants. Soil-active cutworms, like the black cutworm, chew through plant stems at or near the soil line, causing young plants to topple over. Climbing cutworms, such as the variegated cutworm, climb on plants and feed on parts above ground. Cutworm larvae are typically active at night. Conventional tillage and incorporation of crop debris into the soil helps reduce populations. If soil-active cutworm damage is anticipated, it is best to treat it preventively with insecticide. Climbing cutworms can be scouted for and treated with good efficacy using materials listed for Caterpillar 'Worm' Pests.

| Apply one of the following formulations: |                                                                                     |                 |                                                                                                   |            |            |           |
|------------------------------------------|-------------------------------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------------------------|------------|------------|-----------|
| Group                                    | Product Name<br>(* = Restricted Use)                                                | Product Rate    | Active Ingredient(s)<br>and Crop Restrictions                                                     | PHI<br>(d) | REI<br>(h) | Bee<br>TR |
| 1A                                       | Lannate LV*                                                                         | 1.5 pt/A        | methomyl - <b>not labeled for cutworm control on broccoli, Chinese cabbage, kale, or kohlrabi</b> | see label  | 48         | H         |
| 1B                                       | Diazinon AG500*                                                                     | 2.0 to 4.0 qt/A | diazinon - <b>not labeled for cutworm control on kohlrabi</b>                                     | AP         | 96         | H         |
| 3A                                       | Pyrethroid insecticides registered for use on Cole Crops: see Group 3A table below. |                 |                                                                                                   |            |            |           |

**Aboveground Pests****Aphids**

Aphids can occasionally become a problem, particularly as a contaminant in Brussels sprouts, cabbage and some types of kale. To prevent flare-ups, avoid overuse of pyrethroid (Group 3A) insecticides for caterpillar control. If growing transplants for field use, control aphid populations in the greenhouse to avoid transplanting infested crops.

| <b>Apply one of the following formulations:</b> |                                                                                                      |                      |                                                         |                    |                    |                   |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------|----------------------|---------------------------------------------------------|--------------------|--------------------|-------------------|
| <b>Group</b>                                    | <b>Product Name<br/>(* = Restricted Use)</b>                                                         | <b>Product Rate</b>  | <b>Active Ingredient(s)<br/>and Crop Restrictions</b>   | <b>PHI<br/>(d)</b> | <b>REI<br/>(h)</b> | <b>Bee<br/>TR</b> |
| 1B                                              | Orthene 97                                                                                           | 0.5 to 1.0 lb/A      | acephate - <b>Brussels sprouts and cauliflower only</b> | 14                 | 24                 | H                 |
| 4A                                              | Neonicotinoid insecticides registered for use on Cole Crops: see table at the end of Insect Control. |                      |                                                         |                    |                    |                   |
| 4D                                              | Sivanto Prime                                                                                        | 7.0 to 14.0 fl oz/A  | flupyradifurone - <b>foliar</b>                         | 1                  | 4                  | M                 |
| 4D                                              | Sivanto Prime                                                                                        | 21.0 to 28.0 fl oz/A | flupyradifurone - <b>soil</b>                           | 21                 | 4                  | M                 |
| 9B                                              | Fulfill 50WDG                                                                                        | 2.75 oz/A            | pymetrozine                                             | 7                  | 12                 | L                 |
| 9B                                              | PQZ                                                                                                  | 2.4 to 3.2 fl oz/A   | pyrifluquinazon                                         | 1                  | 12                 | L                 |
| 9D                                              | Versys                                                                                               | 1.5 fl oz/A          | Afidopyropen                                            | 0                  | 12                 | L                 |
| 21A                                             | Torac                                                                                                | 17.0 to 21.0 fl oz/A | tolfenpyrad                                             | 1                  | 12                 | H                 |
| 23                                              | Boxadon 360                                                                                          | 2.1 to 3.4 fl oz/A   | spirotetramat                                           | 1                  | 24                 | L                 |
| 23                                              | Movento                                                                                              | 4.0 to 5.0 fl oz/A   | spirotetramat                                           | 1                  | 24                 | L                 |
| 23 + 7C                                         | Senstar                                                                                              | 6.0 to 10.0 fl oz/A  | spirotetramat + pyriproxifen                            | 7                  | 24                 | L                 |
| 28                                              | Exirel                                                                                               | 13.5 to 20.5 fl oz/A | cyantraniliprole                                        | 1                  | 12                 | H                 |
| 28                                              | Verimark                                                                                             | 6.75 to 13.5 fl oz/A | cyantraniliprole - <b>soil/drip chemigation</b>         | AP/1               | 4                  | H                 |
| 29                                              | Beleaf 50SG                                                                                          | 2.0 to 2.8 oz/A      | flonicamid                                              | 0                  | 12                 | L                 |

**Caterpillar “Worm” Pests Including:****Cabbage Loopers (CL), Diamondback Moths (DBM), Imported Cabbageworms (ICW), Cross-striped Cabbageworms, Cabbage Webworms, and Armyworms**

Not all materials are labeled for all crops, caterpillar species, or application methods; be sure to read the label. Due to resistance, pyrethroids (Group 3A) are not recommended for control of DBM or beet armyworm (BAW). Diamide (Group 28) resistance in BAW is a concern. Other insecticides may no longer be effective in certain areas due to DBM resistance; Consult your county Extension office for most effective insecticides in your area. Cole crops may require multiple treatments per season. Rotate insecticides with different modes of action to reduce the development of resistance. Insecticides in the 1A and 1B class are harmful to beneficials, and should ideally be used later in the season, when necessary, to preserve natural enemies.

**Threshold:** For fresh-market cabbage, Brussels sprouts, broccoli, and cauliflower, treat when 20% or more of the plants are infested with any species during seedling stage, then 30% infestation from early vegetative to cupping stage. From early head to harvest in cabbage and Brussels sprouts use a 5% threshold. For broccoli and cauliflower, use 15% at curd initiation/cupping, then 5% from curd development to harvest. Spray coverage under the leaves is essential for effective control particularly with *Bacillus thuringiensis* and contact materials. 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 the need for further treatment.

| <b>Apply one of the following formulations:</b> |                                                                                                   |                         |                                                         |                    |                    |                   |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------|-------------------------|---------------------------------------------------------|--------------------|--------------------|-------------------|
| <b>Group</b>                                    | <b>Product Name<br/>(* = Restricted Use)</b>                                                      | <b>Product Rate</b>     | <b>Active Ingredient(s)<br/>and Crop Restrictions</b>   | <b>PHI<br/>(d)</b> | <b>REI<br/>(h)</b> | <b>Bee<br/>TR</b> |
| 1A                                              | Lannate LV*                                                                                       | 0.75 to 3.0 pt/A        | methomyl - <b>not labeled for kohlrabi</b>              | see label          | 48                 | H                 |
| 1B                                              | Dibrom 8E*                                                                                        | 1 to 2 pt/A - see label | naled - <b>not labeled for kohlrabi</b>                 | 1                  | 48                 | H                 |
| 1B                                              | Orthene 97                                                                                        | 1.0 lb/A                | acephate - <b>Brussels sprouts and cauliflower only</b> | 14                 | 24                 | H                 |
| 3A <sup>1</sup>                                 | Pyrethroid insecticides registered for use on Cole Crops: see table at the end of Insect Control. |                         |                                                         |                    |                    |                   |
| 5                                               | Entrust SC (OMRI)                                                                                 | 1.5 to 10.0 fl oz/A     | spinosad                                                | 1                  | 4                  | H                 |
| 5                                               | Radiant SC                                                                                        | 5.0 to 10.0 fl oz/A     | spinetoram                                              | 1                  | 4                  | H                 |
| 6                                               | Proclaim 5SG*                                                                                     | 2.4 to 4.8 oz/A         | emamectin benzoate (PHI on collards and kale 14 d)      | 7/14               | 12                 | H                 |
| 11A                                             | DiPel DF (OMRI)                                                                                   | 0.5 to 2.0 lb/A         | <i>Bacillus thuringiensis kurstaki</i>                  | 0                  | 4                  | N                 |
| 11A                                             | XenTari (OMRI)                                                                                    | 0.5 to 1.5 lb/A         | <i>Bacillus thuringiensis aizawai</i>                   | 0                  | 4                  | N                 |
| 15                                              | Rimon 0.83EC                                                                                      | 6.0 to 12.0 fl oz/A     | novaluron                                               | 7                  | 12                 | M                 |
| 15 + 4A                                         | Cormoran                                                                                          | 9.0 to 12.0 fl oz/A     | novaluron + acetamiprid                                 | 7                  | 12                 | M                 |
| 18                                              | Confirm 2F                                                                                        | 6.0 to 8.0 fl oz/A      | tebufenozide                                            | 7                  | 4                  | M                 |

Caterpillar “Worm” Pests - continued next page

**Caterpillar “Worm” Pests - continued**

|                                  |                                                         |                                        |                                                                         |      |    |   |
|----------------------------------|---------------------------------------------------------|----------------------------------------|-------------------------------------------------------------------------|------|----|---|
| 18                               | Intrepid 2F                                             | 4.0 to 16.0 fl oz/A                    | methoxyfenozide                                                         | 1    | 4  | L |
| 21A                              | Torac                                                   | 17.0 to 21.0 fl oz/A                   | tolfenpyrad - <b>not for cabbage looper</b>                             | 1    | 12 | H |
| 22                               | Avaunt 30WDG,<br>Avaunt eVo                             | 2.5 to 3.5 oz/A                        | indoxacarb                                                              | 3    | 12 | H |
| 28 <sup>2</sup>                  | Coragen 1.67SC <sup>1</sup><br>Coragen eVo <sup>1</sup> | 3.5 - 7.5 fl oz/A<br>1.2 - 2.5 fl oz/A | chlorantraniliprole                                                     | 3    | 4  | L |
| 28 <sup>2</sup>                  | Exirel                                                  | 10.0 to 20.5 fl oz/A                   | cyantraniliprole - <b>foliar</b>                                        | 1    | 12 | H |
| 28 <sup>2</sup>                  | Harvanta 50SL                                           | 10.9 to 16.4 fl oz/A                   | cyclaniliprole                                                          | 1    | 4  | H |
| 28 <sup>2</sup>                  | Verimark                                                | 5.0 to 13.5 fl oz/A                    | cyantraniliprole - <b>soil</b>                                          | AP/1 | 4  | H |
| 28 <sup>2</sup> +3A <sup>1</sup> | Besiege*                                                | 5.0 to 9.0 fl oz/A                     | chlorantraniliprole + lambda-cyhalothrin                                | 3    | 24 | H |
| 28 <sup>2</sup> +3A <sup>1</sup> | Elevest*                                                | 7.0 to 9.6 fl oz/A                     | chlorantraniliprole + bifenthrin                                        | 7    | 12 | H |
| 28 <sup>2</sup> +4A              | Durivo                                                  | 10.0 to 13.0 fl oz/A                   | thiamethoxam + chlorantraniliprole - <b>soil</b>                        | 30   | 12 | H |
| 28 <sup>2</sup> +4A              | Voliam Flexi                                            | 4.0 to 7.0 oz/A                        | thiamethoxam + chlorantraniliprole<br>(PHI on collards and kale 7 days) | 3/7  | 12 | H |
| 30                               | Incipio                                                 | 2.1 to 4.1 fl oz/A                     | isocycloseram - <b>CL, DBM, and ICW only</b>                            | 1    | 12 | H |

<sup>1</sup>Resistance concerns with DBM and BAW. <sup>2</sup>Resistance concerns with BAW.

[Insecticides with Suppression Only on the label: Movento, Boxadon 360]

**Flea Beetles** Treat if the population reaches 1 beetle per transplant or 5 beetles per 10 plants during cotyledon stage. Crop rotation, management of wild hosts (wild mustard, rocket etc.) and prompt destruction of crop residue are helpful in population suppression. Sequential plantings of host crops can result in population build-up.

| Apply one of the following formulations: |                                                                                                      |                      |                                                 |            |            |           |
|------------------------------------------|------------------------------------------------------------------------------------------------------|----------------------|-------------------------------------------------|------------|------------|-----------|
| Group                                    | Product Name<br>(* = Restricted Use)                                                                 | Product Rate         | Active Ingredient(s)<br>and Crop Restrictions   | PHI<br>(d) | REI<br>(h) | Bee<br>TR |
| 1A                                       | Sevin XLR Plus                                                                                       | 0.5 to 1.0 qt/A      | carbaryl (PHI on leafy brassicas 14 d)          | 3/14       | 12         | H         |
| 3A                                       | Pyrethroid insecticides registered for use on Cole Crops: see table at the end of Insect Control.    |                      |                                                 |            |            |           |
| 4A                                       | Neonicotinoid insecticides registered for use on Cole Crops: see table at the end of Insect Control. |                      |                                                 |            |            |           |
| 5                                        | Entrust SC (OMRI)                                                                                    | 4.0 to 8.0 fl oz/A   | spinosad - <b>suppression only</b>              | 1          | 4          | H         |
| 21A                                      | Torac                                                                                                | 17.0 to 21.0 fl oz/A | tolfenpyrad                                     | 1          | 12         | H         |
| 28                                       | Exirel                                                                                               | 13.5 to 20.5 fl oz/A | cyantraniliprole                                | 1          | 12         | H         |
| 28                                       | Harvanta 50SL                                                                                        | 10.9 to 16.4 fl oz/A | cyclaniliprole                                  | 1          | 4          | H         |
| 28                                       | Verimark                                                                                             | 6.75 to 13.5 fl oz/A | cyantraniliprole - <b>soil/drip chemigation</b> | AP/1       | 4          | H         |
| 30                                       | Incipio                                                                                              | 2.1 to 4.1 fl oz/A   | isocycloseram                                   | 1          | 12         | H         |

**Harlequin Bugs**

These orange, black, and white stinkbugs can be quite destructive, particularly on leafy cole crops like collards. Egg masses consist of numerous white and black barrel-shaped eggs in neat rows. Nymphs remain clustered near the eggs until molting. Infestations can be quite heavy. Feeding results in pale blotches with scalloped edges on foliage.

| Apply one of the following formulations: |                                                                                                      |                    |                      |            |            |           |
|------------------------------------------|------------------------------------------------------------------------------------------------------|--------------------|----------------------|------------|------------|-----------|
| Group                                    | Product Name<br>(* = Restricted Use)                                                                 | Product Rate       | Active Ingredient(s) | PHI<br>(d) | REI<br>(h) | Bee<br>TR |
| 3A                                       | Pyrethroid insecticides registered for use on Cole Crops: see table at the end of Insect Control.    |                    |                      |            |            |           |
| 4A                                       | Neonicotinoid insecticides registered for use on Cole Crops: see table at the end of Insect Control. |                    |                      |            |            |           |
| 30                                       | Incipio                                                                                              | 3.1 to 4.1 fl oz/A | isocycloseram        | 1          | 12         | H         |

[Insecticides with Suppression Only on the label: Harvanta]

**Slugs**

| Apply one of the following formulations: |                                      |                  |                      |            |            |           |
|------------------------------------------|--------------------------------------|------------------|----------------------|------------|------------|-----------|
| Group                                    | Product Name<br>(* = Restricted Use) | Product Rate     | Active Ingredient(s) | PHI<br>(d) | REI<br>(h) | Bee<br>TR |
| n/a                                      | Sluggo (OMRI)                        | 20 to 44.0 lb/A  | iron phosphate       | 0          | 0          | N         |
| n/a                                      | Ferroxx AQ                           | 4.0 to 25.0 lb/A | iron phosphate       | 0          | 0          | N         |
| n/a                                      | Deadline Bullets                     | Up to 25 lb/A    | metaldehyde          | 0          | 12         | N         |

**Swede Midge**

Swede midge was confirmed in Pennsylvania in 2020. Larval feeding results in growth distortions and can be mistaken for molybdenum injury, herbicide injury, and abiotic stressors. Symptoms include ‘blind heads’, leaf puckering, multiple shoots, many small heads, brown corky scarring, swollen flower buds/florets or leaves. Field

## F. Cole Crops

rotation is important to limit population growth. Adults are poor fliers and move into plantings from overwintering sites in previous cole crops and weedy brassica host locations.

| Apply one of the following formulations: |                                      |                      |                                                                                  |            |            |           |
|------------------------------------------|--------------------------------------|----------------------|----------------------------------------------------------------------------------|------------|------------|-----------|
| Group                                    | Product Name<br>(* = Restricted Use) | Product Rate         | Active Ingredient(s)<br>and Crop Restrictions                                    | PHI<br>(d) | REI<br>(h) | Bee<br>TR |
| 4A                                       | Assail 30SG                          | 4.0 to 5.3 oz/A      | acetamiprid (PHI on leafy brassicas 7 d)                                         | 3/7        | 12         | M         |
| 4A                                       | Assail 30SC                          | 3.4 to 4.5 fl oz/A   | acetamiprid (PHI on leafy brassicas 7 d)                                         | 3/7        | 12         | M         |
| 4A + 15                                  | Cormoran                             | 12.0 fl oz           | acetamiprid + novaluron - <b>not labeled for Swede midge on collards or kale</b> | 7          | 12         | M         |
| 23                                       | Boxadon 360                          | 2.1 to 3.4 fl oz/A   | spirotetramat                                                                    | 1          | 24         | L         |
| 23                                       | Movento                              | 4.0 to 5.0 fl oz/A   | spirotetramat                                                                    | 1          | 24         | L         |
| 23 + 7C                                  | Senstar                              | 6.0 to 10.0 fl oz/A  | spirotetramat + pyriproxyfen                                                     | 7          | 24         | L         |
| 28                                       | Exirel                               | 13.5 to 20.5 fl oz/A | cyantraniliprole                                                                 | 1          | 12         | H         |

## Thrips

The small size of thrips, their habit of feeding near growing points, and the waxy nature of cole crop foliage can result in poor control with contact insecticides. The addition of a wetting agent may improve efficacy. Thrips can cause leaf distortions on cabbage. Pyrethroids may not provide acceptable control of thrips.

| Apply one of the following formulations: |                                                                                                      |                     |                      |            |            |           |
|------------------------------------------|------------------------------------------------------------------------------------------------------|---------------------|----------------------|------------|------------|-----------|
| Group                                    | Product Name<br>(* = Restricted Use)                                                                 | Product Rate        | Active Ingredient(s) | PHI<br>(d) | REI<br>(h) | Bee<br>TR |
| 3A <sup>1</sup>                          | Pyrethroid insecticides registered for use on Cole Crops: see table at the end of Insect Control.    |                     |                      |            |            |           |
| 4A <sup>2</sup>                          | Neonicotinoid insecticides registered for use on Cole Crops: see table at the end of Insect Control. |                     |                      |            |            |           |
| 5                                        | Entrust SC (OMRI)                                                                                    | 4.0 to 10.0 fl oz/A | spinosad             | 1          | 4          | H         |
| 5                                        | Radiant SC                                                                                           | 6.0 to 10.0 fl oz/A | spinetoram           | 1          | 4          | H         |
| 15                                       | Rimon                                                                                                | 12.0 fl oz/A        | novaluron            | 7          | 12         | M         |
| 21A                                      | Torac                                                                                                | 21.0 fl oz/A        | tolfenpyrad          | 1          | 12         | H         |

<sup>1</sup> Resistance concerns for western flower thrips. <sup>2</sup> Resistance concerns for tobacco thrips. [Insecticides with Suppression Only on the label: Movento, Boxadon 360, Harvanta, Verimark]

## Whiteflies

Due to insecticide resistance issues with several species, rotation among insecticide groups is essential for control and management of resistance in local populations. Thorough coverage, use of wetting agents, and initiation of treatment at low population levels will all improve control.

| Apply one of the following formulations: |                                                                                                      |                      |                                                 |            |            |           |
|------------------------------------------|------------------------------------------------------------------------------------------------------|----------------------|-------------------------------------------------|------------|------------|-----------|
| Group                                    | Product Name<br>(* = Restricted Use)                                                                 | Product Rate         | Active Ingredient(s)                            | PHI<br>(d) | REI<br>(h) | Bee<br>TR |
| 4A                                       | Neonicotinoid insecticides registered for use on Cole Crops: see table at the end of Insect Control. |                      |                                                 |            |            |           |
| 4D                                       | Sivanto Prime                                                                                        | 10.5 to 14.0 fl oz/A | flupyradifurone - <b>foliar</b>                 | 1          | 4          | M         |
| 4D                                       | Sivanto Prime                                                                                        | 21.0 to 28.0 fl oz/A | flupyradifurone - <b>soil</b>                   | 21         | 4          | M         |
| 7C                                       | Knack                                                                                                | 8.0 to 10.0 fl oz/A  | pyriproxifen                                    | 7          | 12         | L         |
| 9B                                       | PQZ                                                                                                  | 2.4 to 3.2 fl oz/A   | pyrifluquinazon                                 | 1          | 12         | L         |
| 9D                                       | Versys                                                                                               | 5.0 to 7.0 fl oz/A   | afidopyropen                                    | 0          | 12         | L         |
| 15                                       | Rimon 0.83EC                                                                                         | 12.0 fl oz/A         | novaluron                                       | 7          | 12         | M         |
| 16                                       | Courier SC                                                                                           | 9.0 to 13.6 fl oz/A  | buprofezin                                      | 1          | 12         | L         |
| 23                                       | Boxadon 360                                                                                          | 2.1 to 3.4 fl oz/A   | spirotetramat                                   | 1          | 24         | L         |
| 23                                       | Movento                                                                                              | 4.0 to 5.0 fl oz/A   | spirotetramat                                   | 1          | 24         | L         |
| 23 + 7C                                  | Senstar                                                                                              | 6.0 to 10.0 fl oz/A  | spirotetramat + pyriproxyfen                    | 7          | 24         | L         |
| 28                                       | Exirel                                                                                               | 13.5 to 20.5 fl oz/A | cyantraniliprole                                | 1          | 12         | H         |
| 28                                       | Verimark                                                                                             | 6.75 to 13.5 fl oz/A | cyantraniliprole - <b>soil/drip chemigation</b> | AP/1       | 4          | H         |

### Group 3A Pyrethroid Insecticides Registered for Use on Cole Crops

Apply one of the following formulations (check if the product label lists the insect you intend to spray; not all pyrethroids are labeled for all Cole Crops; the label is the law):

| Product Name<br>(* = Restricted Use) | Product Rate       | Active Ingredient(s)<br>and Crop Restrictions | PHI<br>(d)   | REI<br>(h) | Bee<br>TR |
|--------------------------------------|--------------------|-----------------------------------------------|--------------|------------|-----------|
| Asana XL*                            | 2.9 to 9.6 fl oz/A | esfenvalerate - <b>not labeled for kale</b>   | 3/7 collards | 12         | H         |
| Baythroid XL*                        | 0.8 to 3.2 fl oz/A | beta-cyfluthrin                               | 0            | 12         | H         |
| Brigade 2EC*, Brigade eVo            | 2.1 to 6.4 fl oz/A | bifenthrin                                    | 7            | 12         | H         |

Group 3A Pyrethroid Insecticides Registered for Use on Cole Crops Group - continued next page



**Group 3A Pyrethroid Insecticides Registered for Use on Cole Crops - continued**

|                                               |                      |                                                                                               |    |    |   |
|-----------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------|----|----|---|
| Capture LFR*                                  | 3.4 to 6.8 fl oz/A   | bifenthrin - <b>at plant</b>                                                                  | AP | 12 | H |
| Capture LFR*                                  | 2.8 to 8.5 fl oz/A   | bifenthrin - <b>foliar</b>                                                                    | 7  | 12 | H |
| Declare*                                      | 0.77 to 1.54 fl oz/A | gamma-cyhalothrin<br>- <b>not labeled for kale or collards</b>                                | 1  | 24 | H |
| Fastac CS*                                    | 2.2 to 3.8 fl oz/A   | alpha-cypermethrin<br>- <b>not labeled for kale or collards</b>                               | 1  | 12 | H |
| Lambda-Cy 1EC*, others                        | 1.92 to 3.84 fl oz/A | lambda-cyhalothrin<br>- <b>not labeled for kale or collards</b>                               | 1  | 24 | H |
| Warrior II*                                   | 0.96 to 1.92 fl oz/A | lambda-cyhalothrin<br>- <b>not labeled for kale or collards</b>                               | 1  | 24 | H |
| Permethrin 3.2EC*                             | 2.0 to 8.0 fl oz/A   | permethrin<br>- <b>not labeled for kale or collards</b>                                       | 1  | 12 | H |
| Mustang Maxx*                                 | 2.24 to 4.0 fl oz/A  | zeta-cypermethrin                                                                             | 1  | 12 | H |
| Hero*                                         | 4.0 to 10.3 fl oz/A  | zeta-cypermethrin + bifenthrin                                                                | 7  | 12 | H |
| Tombstone*                                    | 0.8 to 3.2 fl oz/A   | cyfluthrin                                                                                    | 0  | 12 | H |
| <b>Combo products containing a pyrethroid</b> |                      |                                                                                               |    |    |   |
| Besiege*                                      | 5.0 to 9.0 fl oz/A   | lambda-cyhalothrin + chlorantraniliprole (Group 28) - <b>not labeled for kale or collards</b> | 3  | 24 | H |
| Brigadier*                                    | 3.8 to 6.1 fl oz/A   | bifenthrin + imidacloprid (Group 4A) - <b>foliar</b>                                          | 7  | 12 | H |
| Elevest*                                      | 5.6 to 9.6 fl oz/A   | bifenthrin + chlorantraniliprole (Group 28)                                                   | 7  | 12 | H |
| Endigo ZC* and ZCX*                           | 4.0 to 4.5 fl oz/A   | lambda-cyhalothrin + thiamethoxam (Group 4A)                                                  | 1  | 24 | H |
| Leverage 360*                                 | 3.0 fl oz/A          | beta-cyfluthrin + imidacloprid (Group 4A)                                                     | 7  | 12 | H |

**Group 4A Neonicotinoid Insecticides Registered for Use on Cole Crops**

Apply one of the following formulations (check if the product label lists the insect you intend to spray;  
not all neonicotinoids are labeled for all Cole Crops; the label is the law):

| Product Name<br>(*=Restricted Use)               | Product Rate         | Active Ingredient(s)<br>and Crop Restrictions                                      | PHI<br>(d)  | REI<br>(h) | Bee<br>TR |
|--------------------------------------------------|----------------------|------------------------------------------------------------------------------------|-------------|------------|-----------|
| Actara 25WDG                                     | 1.5 to 5.5 oz/A      | thiamethoxam                                                                       | 0/7 (leafy) | 12         | H         |
| Admire Pro                                       | 4.4 to 10.5 fl oz/A  | imidacloprid - <b>soil</b>                                                         | 21          | 12         | H         |
| Admire Pro                                       | 1.3 fl oz/A          | imidacloprid - <b>foliar</b>                                                       | 7           | 12         | H         |
| Assail 30SG                                      | 2.0 to 5.3 oz/A      | acetamiprid<br>- <b>for specific kohlrabi rates/instruction see labels</b>         | 7/3 (leafy) | 12         | M         |
| Assail 30SC                                      | 1.7 to 4.5 fl oz/A   |                                                                                    |             |            |           |
| Assail WP                                        | 0.8 to 2.3 fl oz/A   |                                                                                    |             |            |           |
| Belay 2.13SC                                     | 9.0 to 12.0 fl oz/A  | clothianidin - <b>soil</b>                                                         | 21          | 12         | H         |
| Belay 2.13SC                                     | 3.0 to 4.0 fl oz/A   | clothianidin - <b>foliar</b>                                                       | 7           | 12         | H         |
| Platinum 75SG                                    | 1.66 to 3.67 oz/A    | thiamethoxam                                                                       | 30          | 12         | H         |
| Venom 70SG                                       | 5.0 to 7.5 oz/A      | dinotefuran - <b>soil, not labeled for kale or collards</b>                        | 21          | 12         | H         |
| Venom 70SG                                       | 1.0 to 4.0 oz/A      | dinotefuran - <b>foliar, not labeled for kale or collards</b>                      | 1           | 12         | H         |
| <b>Combo products containing a neonicotinoid</b> |                      |                                                                                    |             |            |           |
| Brigadier*                                       | 3.8 to 6.1 fl oz/A   | imidacloprid + bifenthrin (Group 3A) - <b>foliar</b>                               | 7           | 12         | H         |
| Cormoran                                         | 9.0 to 12.0 fl oz/A  | acetamiprid + novaluron (Group 15)                                                 | 7           | 12         | M         |
| Durivo                                           | 10.0 to 13.0 fl oz/A | thiamethoxam + chlorantraniliprole (Group 28) - <b>soil</b>                        | 30          | 12         | H         |
| Endigo ZC* and ZCX*                              | 4.0 to 4.5 fl oz/A   | thiamethoxam + lambda-cyhalothrin (Group 3A)                                       | 1           | 24         | H         |
| Leverage 360*                                    | 3.0 fl oz/A          | imidacloprid + beta-cyfluthrin (Group 3A)                                          | 7           | 12         | H         |
| Savoy EC*                                        | 4.9 to 12.9 fl oz/A  | acetamiprid + bifenthrin (Group 3A)                                                | 7           | 12         | H         |
| Voliam Flexi                                     | 4.0 to 7.0 oz/A      | thiamethoxam + chlorantraniliprole (Group 28)<br>(PHI on collards and kale 7 days) | 3/7 (leafy) | 12         | H         |

**Disease Control**

**THE LABEL IS THE LAW**-see the Pesticide Use Disclaimer on the first page of Chapter F.  
**Recommended Fungicides**

**Nematodes** See sections E 1.5. Soil Fumigation and E 1.6. Nematode Control.

Velum Prime 4.16SC can be used at 6.5 to 6.84 fl oz in-furrow at-planting in the following methods:

- Chemigation into root-zone through low-pressure drip, trickle, micro-sprinkler or equivalent equipment.
- Post-planting drench, or hill drench. (*continued next page*)

## F. Cole Crops

- Transplant water drench with mechanical planting.
- Transplant water drench with hand planting. Minimum 5-day interval between soil applications.

### **Seed Treatment**

Purchase hot water treated, certified seed, or request hot water seed treatment by the seed company. If you are unsure whether your seeds have been treated, consult a qualified seed testing service.

Hot water seed treatment is a non-chemical alternative to conventional chlorine treatment which only kills pathogens on the surface of the seed. Heat-treatment done correctly kills pathogens inside the seed as well. If done incorrectly, it may not eradicate pathogens and may reduce germination and vigor. For cole crops, it is especially important to follow treatment protocols as seeds can split.

Seed heat treatment follows a strict time and temperature protocol and is best done with thermostatically controlled water baths. Two baths are required: one for pre-heating, and a second for the effective (pathogen killing) temperature. For cole crops, the initial pre-heating is at 100°F (38°C) for 10 minutes. The effective temperature is 122°F (50°C). Soaking at the effective temperature should be done for 20 minutes for broccoli, cauliflower, collards, kale, and Chinese cabbage, and 25 minutes for Brussels sprouts and cabbage. Immediately after removal from the bath, seeds should be rinsed with cool water to stop the heating process. After that, seeds should be dried on a screen or paper. Pelleted seeds are not recommended for heat treatment. **Only treat seed that will be used immediately.**

As an alternative to hot water seed treatment, use 1 part Alcide (sodium chlorite), 1 part lactic acid, and 18 parts water as a seed soak. Treat seed 1-2 minutes and rinse for 5 minutes in running water at room temperature.

Following hot water or chlorine treatment, dust the dried seed with Captan 50WP or Thiram 480DP at 1 level tsp/lb of seed (3 oz/100 lb).

### **Damping-off caused by *Pythium*, *Phytophthora*, and *Rhizoctonia***

| Apply one of the following formulations:                                                                            |                                    |                                                                                       |                          |            |            |           |
|---------------------------------------------------------------------------------------------------------------------|------------------------------------|---------------------------------------------------------------------------------------|--------------------------|------------|------------|-----------|
| Code                                                                                                                | Product Name<br>(*=Restricted Use) | Product Rate                                                                          | Active Ingredient(s)     | PHI<br>(d) | REI<br>(h) | Bee<br>TR |
| After seeding, apply one of the following in a band up to 7 inches wide. See labels for rates based on row spacing. |                                    |                                                                                       |                          |            |            |           |
| <b>Phytophthora and Pythium root rot</b>                                                                            |                                    |                                                                                       |                          |            |            |           |
| 4                                                                                                                   | Ridomil Gold 4SL                   | 0.5 to 1.0 pt/A                                                                       | mefenoxam                | AP         | 48         | N         |
| <b>Phytophthora, Pythium, and Rhizoctonia root rot</b>                                                              |                                    |                                                                                       |                          |            |            |           |
| 4 + 11                                                                                                              | Uniform 3.72SC                     | 0.34 fl oz/1000 ft row. Avoid direct seed contact, which may cause delayed emergence. | mefenoxam + azoxystrobin | AP         | 0          | N         |
| <b>Rhizoctonia root rot</b>                                                                                         |                                    |                                                                                       |                          |            |            |           |
| 11                                                                                                                  | azoxystrobin 2.08F                 | 0.40 to 0.80 fl oz/1000 ft row                                                        | azoxystrobin             | AP         | 4          | N         |

## **Bacterial and Fungal Diseases**

### **Bacterial Head Rot**

Bacterial head rot can be a problem on broccoli. The only effective control strategy is to plant tolerant varieties. Tolerant varieties to bacterial head rot have dome-shaped, tight heads with very small beads.

### **Black Rot**

Black rot caused by a bacterium, *Xanthomonas campestris*, and can cause serious losses. Symptoms of black rot include large, V-shaped chlorotic lesions that develop on the margins of leaves and its development is favored by warm, wet weather. The pathogen can be seed borne, thus purchase certified seed or use hot water seed treatment.

For black rot control, rotate at least 2 years between plantings. Fixed copper sprays (1.0 lb active ingredient/A) will reduce the spread of black rot if treatments are started as soon as the disease is present and applied throughout the season. Some copper-based products are OMRI listed and may help suppress these diseases in organic production systems. Copper applied at high rates may cause phytotoxicity for some cabbage cultivars in the form of flecking on the wrapper leaves.

### **Blackleg**

Blackleg (Phoma stem canker) is caused by the fungus, *Phoma lingam*, and can survive in the soil for up to 3 years and on related weed hosts. On seedlings, pale gray lesions develop near the soil line causing the seedling to die off. On infected stems, elongated light brown sunken lesions with purple margins develop. Spores are spread rapidly

via rainfall and overhead irrigation. Blackleg can be seed borne, thus purchase certified seed or use hot water seed treatment. For blackleg control, rotate fields to allow 4 years between plantings and control related weeds.

| Code                                                                                                                                                                                                   | Product Name<br>(* = Restricted Use) | Product Rate         | Active Ingredient(s)          | PHI<br>(d)       | REI<br>(h) | Bee<br>TR |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|----------------------|-------------------------------|------------------|------------|-----------|
| <b>Apply one of the following at the first sign of disease and continue every 7-10 days. Rotate between fungicides with different modes of action as long as conditions favor disease development.</b> |                                      |                      |                               |                  |            |           |
| M01                                                                                                                                                                                                    | copper (OMRI) <sup>1</sup>           | at labeled rates     | copper                        | 0                | 48         | N         |
| 3                                                                                                                                                                                                      | tebuconazole 3.6F                    | 3.0 to 4.0 fl oz/A   | tebuconazole                  | 7                | 12         | N         |
| 3 + 9                                                                                                                                                                                                  | Inspire Super 2.82EW                 | 16.0 to 20.0 fl oz/A | difenoconazole + cyprodinil   | 7                | 12         | --        |
| 3 + 11                                                                                                                                                                                                 | Quadris Top 1.67SC                   | 12.0 to 14.0 fl oz/A | difenoconazole + azoxystrobin | 1                | 12         | --        |
| 7 + 11                                                                                                                                                                                                 | Priaxor 4.17SC                       | 6.0 to 8.2 fl oz/A   | fluxapyroxad + pyraclostrobin | 3                | 12         | N         |
| 11                                                                                                                                                                                                     | Cabrio 20EG <sup>2</sup>             | 12.0 to 16.0 oz/A    | pyraclostrobin                | 0/3 <sup>2</sup> | 12         | N         |

<sup>1</sup>Some copper-based products are OMRI listed and may help suppress some fungal diseases in organic production systems. Copper applied at high rates may cause phytotoxicity for some cabbage cultivars in the form of flecking on the wrapper leaves. <sup>2</sup>For Cabrio, PHI=0 d for broccoli, Brussels sprouts, cabbage, tight-heading varieties of Chinese cabbage, cauliflower, and kohlrabi; PHI=3 d for collards and kale.

### For blackleg control in broccoli only:

use iprodione 4L at 2.0 lb/A 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.

### Clubroot

Use of irrigation water containing clubroot spores is the principal way the disease spreads to other fields. If clubroot occurs, clean and disinfest all equipment. 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. Although limited options are available, ask your seed dealer about clubroot resistant varieties.

| Code                                                                                                                                  | Product Name<br>(* = Restricted Use) | Product Rate                                                                                                                                                                                                                                                                                                                                                                                                        | Active Ingredient(s)            | PHI<br>(d) | REI<br>(h) | Bee<br>TR |
|---------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|------------|------------|-----------|
| 14                                                                                                                                    | Terraclor 400                        | <b>Option 1:</b> Use 5.62 gal /A or 5.5 fl oz/100 ft of row based on 40 in row spacing. Spray as a 12-inch band centered on row and incorporate 4-6 inches deep before planting<br><b>Option 2:</b> Use 5.62 gal/A in 30 gal of water as a pre-plant broadcast and incorporate 4-6 inches deep before planting,<br><b>Option 3:</b> Use 3 pt/100 gal of solution and 0.5 to 0.75 pt/plant as a transplant solution. | pentachloro-nitrobenzene (PCNB) | AP         | 12         | H         |
| <b>In addition, Ranman 400SC or Omega 500F, Orbus 4F can be used in the following options, see label for additional instructions.</b> |                                      |                                                                                                                                                                                                                                                                                                                                                                                                                     |                                 |            |            |           |
| 21                                                                                                                                    | Ranman 400SC                         | <b>Option 1:</b> 12.9 to 25.75 fl oz/A use as a transplant soil drench, or<br><b>Option 2:</b> 20.0 fl oz/A use incorporated into the soil                                                                                                                                                                                                                                                                          | cyazofamid                      | 0          | 12         | L         |
| 29                                                                                                                                    | Omega 500F;<br>Orbus 4F              | <b>Apply either, using the following options:</b><br><b>Option 1:</b> 6.45 fl oz/100 gal as a transplant soil drench, or<br><b>Option 2:</b> 41.6 fl oz/A as a banded application                                                                                                                                                                                                                                   | fluazinam                       | 50         | 12-48      | --        |

### Downy Mildew

Downy mildew, caused by *Peronospora parasitica*, can cause serious losses if left uncontrolled. Symptoms include light green, chlorotic spots on the upper leaf surface. During periods of high humidity, grayish white spores may develop on the underside of leaves. High humidity, fog, drizzling rains, and heavy dew favor disease development. Optimum conditions for disease development are night temperatures of 46-61°F for 4 or more successive nights, and day temperature ~75°F or lower. Control related weeds and avoid overhead irrigation. Initiate fungicide applications prior to the onset of disease symptoms and continue as long as weather conditions favor disease development. Rotate and/or tank mix chlorothalonil 6F with one of the following fungicides. Rotate between fungicides with different modes of action.

| Code | Product Name<br>(* = Restricted Use)                             | Product Rate        | Active Ingredient(s) | PHI<br>(d)       | REI<br>(h) | Bee<br>TR |
|------|------------------------------------------------------------------|---------------------|----------------------|------------------|------------|-----------|
| M05  | chlorothalonil 6F (not labeled for collards, kale, and kohlrabi) | 1.5 pt/A            | chlorothalonil       | 7                | 12         | M         |
| 11   | azoxystrobin 2.08F                                               | 6.0 to 15.5 fl oz/A | azoxystrobin         | 0                | 4          | N         |
| 11   | Cabrio 20EG                                                      | 12.0 to 16.0 oz/A   | pyraclostrobin       | 0/3 <sup>2</sup> | 12         | N         |
| 21   | Ranman 400SC                                                     | 2.75 fl oz/A        | cyazofamid           | 0                | 0          | L         |

Downy Mildew - continued next page

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### Downy Mildew - continued

|                                                                                                                 |                      |                              |                                  |   |    |    |
|-----------------------------------------------------------------------------------------------------------------|----------------------|------------------------------|----------------------------------|---|----|----|
| 22                                                                                                              | Elumin 4SC           | 8.0 fl oz/A                  | ethaboxam                        | 2 | 12 | -- |
| 40                                                                                                              | Revus 2.08F          | 8.0 fl oz/A                  | mandipropamid                    | 1 | 4  | -- |
| 40 + 45                                                                                                         | Zampro 525SC         | 14.0 fl oz/A                 | dimethomorph + ametoctradin      | 0 | 12 | -- |
| 40 + 49                                                                                                         | Orondis Ultra 2.33SC | 5.5 to 8.0 fl oz/A           | mandipropamid + oxathiapiprolin  | 1 | 4  | -- |
| 43                                                                                                              | Presidio 4SC         | 3.0 to 4.0 fl oz/A           | fluopicolide                     | 2 | 12 | L  |
| 49+M05                                                                                                          | Orondis Opti         | 1.75 to 2.5 pt/A             | oxathiapiprolin + chlorothalonil | 7 | 12 | -- |
| P07                                                                                                             | Aliette 80WDG        | 3.0 to 5.0 lb/A (every 14 d) | fosetyl-Al                       | 3 | 12 | N  |
| P07                                                                                                             | Phosphite            | 1.0 to 3.0 qt/A              | phosphite                        | 0 | 4  | N  |
| <b>Actigard is a plant defense activator.</b>                                                                   |                      |                              |                                  |   |    |    |
| <b>Begin applications 7-10 d after thinning and reapply every 7 d for a total of 4 applications per season.</b> |                      |                              |                                  |   |    |    |
| P01                                                                                                             | Actigard 50WG        | 1.0 oz/A                     | acibenzolar-S-methyl             | 7 | 12 | N  |

## Alternaria Leaf Blight and Head Rot (Caused by *Alternaria* spp.)

Alternaria leaf blight and head rot (ABHR) can cause serious losses if left uncontrolled. The disease is favored by long extended periods of cool, wet weather and favored by rain, heavy dews, and overhead irrigation. Symptoms of ABHR include yellow, dark brown to black circular leaf spots with target like, concentric rings. Initiate fungicide applications prior to the onset of disease symptoms and continue if weather conditions favor disease development. Rotate between fungicides with different modes of action. Protection of heads may require fungicide applications close to harvest; pay close attention to PHIs.

| Code                                                                                                                                                                                                                                                                                                   | Product Name<br>(* = Restricted Use) | Product Rate         | Active Ingredient(s)          | PHI<br>(d)        | REI<br>(h) | Bee<br>TR |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|----------------------|-------------------------------|-------------------|------------|-----------|
| <b>Apply fungicides at the first symptoms of disease and continue every 7-10 days. Rotate between fungicides with different modes of action as long as conditions favor disease development. Protection of heads may require fungicide applications close to harvest; pay close attention to PHIs.</b> |                                      |                      |                               |                   |            |           |
| M01                                                                                                                                                                                                                                                                                                    | copper (OMRI) <sup>1</sup>           | at labeled rates     | copper                        | 0                 | 48         | N         |
| M05                                                                                                                                                                                                                                                                                                    | Bravo Weather Stik                   | 1.5 pt/A             | chlorothalonil                | 7                 | 12         | M         |
| 3                                                                                                                                                                                                                                                                                                      | Rhyme 2.08SC                         | 5.0 to 7.0 fl oz/A   | flutriafol                    | 7                 | 12         | --        |
| 3 + 9                                                                                                                                                                                                                                                                                                  | Inspire Super 2.82EW                 | 16.0 to 20.0 fl oz/A | difenoconazole + cyprodinil   | 7                 | 12         | --        |
| 3 + 11                                                                                                                                                                                                                                                                                                 | Quadris Top 1.67SC                   | 12.0 to 14.0 fl oz/A | difenoconazole + azoxystrobin | 1                 | 12         | --        |
| 3 + 11                                                                                                                                                                                                                                                                                                 | Topguard EQ                          | 5.0 to 8.0 fl oz/A   | flutriafol + azoxystrobin     | 7                 | 12         | --        |
| 7                                                                                                                                                                                                                                                                                                      | Endura 70WG <sup>2</sup>             | 6.0 to 9.0 oz/A      | boscalid                      | 0/14 <sup>1</sup> | 12         | --        |
| 7                                                                                                                                                                                                                                                                                                      | Fontelis 1.67SC                      | 14.0 to 30.0 fl oz/A | penthiopyrad                  | 0                 | 12         | L         |
| 7 + 3                                                                                                                                                                                                                                                                                                  | Luna Flex 3.13SC                     | 10.0 to 13.6 fl oz/A | fluopyram + difenoconazole    | 1                 | 12         | --        |
| 7 + 11                                                                                                                                                                                                                                                                                                 | Luna Sensation 4.25SC                | 5.0 to 7.6 fl oz/A   | fluopyram + trifloxystrobin   | 0                 | 12         | --        |
| 7 + 11                                                                                                                                                                                                                                                                                                 | Priaxor 4.17SC                       | 6.0 to 8.2 fl oz/A   | fluxapyroxad + pyraclostrobin | 3                 | 12         | N         |
| 7 + 12                                                                                                                                                                                                                                                                                                 | Miravis Prime                        | 10.3 to 13.4 fl oz/A | pydiflumetofen + fludioxonil  | 7                 | 12         | --        |
| 9 + 12                                                                                                                                                                                                                                                                                                 | Switch 62.5WG                        | 11.0 to 14.0 oz/A    | cyprodinil + fludioxonil      | 7                 | 12         | L         |
| 11                                                                                                                                                                                                                                                                                                     | Cabrio 20EG <sup>3</sup>             | 12.0 to 16.0 oz/A    | pyraclostrobin                | 0/3 <sup>2</sup>  | 12         | N         |
| 19                                                                                                                                                                                                                                                                                                     | OSO 5% SC (OMRI) <sup>1</sup>        | 6.5 to 13.0 fl oz/A  | polyoxon D zinc salt          | 0                 | 4          | --        |

<sup>1</sup>OMRI listed products available; see labels for specifics. <sup>2</sup>See Endura label for specific recommendations. <sup>3</sup>For Cabrio, PHI=0 d for broccoli, Brussels sprouts, cabbage, tight-heading varieties of Chinese cabbage, cauliflower, and kohlrabi, and PHI=3 d for collards and kale.

## White Mold

| Code                                                                                                                                                                                                                                                                                                                                                    | Product Name<br>(* = Restricted Use) | Product Rate         | Active Ingredient(s)         | PHI<br>(d)        | REI<br>(h) | Bee<br>TR |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|----------------------|------------------------------|-------------------|------------|-----------|
| Apply Contans 5.3WG 3-4 months prior to the onset of disease to allow the active agent to reduce inoculum levels of sclerotia in the soil. Following application, incorporate 1-2 inches deep but do not plow before seeding cole crops to avoid untreated sclerotia in lower soil layers from infesting the upper soil layer. See label for specifics. |                                      |                      |                              |                   |            |           |
| 44                                                                                                                                                                                                                                                                                                                                                      | Contans 5.3WG (OMRI)                 | 2.0 to 4.0 lb/A      | <i>Coniothyrium minitans</i> | --                | --         | N         |
| <b>Alternatively, during seasons when soils remain wet for an extended period of time apply one of the following preventatively:</b>                                                                                                                                                                                                                    |                                      |                      |                              |                   |            |           |
| 7                                                                                                                                                                                                                                                                                                                                                       | Endura 70WG                          | 6.0 to 9.0 oz/A      | boscalid                     | 0/14 <sup>1</sup> | 12         | --        |
| 7                                                                                                                                                                                                                                                                                                                                                       | Fontelis 1.67SC                      | 16.0 to 30.0 fl oz/A | penthiopyrad                 | 0                 | 12         | L         |
| 7 + 3                                                                                                                                                                                                                                                                                                                                                   | Luna Flex 3.13SC                     | 10.0 to 13.6 fl oz/A | fluopyram + difenoconazole   | 1                 | 12         | --        |
| 7 + 11                                                                                                                                                                                                                                                                                                                                                  | Luna Sensation 4.25SC                | 7.6 fl oz/A          | fluopyram + trifloxystrobin  | 0                 | 12         | --        |

<sup>1</sup>See Endura label for specific recommendations.

## Yellows (*Fusarium*)

Use resistant varieties when possible and practice long crop rotations.