

# Cole Crops and Brassica Leafy Greens

## Spacing

**Broccoli:** Rows 3 feet apart. Plants 12 to 18 inches apart in row.

**Brussels sprouts:** Rows 3 feet apart. Plants 18 to 24 inches apart in row.

**Cabbage for Market:** Rows 2 to 3 feet apart. Plants 12 to 15 inches apart in row.

**Cabbage for Kraut:** Rows 3 feet apart. Plants 18 inches apart in row.

**Cauliflower:** Rows 3 feet apart. Plants 15 to 18 inches apart in row.

**Collards:** Rows 3 to 3.5 feet apart. Plants 18 to 24 inches apart in row. Seed 1 to 2 pounds per acre.

**Kale:** Rows 2 to 3 feet apart. Plants 8 to 16 inches apart in row. Seed 2 to 4 pounds per acre. Use denser plantings if harvesting small leaves for salad or braising mixes.

**Mustard:** Rows 1 to 1.5 feet apart. Plants 10 to 12 inches apart in row. Seed 3 to 5 pounds per acre. Use denser plantings if harvesting small leaves for salad or braising mixes.

**Turnip greens:** Rows 6 to 12 inches apart. Plants 1 to 4 inches apart in row.

Raised beds (6 inches high, 40 inches wide, with 2 rows 11 inches apart on beds) may be desirable under certain conditions.

## Fertilizing

**Lime:** To maintain a soil pH of 6.0 to 6.5.

### Preplant

#### *Cole crops (broccoli, cabbage, cauliflower, and Brussels sprouts)*

**N:** 120 pounds per acre if soil organic matter less than 3 percent, and 80 pounds per acre if soil organic matter greater than 3 percent. **P<sub>2</sub>O<sub>5</sub>:** 25 to 200 pounds per acre. **K<sub>2</sub>O:** 0 to 250 pounds per acre. Cole crops, particularly cauliflower, are responsive to B on low organic matter soils, sandy soils, or where the pH is greater than 7.0. If B is needed, apply 1 to 2 pounds B per acre broadcast. Soil test and/or perform plant analysis on the previous crop to be sure B is needed. High soil B can be detrimental to rotational crops such as sweet corn, peas, or beans.

#### *Greens (collards, kale, and mustard)*

**N:** 60 pounds per acre. **P<sub>2</sub>O<sub>5</sub>:** 0 to 150 pounds per acre. **K<sub>2</sub>O:** 0 to 200 pounds per acre.

### All crops

Adjust recommendations according to soil type, previous management, and soil test results for your state. For transplants, set each plant with 1 cup (8 ounces) of starter solution. If the transplant flat receives a heavy fertilizer feeding just prior to setting, the starter solution can be eliminated.

### Sidedress N

#### *Cole Crops*

60 pounds N per acre, two to three weeks after setting the transplants and when rapid growth has begun. Eliminate sidedressing if following soybeans. If leaching is likely on sandy soils, apply an additional 30 pounds N as a sidedress. Avoid excessive N fertilization with broccoli as it can cause too rapid growth and a hollow flower stalk.

#### *Greens*

30 pounds N per acre on soils with more than 3 percent organic matter and following soybeans, alfalfa, or a grass-legume hay crop. For greens on soils with less than 3 percent organic matter and following those crops, apply 45 pounds N per acre. For greens following corn, small grains, or a vegetable crop, apply 60 pounds N per acre.

## Harvesting

**Broccoli:** Harvesting is done by hand while the head is still compact and before the flowers open. The central heads should be dark blue or green and 4 to 6 inches across when mature. If harvesting too late or when the heads are over mature, woodiness in the stems will develop. Depending on your marketing requirements, the main head is cut with 8 to 10 inches of stem. Sometimes a second harvest of side shoots can be obtained. Broccoli for processing should be cut with less attached stem (6 to 7 inches) and with few or no leaves. Fresh market broccoli should be cut longer, with little trimming. Broccoli quality is based on the degree of compactness, leafiness, head trimness, damage, and freedom from insects and extraneous debris.

**Cauliflower:** When ready to harvest, the heads should be compact and clear white. The heads become discolored and develop an undesirable flavor when exposed to

sunlight. The longest leaves are normally tied loosely together over the head to “blanch” and prevent the head from being exposed to the sun. The desirable harvest size is a diameter of approximately 6 inches. Delaying harvest usually will not result in obtaining larger heads. Instead, consider proper cultivar selection and plant spacing. Cauliflower should be hand-harvested and cut with 1 to 2 whorls of leaves to protect the head.

## Pesticide Use in Greenhouses

Before using any pesticide, always read the product label for mention of greenhouse restrictions. See Selected Information About Recommended Fungicides (page 79), Selected Information About Recommended Herbicides (page 69), and Selected Information About Recommended Insecticides (page 54).

## Disease Control

### *Alternaria* Leaf Spot

Practice a 3-4 year crop rotation to non-cruciferous crops. Incorporate crop residue to speed up decomposition. Use pathogen-free seed, and keep cruciferous weeds out of growing areas.

### Recommended Products

**Bravo**®, **Echo**®, **Equus**®, and **Initiate**® formulations are labeled at various rates. *Not for collard, kale, mustard, or turnip greens.* 7-day PHI.

**Cabrio**® at the following rates:

*Turnip greens:* 8-12 oz. per acre.

*All others:* 12-16 oz. per acre.

3-day PHI for collard, kale, and mustard. 0-day PHI for all others.

**Endura 70WG**® at 6-9 oz. per acre. *Not for turnip greens.* 14-day PHI for collard, kale, and mustard. 0-day PHI for all others.

**Fontelis**® at 14-30 fl. oz. per acre. 0-day PHI.

**Inspire Super**® at 16-20 fl. oz. per acre. 7-day PHI.

**Quadris**® at 6.2-15.4 fl. oz. per acre. 0-day PHI.

**Quadris Top**® at 12-14 fl. oz. per acre. 1-day PHI.

**Reason**® at 8.2 fl. oz. per acre. 2-day PHI.

**Ridomil Gold Bravo SC**® at 1.5 lbs. per acre. *Not for collard, kale, mustard, or turnip greens.* 7-day PHI.

**Satori**® at 6.0-15.4 fl. oz. per acre. 0-day PHI.

**Switch**® at 11-14 oz. per acre. 7-day PHI.

### Black Leg

Black leg is an important disease of broccoli, Brussels sprouts, cauliflower, and turnip. Since oilseed rape is particularly susceptible to black leg, avoid planting crucifer crops close to oilseed rape. Practice a 3-4 year crop rotation to non-cruciferous crops. Plant disease-free seeds or transplants. Hot water seed treatment helps eliminate seedborne pathogens.

### Recommended Products

**Cabrio**® at the following rates:

*Turnip greens:* 8-12 oz. per acre.

*All other labeled crops:* 12-16 oz. per acre.

3-day PHI for collard, kale, and mustard. 0-day PHI for all others.

**Rovral**® at the following rates:

*Flowable (F) formulations:* 2 pts. per acre.

*Dry formulations:* 1.3 lbs. per acre.

*Broccoli only.* 0-day PHI.

### Black Rot

Practice a 3-4 year crop rotation to non-cruciferous crops. Plant disease-free seeds or transplants. Hot water seed treatment helps eliminate seedborne pathogens. Plant pathogen-resistant cabbage varieties — several varieties with partial resistance are available.

### Recommended Products

**Actigard**® at 0.5-1 oz. per acre. *Suppression only.* Do not apply to stressed plants. 7-day PHI.

 **Fixed copper** formulations at various rates. Read labels carefully to make sure your crop is included. Copper applications may slow the spread of black rot.

### Club Root

Plant only disease-free transplants. Club root may be brought in with diseased transplants.

Rotate crops 5 years or more with a non-cruciferous crop between plantings. Avoid poorly drained soils with a history of club root. Serious losses can be avoided by raising the pH to 7.2-7.3.

### Recommended Products

**Blocker 4F**® at 3 pts. per acre in transplant solution or banded soil application, or **Blocker 10G**® at 5.15 lbs. per 1,000 feet of linear row. *Not for turnip.*

**Omega 500F**® at 6.45 fl. oz. per 100 gals. of water. Apply 3.4 fl. oz. of solution to each plant. Apply at transplant as a soil drench. *Not for edible turnip roots.* 20-day PHI for leafy greens. 50-day PHI for heading vegetables.

 May be acceptable for use in certified organic production. Check with your certifier before use.

## Downy Mildew

Practice a 2 year crop rotation. Rotating to non-cruciferous crops may reduce pathogen populations and increase fungicide efficacy. Plant disease-resistant broccoli varieties — several varieties with resistance are available.

### Recommended Products

**Actigard**® at 0.5-1 oz. per acre. Do not apply to stressed plants. 7-day PHI.

**BP Agri-Fos 400**® at 2 teaspoons-2 fl. oz. per gal. of water. *Not for turnip greens.* 0-day PHI.

**Bravo**®, **Echo**®, and **Equus**® formulations are labeled at various rates. *Not for use on collard, kale, mustard, or turnip greens.* 7-day PHI.

**Cabrio**® at the following rates:

*Turnip greens:* 8-12 oz. per acre.

*All others:* 12-16 oz. per acre.

3-day PHI for collard, kale, and mustard. 0-day PHI for all others.

**Forum**® at 6 fl. oz. per acre. 0-day PHI.

**Orondis Opti**® at 1.75-2.5 pts. per acre. 0-day PHI.

**Orondis Ultra**® at 5.5-8.0 fl oz per acre. 0-day PHI.

**BP Phostrol**® at 2.5-5 pts. per acre. *Not for turnip greens.*

**Presidio**® at 3-4 oz. per acre. *Not for turnip.* Must be tank-mixed with another effective fungicide with a different mode of action. 2-day PHI.

**Prophyt**® at 2-4 pts. per acre. *Not for turnip greens.* 0-day PHI.

**Quadris**® at 6.2-15.4 fl. oz. per acre. 0-day PHI.

**Ranman SC**® at 2.75 fl. oz. per acre. 0-day PHI.

**Reason**® at 5.5-8.2 fl. oz. per acre. 2-day PHI.

**Revus 2.09SC**® at 8 fl. oz. per acre. *Not for turnip greens.* 1-day PHI.

**Ridomil Gold Bravo SC**® at 1.5 pts. per acre. 7-day PHI.

**Satori**® at 6.2-15.4 fl. oz. per acre. 0-day PHI.

**Zampro**® at 14 fl. oz. per acre. *Not for turnips.* 0-day PHI.

## Fusarium Yellows

Plant yellows-resistant varieties. Disease may be seedborne.

## Powdery Mildew

Resistant cultivars exist for Brussels sprout and cabbage.

## Recommended Products

**Cabrio**® at the following rates:

*Turnip greens:* 8-12 oz. per acre.

*All others:* 12-16 oz. per acre.

3-day PHI for collard, kale, and mustard. 0-day PHI for all others.

**Endura 70WG**® at 6-9 oz. per acre. *Not for turnip greens. Suppression only.* 0-day PHI for broccoli, Brussels sprouts, cabbage, and cauliflower. 14-day PHI for all others.

**Fontelis**® at 14-30 fl. oz. per acre. 0-day PHI.

**Microthiol Disperss**® at 3-10 lbs. per acre. 0-day PHI.

**Procure 480SC**® at 6-8 fl oz per acre. 1-day PHI.

## Rhizoctonia Diseases

Clean and sanitize transplant trays, benches, etc.

### Recommended Products

#### Bottom Rot

**Endura 70WG**® at 6-9 oz. per acre. *Not for turnip greens. Suppression only.* 0-day PHI for broccoli, Brussels sprouts, cabbage, and cauliflower. 14-day PHI for all others.

#### Rhizoctonia Blight

**Cabrio**® at the following rates:

*Turnip greens:* 8-12 oz. per acre.

*All others:* 12-16 oz. per acre.

3-day PHI for collard, kale, and mustard. 0-day PHI for all others.

## Rhizoctonia Diseases — Wirestem

### Recommended Products

**Blocker 4F**® is labeled for use at various rates depending on application method. See label.

## Sclerotinia Stem Rot

### Recommended Products

**Cabrio EG**® at 12-16 oz. per acre. *Collards, kale, and mustard only. Suppression only.* 3-day PHI.

**Endura 70WG**® at 6-9 oz. per acre. *Not for turnip greens.* 0-day PHI for broccoli, Brussels sprouts, cabbage, and cauliflower. 14-day PHI for all others.

**Fontelis**® at 16-30 fl. oz. per acre. 0-day PHI.

## White Rust

Use crop rotations of 2-3 years, practice sanitation, use pathogen-free seed, and use resistant varieties when possible.

## Recommended Products

**Cabrio EG**® at the following rates:

*Cabbage, broccoli, cauliflower, collards, kale, mustard:*  
12-16 oz. per acre.

*Turnip:* 8-16 oz. per acre.

3-day PHI for collard, kale, and mustard. 0-day PHI for all others.

**Quadris**® at 6.0-15.5 fl. oz. per acre. 0-day PHI.

**Reason**® at 8.2 fl. oz. per acre. 2-day PHI.

## Weed Control

For specific weeds controlled by each herbicide, check Relative Effectiveness of Herbicides for Vegetable Crops (page 68).

Rates provided in the recommendations below are given for overall coverage. For band treatment, reduce amounts according to the portion of acre treated.

### Burndown or Directed/Shielded

#### Application Broadleaves and Grasses

##### Recommended Products

**Gramoxone SL 2.0**® at 2-4 pts. per acre. *Not for turnip greens.* Include 1 qt. of COC or 4-8 fl. oz. of NIS per 25 gallons of spray solution. Apply before seeding or transplanting, or after seeding but before crop emergence. RUP.

**Glyphosate** products at 0.75-3.75 lbs. acid equivalent (ae) per acre. Use formulations containing 3 lbs. ae/gal. (4 lbs. isopropylamine salt/gal.) at 1-5 qts. per acre, or formulations containing 4.5 lbs. ae/gal. (5 lbs. potassium salt/gal.) at 0.66-3.3 qts. per acre. *Not for turnip greens.* Broadcast before seeding or transplanting, after seeding but before crop emergence, or apply between crop rows with hooded or shielded sprayers. Use low rate for annuals and higher rates for perennials. See label for suggested application volume and adjuvants. 14-day PHI.

### Burndown or Directed/Shielded

#### Application Broadleaves

##### Recommended Products

**Aim EC**® at 0.5-2 fl. oz. per acre. Apply with hooded sprayers as a directed application between crop rows. Use COC or NIS. Weeds must be actively growing and less than 4 inches tall. Do not allow spray to contact crop. Do not exceed 6.1 fl. oz. per acre per season.

### Preemergence Broadleaves and Grasses

##### Recommended Products

**Command 3ME**® at 0.67-1.3 pts. per acre. *Cabbage only.* Apply before seeding or transplanting or after seeding before crop emerges. Use low rate for seeded cabbage. May cause early stunting or discoloration of cabbage. 45-day PHI. 45-day PHI.

**Devrinol 50DF**® at 2 lbs. per acre. *Not for collards, kale, mustard greens, or turnip greens.* Apply and incorporate 1-2 inches before seeding or transplanting or apply after seeding and irrigate to wet soil 2-4 inches deep. After harvest or prior to planting succeeding crops, deep moldboard or disk plow. Do not seed alfalfa, small grains, sorghum, corn, or lettuce for 12 months after application. Most effective when combined with Goal®.

**Dual Magnum**® in *Indiana, Michigan, and Ohio only* at the following rates:

*Broccoli raab, Chinese cabbage (bok choy), collards, kale, mizuna, mustard greens, mustard spinach, rape greens, and turnip greens in Indiana, Michigan, and Ohio only:* 0.67-1.3 pts. per acre. Apply after seeding before weeds or crop emerge, or apply broadcast after crops have 1-2 true leaves. Do not exceed 1.3 pts. per acre or 1 application per crop per season. 30-day PHI.

*Cabbage transplants in Indiana, Michigan, and Ohio only:* 0.5-1.3 pts. per acre. Apply before transplanting and do not incorporate, or apply within 48 hours after transplanting. Reduce risk of crop injury by applying after transplanting and by using a directed spray rather than spraying over the top of transplants. Do not exceed 1.3 pts. per acre or 1 application per crop per season. 60-day PHI.

*Broccoli, Brussels sprouts, and cauliflower transplants in Michigan only:* 0.5-1.3 pts. per acre. *Must possess 24(c) label.* Apply to soil surface before transplanting or within 48 hours of transplanting. Do not tank-mix with Goal® for post-transplant application. 60-day PHI.

**Prowl H2O**® at 1-2.1 pts. per acre.

*Broccoli, Brussels sprouts, cabbage, and cauliflower only.* Apply to soil between rows 1-3 days after transplanting, or at 2-4 leaf stage after direct seeding. Spray contact with plants may cause crop stunting. 60-day PHI for broccoli. 70-day for all other labeled crops.

**Satellite**® Hydrocap at 1-2.1 pts. per acre.

*Broccoli, Brussels sprouts, cabbage, cauliflower, Chinese broccoli, Chinese cabbage (napa), Chinese mustard cabbage, Cavalo broccoli, Kohlrabi only.* Apply pre- or posttransplanting broadcast, or directed between rows at the 2-4 leaf stage. Apply at 2-4 leaf stage of direct seeded plants. 60-day PHI for broccoli; 70-day PHI for other listed crops.

*Broccoli raab, bok choy, collards, kale, mizuna, mustard greens, mustard spinach, rape greens, turnip greens only.* Apply as a broadcast spray at the 4-5 leaf stage of direct seeded or transplanted plants. Do not use roots from treated turnips for feed or food. 21-day PHI.

**BP** This is a biopesticide. See page 37 for details.

**Trifluralin** products at 0.5-0.75 lbs. a.i. per acre. Use 4EC formulations at 1-1.5 pts. per acre. *Not for turnip greens.* Use low rate on soils with less than 2% organic matter. Apply before seeding or transplanting and incorporate 2-3 inches immediately. Not effective on muck or high organic matter soils. Delayed emergence or stunting may occur when soil is cool.

## Preemergence Broadleaves

### Recommended Products

**Goal 2XL**® at 1-2 pts. per acre, or **GoalTender**® at 0.5-1 pt. per acre. *Broccoli, cabbage and cauliflower transplants only. Not for direct-seeded crops.* Use lower rate on coarse-textured soils. Apply after preparing soil but before transplanting. Transplant within 7 days of application.

**Spartan 4F**® at 2.25-12 fl. oz. per acre. *Transplanted cabbage for processing only. Not for broccoli, Brussels sprouts, fresh market cabbage, cauliflower, collards, kale, mustard or turnip greens.* Apply preemergence before transplanting as a broadcast or banded spray or band to row middles within 72 hours after transplanting. May be incorporated no deeper than 2 inches before transplanting. Do not use on soils classified as sand, with less than 1% organic matter. Controls pigweeds.

**Spartan Charge**® at 2.9-15.2 fl. oz. per acre. *Transplanted cabbage only. Not for broccoli, cauliflower, Brussels sprouts, collards, kale, mustard greens, or turnip greens.* Apply before transplanting, or band between rows within 72 hours after transplanting. May be incorporated no deeper than 2 inches before transplanting. Do not use on sandy soils with less than 1% organic matter. Has not been tested on all varieties. Refer to label for additional precautions. Maximum 15.2 fl. oz. per acre.

## Preemergence Grasses

### Recommended Products

**Dacthal W-75**® at 6-14 lbs. per acre, or **Dacthal Flowable**® at 6-14 pts. per acre. Apply at seeding or transplanting. May be incorporated. May be applied over top of transplants.

**Prefar 4E**® at 5-6 qts. per acre. Use low rate on soils with less than 1% organic matter. Apply before planting and incorporate 1-2 inches or apply after seeding before crop emerges and irrigate within 24 hours.

## Postemergence

### Recommended Products

**Glyphosate** products. See details above under Burndown or Directed/Shielded Application.

## Postemergence Broadleaves

### Recommended Products

**Aim EC**® See details above under Burndown or Directed/Shielded Application.

**GoalTender**® at 4-8 fl. oz. per acre. *Michigan only — applicators must have 24(c) label. Broccoli, cabbage and cauliflower only.* Apply to well-established transplants at least 2 weeks in the field. Apply to directed seeded plants with at least 4 true leaves. Do not exceed 16 fl. oz. pre- and postemergence. Do not add adjuvant. 35-day PHI.

**Stinger 3L**® at 4-8 fl. oz. per acre. Apply at any crop stage. Kills composite weeds, legumes, and nightshade. Do not exceed 2 applications and 8 fl. oz. per acre per year. 30-day PHI.

## Postemergence Grasses

### Recommended Products

**Clethodim** products at the following rates:

**Select Max**® at 9-16 fl. oz. per acre. Use Select Max® with 8 fl. oz. of NIS per 25 gals. of spray solution (0.25% v/v). Do not exceed 64 fl. oz. of Select Max® per acre per season.

**2EC formulations of clethodim products** at 6-8 fl. oz. per acre. Use 2EC formulations with 1 qt. of COC per 25 gals. of spray solution (1% v/v). Do not exceed 32 fl. oz. of 2EC formulations per acre per season.

Use low rates for annual grasses, the high rates for perennial grasses. Spray on actively growing grass. Wait at least 14 days between applications. 14-day PHI for greens. 30-day PHI for broccoli, Brussels sprouts, cauliflower, cabbage, and kohlrabi.

**Poast 1.5E**® at 1-1.5 pts. per acre, plus 1 qt. COC per acre. Spray on actively growing grass. Use high rate on quackgrass. Do not exceed 2.5 pts. per acre per season for turnip greens, or 3 pts. per acre per season for other crops. 14-day PHI for turnip greens. 30-day PHI for all others.

**Herbicides for Cole Crops and Leafy Greens<sup>1</sup>**

Product (REI/PHI)	Common Name	Timing and Application Location Relative to Crop					Incorporated	Timing Relative to Weeds		Weed Groups Controlled			Crops				
		Before seeding	After seeding before emergence	Before transplanting	Postemergence — between rows only	Postemergence		Preemergence	Postemergence	Annual grasses	Small-seeded broadleaves	Broadleaves	Broccoli	Brussels sprouts	Cabbage	Cauliflower	Brassica greens
Aim EC* (12h/-)	carfentrazone				X			X		X			X		X		X
Command 3ME* (12h/45d)	clomazone	X	X	X				X	X	X							
Dacthal* (12h/-)	DCPA	X	X	X				X							X		X
Devrinol 50DF* (12h/-)	napropamide	X	X	X			Yes	X	X	X					X		
Dual Magnum* (24h/21d)	s-metolachlor		X					X									X
Goal Tender 4 SC (12h/-)	oxyfluorfen			X				X		X					X		
Gramoxone* (12h to 24h/-)	paraquat	X	X	X						X					X		X
Poast* (12h/14-30d)	sethoxydim	X	X	X						X					X		X
Prefar 4E* (12h/-)	bensulide	X	X	X				X							X		X
Roundup*, others (12h/14d)	glyphosate	X	X	X	X					X					X		X
Satellite* Hydrocap 3.8 CS	pendimethalin			X	X		No	X							X		X
Select Max*, others (12h/14-30d)	clethodim	X	X	X						X					X		X
Spartan DF* (12h/1d)	sulfentrazone			X	X			X									
Spartan Charge* (12h/-)	sulfentrazone plus carfentrazone			X	X			X							X		
Stinger*	clopyralid	X	X	X	X										X		X
Treflan*, others (12h/-)	trifluralin	X		X			Yes	X							X		X

<sup>1</sup>For effectiveness against specific weeds, see Relative Effectiveness of Herbicides for Vegetable Crops (page 68), and read label. This table does not include all label information. Be sure to read and follow all instructions and precautions on the herbicide label. Herbicides can cause serious crop injury and yield loss if not used properly.

## Insect Control

### Insect and Slug Control

#### Aphids

Conserve natural enemies by avoiding broad-spectrum insecticide applications. Limit the use of insecticides to conserve predators and parasites.

#### Recommended Products

**Actara**® (25WDG) at 1.5-3 oz. per acre. Do not exceed 11 oz. per acre per season. 0-day PHI for broccoli, Brussels sprouts, cabbage and cauliflower. 7-day PHI for leafy greens.

**Admire Pro**® (4.6F) at the following rates:

*Soil applications:* 4.4-10.5 fl. oz. per acre. Do not exceed 10.5 fl. oz. per acre per crop. 21-day PHI.

*Foliar applications:* 1.3 fl. oz. per acre. Do not exceed 6.5 fl. oz. per acre per crop. 7-day PHI.

**Assail**® (30SG) at 2-5.3 oz. per acre for leafy crops. 2-4 oz. per acre for heading crops. Do not exceed 20 oz. per acre per season. 7-day PHI.

**Belay**® (2.13SC) at the following rates:

*Soil applications:* 9-12 fl. oz. per acre. 21-day PHI.

*Foliar applications:* 3-4 fl. oz. per acre. 7-day PHI.

**Beleaf**® (50SG) at 2-2.8 oz. per acre. 0-day PHI.

**Dimethoate 400**® or **Dimethoate 4E**® at 0.5-1 pt. per acre, 7-day PHI for broccoli and cauliflower. 14-day PHI for kale and mustard greens.

**Exirel**® (0.83SE) at 13.5-20 fl. oz. per acre. Do not exceed 61 fl. oz. per acre per crop. 1-day PHI.

**Fulfill**® (50WDG) at 2.75 oz. per acre. Do not exceed 5.5 oz. per acre per crop per season. 7-day PHI.

**Lorsban 4E**® (RUP) at 1-2 pts. per acre, or **Lorsban 75WG** (not RUP) at 0.67-1.33 lbs. per acre. *Cabbage aphids only.* 21-day PHI.

**Movento**® (2SC) at 4-5 fl. oz. per acre. *Not for turnip greens.* Do not exceed 10 fl. oz. per acre per season. 1-day PHI.

 **M-Pede**® at 1-2% by volume. Must contact aphids to be effective. Works best in tank-mix with other insecticide. 0-day PHI.

**Mustang Maxx**® (0.8EC) at 3.2-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. 1-day PHI. *RUP.*

**Orthene**® (97S) at 0.5-1.0 lb. per acre. *Green peach aphid on brussels sprouts and cauliflower only.* Do not exceed 4 1/8 lbs. per acre per season. 14-day PHI.

**Platinum**® (75SG) soil application 1.66-3.67 oz. per acre. Do not exceed 3.67 oz. per acre per season. 30-day PHI.

**Sivanto Prime**® (1.67) at 7-12 fl. oz. per acre for foliar application. 1-day PHI. Do not exceed 28 fl. oz. per acre per season.

#### Caterpillars (Imported Cabbageworms, Cabbage Loopers, Diamondback Moth Larvae, Cross-Striped Cabbageworms)

#### Recommended Products

**Ambush**® (2EC) at 3.2-12.8 fl. oz. per acre. Rate varies with crop — see label. *Broccoli, Brussels sprouts, and cauliflower:* Do not exceed 51 fl. oz. per acre per season. *Cabbage:* Do not exceed 64 fl. oz. per acre per season. 1-day PHI. *RUP.*

**Asana XL**® (0.66EC) at 2.9-9.6 fl. oz. per acre. *Cabbage, broccoli, cauliflower, collards, and mustard greens only.* Heading crops: Do not exceed 77.5 fl. oz. per acre per season. 3-day PHI. Collards and mustard greens: Do not exceed 38.7 fl. oz. per acre per season. 7-day PHI. *RUP.*

**Avaunt**® (30WDG) at 2.5-3.5 oz. per acre. Do not exceed 14 oz. per acre per crop. 3-day PHI.

 Several *Bacillus thuringiensis* products (Agree®, Biobit®, Crymax®, Deliver®, Dipel®, Javelin®, Xentari®) are available. Follow label directions. Begin applications when worms are small. Using Bt products will help conserve beneficial insects. 0-day PHI.

**Baythroid XL**® (1EC) at 0.8-3.2 fl. oz. per acre depending on species. Do not exceed 12.8 fl. oz. per acre per season. 0-day PHI. *RUP.*

**Brigade**® (2EC) at 2.1-6.4 fl. oz. per acre. Do not exceed 32 fl. oz. per acre per season for heading crops. 25.6 fl. oz. per acre per season for leafy crops. 7-day PHI. *RUP.*

**Confirm**® (2F) at 6.0-8.0 fl. oz. per acre. Do not exceed 40 fl. oz. per crop. 7-day PHI.

**Coragen**® (1.67SC) at 3.5-7.5 fl. oz. per acre. Not for turnip greens. Do not exceed 15.4 fl. oz. per acre per season. 3-day PHI.

 This is a biopesticide. See page 37 for details.

 May be acceptable for use in certified organic production. Check with your certifier before use.

## Caterpillar Threshold

Crop	Stage	% Infested	
		Diamondback Moth Larvae	Imported Cabbageworm and Cabbage Looper
Cabbage — Fresh	seed bed	not applicable	not applicable
	transplant to cupping	50% with $\geq 5$ larvae/plant	30%
	cupping to early head	50% with $\geq 5$ larvae/plant	20%
	early head to harvest	10% with $\geq 1$ larva/plant	10%
Broccoli, Cauliflower	seedbed	10%	10%
	transplant to first curd	40%	20%
	first curd to harvest	10%	10%

 **Entrust**® (2SC) at 1.5-6.0 fl. oz. per acre depending on species. Do not exceed 29 fl. oz. per acre per season. Observe resistance management restrictions. 1-day PHI.

**Exirel**® (0.83SE) at 7-17 fl. oz. per acre. Do not exceed 61 fl. oz. per acre per crop. 1-day PHI.

**Intrepid**® (2F) at 4-10 fl. oz. per acre. 1-day PHI.

**Larvin**® (3.2F) at 16-40 fl. oz. per acre. *Broccoli, cabbage, and cauliflower only.* Do not exceed 160 fl. oz. per acre per season. 7-day PHI. RUP.

**Lorsban 4E** (RUP) at 1-2 pts. per acre, or **Lorsban 75WG** (not RUP) at 0.67-1.33 lbs. per acre.

**Mustang Maxx**® (0.8EC) at 2.24-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. 1-day PHI. RUP.

**Orthene**® (97S) at 1 lb. per acre. *Brussels sprouts and cauliflower only.* Do not exceed 4 1/8 lbs. per acre per season. 14-day PHI.

**Permethrin**® (3.2EC) at 2-8 fl. oz. per acre. Rate varies with crop — see label. Do not exceed 32 fl. oz. per acre per season for broccoli. Do not exceed 16 fl. oz. per acre per season for Brussels sprouts, cabbage, and cauliflower. 1-day PHI. RUP.

**Proclaim**® (5SG) at 2.4-4.8 oz. per acre. Do not exceed 28.8 oz. per acre per season. 7-day PHI for brassica head and stem vegetables. 14-day PHI for brassica leaf vegetables. RUP.

**Radiant SC**® (1SC) at 5-10 fl. oz. per acre. *Not for turnip greens.* Do not exceed 34 fl. oz. per acre per season. 1-day PHI.

**Rimon**® (0.83EC) at 6-12 fl. oz. per acre. *For heading crops only; not for greens.* Do not exceed 24 fl. oz. per acre per season. 7-day PHI.

**Sevin XLR PLUS**® (4F) at 1-2 qts. per acre. Do not exceed 6 qts. per acre per crop. 3-day PHI for broccoli, Brussels sprouts, cabbage, and cauliflower. 14-day PHI for collards, kale, mustard greens, and turnip greens.

**Warrior II**® (2.08CS) at 0.96-1.92 fl. oz. per acre. *For heading crops only; not for greens.* Do not exceed 15.36 fl. oz. per acre per season. 1-day PHI. RUP.

## Flea Beetles

### Recommended Products

**Actara**® (25WDG) at 1.5-3 oz. per acre. Do not exceed 11 oz. per acre per season. 0-day PHI for broccoli, Brussels sprouts, cabbage, and cauliflower. 7-day PHI for leafy greens.

**Ambush**® (2EC) at 6.4-12.8 fl. oz. per acre. *Cabbage only.* Do not exceed 64 fl. oz. per acre per season. 1-day PHI. RUP.

**Asana XL**® (0.66EC) at 5.8-9.6 fl. oz. per acre. *Cabbage, broccoli, cauliflower, collards, and mustard greens only.* Heading crops: Do not exceed 77.5 fl. oz. per acre per season. 3-day PHI. Collards and mustard greens: Do not exceed 38.7 fl. oz. per acre per season. 7-day PHI. RUP.

**Baythroid XL**® (1EC) at 2.4-3.2 fl. oz. per acre. Do not exceed 12.8 fl. oz. per acre per crop. 0-day PHI. RUP.

**Belay**® (2.13SC) at the following:

*Soil applications:* 9-12 fl. oz. per acre. 21-day PHI.

*Foliar applications:* 3-4 fl. oz. per acre. 7-day PHI.

**Brigade**® (2EC) at 2.1-6.4 fl. oz. per acre. Do not exceed 32 fl. oz. per acre per season for heading crops. Do not exceed 25.6 fl. oz. per acre per season for leafy crops. 7-day PHI. RUP.

**Exirel**® (0.83SE) at 13.5-20 fl. oz. per acre. Do not exceed 61 fl. oz. per acre per crop. 1-day PHI.

**FarMore FI400**® commercial seed treatment for leafy Brassicas.

**Kryocide**® at 8-16 lbs. per acre. Do not exceed 96 lbs. per acre per season. 7-day PHI for broccoli, *Brussels sprouts, and cauliflower*. 14-day PHI for cabbage and collards.

**Larvin**® (3.2F) at 16-32 fl. oz. per acre. *Broccoli, cabbage, and cauliflower only*. Do not exceed 160 fl. oz. per acre per season. 7-day PHI. *RUP*.

**Lorsban 4E** at 1-2 pts. per acre, or **Lorsban 75WG** (not *RUP*) at 0.67-1.33 lbs. per acre. *RUP*.

**Mustang Maxx**® (0.8EC) at 2.24-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. 1-day PHI. *RUP*.

**Permethrin**® (3.2EC) at 4-8 fl. oz. per acre. *Cabbage only*. Do not exceed 16 fl. oz. per acre per season. 1-day PHI. *RUP*.

**Platinum**® (75SG) soil application 1.66-3.67 oz. per acre. Do not exceed 3.67 oz. per acre per season. 30-day PHI.

**Prokil Cryolite**® (50D) at 15-30.5 lbs. per acre. Do not exceed 184 lbs. per acre per season. 7-day PHI for broccoli, Brussels sprouts, and cauliflower. 14-day PHI for cabbage and collards.

**Sevin XLR PLUS**® (4F) at 0.5-1 qt. per acre. Do not exceed 6 qts. per acre per crop. 3-day PHI for broccoli, Brussels sprouts, cabbage, and cauliflower. 14-day PHI for collards, kale, mustard greens, and turnip greens.

**Warrior II**® (2.08CS) at 1.28-1.92 fl. oz. per acre. *For heading crops only; not for greens*. Do not exceed 15.36 fl. oz. per acre per season. 1-day PHI. *RUP*.

## Harlequin Bug and Other Stink Bugs

### Recommended Products

 **Azera**® at the following rates:

*Harlequin bug nymphs*: 16 fl. oz. per acre.

*Adult harlequin bug and other stink bugs*: 48 fl. oz. per acre. Use higher rates (48 fl. oz. per acre) when pest pressure is extreme or plant canopy is dense. Do not exceed 10 applications per season. Do not reapply within 3 days except under extreme pest pressure. 0-day PHI.

**Baythroid XL**® (1EC) at 2.4-3.2 fl. oz. per acre. Do not exceed 12.8 fl. oz. per acre per season. 0-day PHI. *RUP*.

**Belay**® (2.13SC) at the following rates:

*Soil applications*: 9-12 fl. oz. per acre. 21-day PHI.

*Foliar applications*: 3-4 fl. oz. per acre. 7-day PHI.

**Brigade**® (2EC) at 2.1-6.4 fl. oz. per acre. Do not exceed 32 fl. oz. per acre per season for heading crops. Do not exceed 25.6 fl. oz. per acre per season for leafy crops. 7-day PHI. *RUP*.

**Malathion 5EC**® at 1.5 pts. per acre, or Malathion 57EC® at 1 pt. per acre. *Harlequin bug on collards only*. 7-day PHI.

**Mustang Maxx**® (0.8EC) at 3.2-4 oz. per acre. Do not exceed 24 fl. oz. per acre per season. 1-day PHI. *RUP*.

**Rimon**® (0.83EC) at 12 fl. oz. per acre. For heading crops only; not for greens. Do not exceed 24 oz. or 2 applications per acre per season. 7-day PHI.

**Sevin XLR PLUS**® (4F) at the following rates:

*Harlequin bug*: 0.5-1 qt. per acre.

*Other stink bugs*: 1-2 qts. per acre.

Do not exceed 6 qts. per acre per season. 3-day PHI for broccoli, Brussels sprouts, cabbage, and cauliflower. 14-day PHI for collards, kale, mustard greens, and turnip greens.

**Venom**® (70SG) at 1-4 oz. per acre. Do not exceed 6 oz. per acre per season. 1-day PHI.

**Warrior II**® (2.08CS) at 1.28-1.92 fl. oz. per acre. *For heading crops only; not for greens*. Do not exceed 15.36 fl. oz. per acre per season. 1-day PHI. *RUP*.

## Leafminers (Dipteran)

### Recommended Products

**Dimethoate 400**® or **Dimethoate 4E**® at 0.5-1 pt. per acre, 7-day PHI for broccoli and cauliflower. 14-day PHI for kale and mustard greens.

 **Entrust**® (2SC) at 4-10 fl. oz. per acre. Do not exceed 29 fl. oz. per acre per year. 1-day PHI.

 **M-Pede**® at 1-2% by volume. Must contact aphids to be effective. Works best in tank-mix with other insecticide. 0-day PHI.

**Exirel**® (0.83SE) at 13.5-20 fl. oz. per acre. Do not exceed 61 fl. oz. per acre per crop. 1-day PHI.

**Mustang Maxx**® (0.8EC) at 3.2-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. 1-day PHI. *RUP.*

 **Radiant SC**® (1SC) at 6-10 fl. oz. per acre. *Not for turnip greens.* Do not exceed 34 fl. oz. per acre per season. 1-day PHI.

**Rimon**® (0.83EC) at 12 fl. oz. per acre. *For heading crops only (not greens).* Do not exceed 24 fl. oz. per acre per season. 7-day PHI.

**Trigard**® (75WP) at 2.66 oz. per acre. Do not exceed 6 applications per season. 7-day PHI.

**Venom**® (70SG) at the following rates:

*Soil applications:* 5-7.5 oz. per acre. Do not exceed 12 oz. per acre per season. 21-day PHI.

*Foliar applications:* 1-4 oz. per acre. Do not exceed 6 oz. per acre per season. 1-day PHI.

## Root Maggots

Cabbage maggot injury is usually more severe when fields have decaying organic matter present, such as plowed down cover crop, or when cool, wet conditions prevail.

## Recommended Products

For use in transplanting water, mix any one of these products in 50 gallons of water. Refer to the comments for each product or product labels regarding drench applications. The transplant mixture application (insecticide plus water) will require about 200-300 gallons of water per acre, based on the number of plants set per acre.

**Capture LFR**® at 0.2-0.39 fl. oz. per 1,000 linear ft. of row. See label. *RUP.*

**Diazinon AG500**® at 2-3 qts. per acre for pre-plant broadcast application using 200-300 gallons of spray mix per acre, or 4-8 fl. oz. in 50 gals. of water for drench application at-planting. *For heading crops only; not for greens.* Water treatments may reduce stands due to plant stress at time of transplanting. Make drench application at the rate of 0.5-1 cup per plant, either by hand or tractor-mounted sprayer with drop nozzles to direct spray to base of plants. In some areas, cabbage maggots are exhibiting resistance to diazinon, resulting in control failures. 4-day PHI. *RUP.*

**Lorsban**® products at the following rates:

*Cauliflower:* **Lorsban 4EC**® (RUP) at 1.6-2.4 fl. oz. per 1,000 linear ft. of row, or **Lorsban 75WG**® (not RUP) at 1.1-1.6 fl. oz. per 1,000 linear ft. of row. 30-day PHI.

*Broccoli, Brussels sprouts, cabbage, collards, kale, and mustard greens:* **Lorsban 4EC**® (RUP) at 1.6-2.75 fl. oz. per 1,000 linear ft. of row, or **Lorsban 75WG**® (not RUP) at 1.1-1.8 fl. oz. per 1,000 linear ft. of row. 30-day PHI.

Apply as a water-based spray directed at the base of plants immediately after setting in field. Use a minimum of 40 gallons of total spray per acre. Do not apply as a foliage application. Do not exceed one application per acre per season.

## Slugs

Prevent infestation by scattering bait products to the soil surface around the perimeter of the planting. Make a rescue treatment by scattering the bait products on the soil as a band between rows.

## Recommended Products

**Deadline M-Ps**® (4B) at 25 lbs. per acre. 0-day PHI.

 **Sluggo**® (1B) at 20-44 lbs. per acre, or at 0.5-1 lb. per square ft. 0-day PHI.

## Swede Midge

Swede midges are most attracted to heading cole crops like broccoli and cauliflower, cabbage, and Brussels sprouts. Leafy cole crops can become twisted, and yield can be reduced. Prevent infestation by rotating crops away from cole crops for three years, and maintain a good weed control program during the rotation. Destroy postharvest trash promptly. Do not use brassica cover crops between cole crop plantings.

In addition to the products labeled for swede midge below, some products that control flea beetle and moths in cole crops work well on swede midge. Growers should take advantage of this implied use in rotation to prevent resistance such as **Admire Pro**® (IRAC 4A), **Coragen**® (IRAC 28), **Exirel**® (IRAC 28), **Lorsban**® (IRAC 1B), **Orthene**® (IRAC 1B), **Verimark**® (IRAC 28), and **Warrior II**® (IRAC 3A).

 May be acceptable for use in certified organic production. Check with your certifier before use.

### Recommended Products

**Assail**® (30SG) at 2-5.3 oz. per acre for leafy crops.  
2-4 oz. per acre or heading crops. Do not exceed  
20 oz. per acre per season. 7-day PHI.

**Movento**® (2SC) at 4-5 fl. oz. per acre. Not for turnip  
greens. Do not exceed 10 fl. oz. per acre per  
season. 1-day PHI.

### Thrips

Some cabbage varieties are tolerant of thrips, such  
as Bantly, Bravo, Brutus, King Cole, Little Rock,  
Manrico, Rio Granda, Rio Verde, Ruby Perfection,  
Starski, Stonar, SuperKraut, Titanic 90, Zerlina, and  
others.

### Recommended Products

**Actara**® (25WDG) at 3-5.5 oz. per acre. Do not exceed  
11 oz. per acre per season. 0-day PHI for broccoli,  
Brussels sprouts, cabbage, and cauliflower. 7-day PHI  
for leafy greens.

**Admire Pro**® (4.6F) at 4.4-10.5 fl. oz. per acre, as soil  
application. Do not exceed 10.5 fl. oz. per acre per  
season. 21-day PHI.

**Ambush**® (2EC) at 3.2-6.4 oz. per acre. *For broccoli,  
Brussels sprouts, and cauliflower.* Do not exceed 51 fl.  
oz. per acre per season. 1-day PHI. *RUP.*

**Assail**® (30SG) at 4-5.3 oz. per acre for leafy crops.  
Heading crops 4 oz. per acre. Do not exceed 20 oz.  
per acre per season. 7-day PHI.

**Baythroid XL**® (1EC) at 0.8-1.6 fl. oz. per acre. Do not  
exceed 12.8 fl. oz. per acre per crop. 0-day PHI. *RUP.*

**Brigade**® (2EC) at 2.1-6.4 fl. oz. per acre. Do not exceed  
32 fl. oz. per acre per season for heading crops. Do  
not exceed 25.6 fl. oz. per acre per season for leafy  
crops. 7-day PHI. *RUP.*

 **Entrust**® (2SC) at 4-10 fl. oz. per acre. Do not exceed  
29 fl. oz. per acre per season. 1-day PHI.

**Exirel**® (0.83SE) at 13.5-20 fl. oz. per acre. Do not exceed  
61 fl. oz. per acre per crop. 1-day PHI.

**Platinum**® (75SG) soil application 1.66-3.67 oz. per acre.  
Do not exceed 3.67 oz. per acre per season. 30-day  
PHI.

**Mustang Maxx**® (0.8EC) at 3.2-4.0 fl. oz. per acre. Do not  
exceed 24 fl. oz. per acre per season. 1-day PHI. *RUP.*

**Radiant SC**® (1SC) at 6-10 fl. oz. per acre. *Not for turnip  
greens.* Do not exceed 34 fl. oz. per acre per season.  
1-day PHI.

 May be acceptable for use in certified organic production.  
Check with your certifier before use.