

# Cole Crops and Brassica Leafy Greens - Horticulture

Major update by Ben Phillips, Liz Maynard – Oct 2020

Reviewed by Ajay Nair, Ben Phillips – Jul 2023

## *Crop Description*

The term “cole crops” refers to leafy brassicas, with waxy leaves, of the species *Brassica oleracea*. Cabbage, cauliflower, broccoli, Brussels sprouts, kale, collards, and kohlrabi are hardy crops and well adapted to cool weather. Mustard and turnip greens, although not cole crops, are also frost-hardy and adapted to cool weather. Careful selection of the planting date and cultivars is crucial to a good harvest in the Midwest. Many cole crop varieties need 80 days or fewer to mature and can be sequentially planted in the spring through mid-summer for sequential harvests starting in the summer through late fall. Some cabbage, and cauliflower varieties – and all Brussels sprouts varieties – need over 100 days mature, and require a full season. Plants maturing under cool weather conditions are the highest in quality.

**Broccoli:** There are heading-types of broccoli that form a distinct domed head, and sprouting “broccolini” types that produce smaller sprigs of flower buds for multiple harvests. There are purple varieties as well. Broccoli is relatively fast-maturing, and varieties can be planted in spring for summer harvest and summer for fall harvest.

**Brussels sprouts:** Brussels sprouts require the entire season from spring to fall to produce small cabbage-like buds in a spiral around the stalk of the plant at the base of each leaf.

**Cabbage:** Among the brassica crops, cabbage is the most widely grown. Small-headed varieties of cabbage (3 to 4 lbs.) are the most desired varieties for fresh market sales. Some varieties can be planted in spring for summer harvest, and in summer for fall harvest. Others require the entire season from spring to fall to mature.

**Cauliflower:** Cauliflower is relatively more difficult to grow. The most common problems associated with cauliflower production are failure to head properly and poor curd quality. Cauliflower “buttoning” is the premature formation of curd. When the curd is formed very early in the plant’s life, the leaves of the plant are not large enough to sustain its development to a marketable size. Cold temperatures during seedling production or at transplanting encourage buttoning. In order to produce a white curd, leaves are tied over the

developing head when it is about the size of a baseball to block out sunlight and blanch it. Self-blanching varieties produce leaves that naturally shade the curd, but they need to be planted closer together to effectively self-blanch, resulting in smaller head sizes. Orange, green, and purple colored varieties, and greenish Romanesco-types do not require blanching. Some varieties can be planted in spring for summer harvest, and in summer for fall harvest. Others require the entire season from spring to fall to mature.

**Collards:** Varieties differ in leaf color and texture, tendency to head, and tendency to bolt. Some varieties may be tender enough to harvest at young stage for salad mixes.

**Kale:** Types and varieties differ in leaf color, texture, and shape. Scotch or Curly kale varieties have frilly leaf margins; cultivar examples include Winterbor, Darkibor, and Redbor (purple-red leaves). Lacinato, also called Tuscan or dinosaur kale, has long narrow leaves with smooth leaf margins and a puckered leaf surface; examples include Black Magic and Toscano. Siberian kale is a different species: *Brassica napus* var. *pabularia*. Siberian kale has wavy lobed leaf margins and is somewhat more tender in terms of eating quality than the curly kales; young leaves do well in salad mixes. Varieties White Russian and Dwarf Siberian are examples. The variety Red Russian has sharply lobed leaves with purple veins; leaves are commonly harvested at a small size for salad mixes. Kale flavor is best when grown in cool weather and harvested after a light frost.

**Kohlrabi:** The edible stem of kohlrabi looks like a turnip growing on top of the ground with sprouting leaves over the surface. Green and purple varieties are available. It can be ready to harvest sooner than most cole crops and therefore can fit well as a crop for farmers markets early in the season.

**Mustard:** Mustards are *B. juncea*, and come in a wide variety of leaf shapes, colors, and textures. Leaves may be harvested for salad or braising mixes when young, or allowed to grow to full size and sold in bunches.

**Turnip Greens:** This *B. rapa* species plant is grown for both a root and its tops. Some varieties are bred more for their tops as true turnip greens, like chard is to beets.

**Other leafy greens:** See the Asian Vegetables and Leafy Greens and Herbs chapter.

## *Planting and Spacing*

Brassicas can be planted from seed, but, aside from baby greens, are more commonly established as transplants. Raised

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

**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. Removing the growing point at the top of the plant when the oldest sprouts are about half their full size can speed development of the remaining buds.

**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, or 12 to 15 inches apart in row for self-blanching types.

**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.

**Kohlrabi:** Rows 2 to 3 feet apart. Plants 4 to 12 inches apart in row. Plant more densely to harvest small plants early and allow later harvested plants to grow larger.

**Mustard:** Rows 1 to 1-1/2 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.

## *Fertilizing*

**pH:** Maintain a soil pH of 6.0 to 6.5.

### **Broccoli, Brussels sprouts, cabbage, cauliflower, and kohlrabi:**

Before planting, apply 50 to 60 pounds N per acre, 25 to 200 pounds P<sub>2</sub>O<sub>5</sub> per acre, and 0 to 250 pounds K<sub>2</sub>O per acre based on soil test results and recommendations from your state. 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. At transplanting, a starter solution at a rate of 1 cup (8 ounces) per plant is recommended. If the transplant flat receives a heavy fertilizer feeding just prior to setting, the starter solution can be eliminated.

Sidedress with 40 pounds N per acre three to four weeks after transplanting and again three weeks later. On organic soils only one sidedressing is needed. Avoid excessive N fertilization with broccoli as it can cause too rapid growth and a hollow flower stalk. Reduce the amount of fertilizer N applied by the value of N credits from green manures, legume crops grown in the previous year, compost and animal manures, and soils with more than 3% organic matter. The total amount of N from fertilizer (including starter) and other credits should be 140 pounds per acre.

### **Collards, kale, and mustard:**

Before planting, apply 50 to 60 pounds N per acre, 0 to 150 pounds per acre P<sub>2</sub>O<sub>5</sub>, and 0 to 200 pounds K<sub>2</sub>O per acre based on soil test results and recommendations from your state.

Sidedress with 30 pounds N per acre two to three weeks after transplanting on soils with more than 3% organic matter and following a legume crop. For greens on soils with less than 3% organic matter and following legume crops, apply 45 pounds N per acre. For greens following corn, small grains, or a vegetable crop, apply 60 pounds N per acre. The total amount of N from fertilizer (including starter) and other credits should be 120 pounds 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 which 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. During the critical period of head formation, prolonged periods of heat (over 85 F) result in poor head quality. Broccoli varieties range in maturity from 55 to 75 days.

**Brussels sprouts:** Harvest when the buds are about 1 inch in diameter, firm, tight and of good color. Sprouts can be harvested as they reach marketable size, or during one single harvest at the end of the season. In a once-over harvest sprouts can be harvested individually, or entire stalks can be cut. Harvesting the entire stalk saves on labor in the field and extends the shelf life of the buds. The flavor is best after the first frosts of the season. Brussels sprouts are generally long season crops ranging from 80 to 110 days to maturity and harvested in the fall.

**Cabbage for fresh market and processing:** Cut cabbage when the head has reached a marketable size of 6 to 12 inches in diameter. Peel off the first few wrapper leaves for fresh market sale. Cabbages for processing into kraut are harvested similarly. Cabbage for the bagged salad market are sometimes field-cored. Cabbage varieties range in maturity from 60 to 120 days.

**Cauliflower:** When ready to harvest, the heads should be compact and clean white. Typical harvest size for wholesale markets is a diameter of approximately 6 inches, but heads can reach 12 inches in diameter and sell well. Delaying harvest usually will not result in obtaining larger heads. If larger heads are desired consider cultivar selection and wider plant spacing. Cauliflower should be hand-harvested and cut with 1 to 2 whorls of leaves to protect the head. Cauliflower varieties range in maturity from 55 to 100 days.

**Greens (collards, kale, mustards, turnip greens):** Greens are ready to harvest when the leaves reach the size that your markets desire. Leaves are grabbed by the handful and cut with knives or plucked by hand by snapping handfuls of leaf stalks downwards, and then quickly bunching them with rubber bands that are preloaded on the picker's wrists. Specialized greens harvesters can be used for baby-leaf greens. From seed to harvest ranges from 30 to 75 days.

**Kohlrabi:** Harvest when its diameter reaches 1-1/2 to 2 inches for best quality. Larger sizes may be tough and stringy. Kohlrabi varieties range in maturity between 45 to 60 days.

# Cole Crops and Brassica Leafy Greens - Diseases

Reviewed by Dan Egel– Aug 2023

## Black Leg of Brassicas - *Phoma Fungus*

Black leg is an important disease of broccoli, Brussel sprouts, cauliflower and turnip. May be seedborne.

### Non-Pesticide

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use disease-free seed and transplants. Hot water seed treatment may help to reduce this seedborne pathogen. Use temperatures and times of 122 for 25 minutes for Brussels sprouts and cabbage, 122 for 15 minutes for mustard greens, and 122 for 20 minutes for other Brassicas. Since oilseed rape is particularly susceptible to black leg, avoid planting crucifer crops close to oilseed rape. Leave 1/4-mile buffer from previously infected fields, delay plant until conditions are dry. Rotate to a non-Brassica crop for 3-5 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

### Pesticide

**iprodione products (iprodione)** *Broccoli* | 2 pts. per acre. Formulations of iprodione include Nevado and Rovral. REI: 24-hour. PHI: 0-day. FRAC 02.

**Priaxor (fluxapyroxad, pyraclostrobin)** *Broccoli, Cabbage, Cauliflower, Collards, Kale, Mustard Greens* | 6-8 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 07, FRAC 11.

## Black Rot of Brassicas - *Xanthomonas Bacteria*

Black rot is an important bacterial disease of cole crops. May be seedborne.

### Non-Pesticide

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use disease-free seed and transplants. Hot water seed treatment may help to reduce this seedborne pathogen. Use temperatures and times of 122 for 25 minutes for Brussels sprouts and cabbage, 122 for 15 minutes for mustard greens, and 122 for

20 minutes for other Brassicas. Rotate to a non-Brassica crop for 2-3 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

## Pesticide

**Actigard (0.5WDG) (acibenzolar-s-methyl)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 0.5-1.0 oz. per acre. Suppression only. Do not apply to stressed plants. REI: 12-hour. PHI: 7-day. FRAC P01.

**copper products (copper hydroxide, copper octanoate, copper oxychloride, copper sulfate, copper diammonium diacetate complex, cuprous oxide)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Several formulations of copper (Badge, Champ, Kocide) are labelled for use and may slow the spread of black rot. See label for directions. REI: 4 to 48-hour. PHI: 0-day. FRAC M01. *OMRI-listed.*

## Bottom Rot of Cabbage - Rhizoctonia Fungus

This soil disease can form a complex with black leg stem canker pathogen.

### Non-Pesticide

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Clean and sanitize transplant trays, benches, and tools. Rogue infected transplants. Avoid working field under wet conditions. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Clean and sanitize transplant trays, benches, and tools. Rogue infected transplants. Avoid working field under wet conditions. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

## Pesticide

**Blocker 4F (PCNB)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 2.8-3.75 gals. per acre of 4F formulation or 3.4 lbs. per 1,000 feet of linear row of 10G formulation. See label for other application methods and rates. The 10G formulation is labeled

for wirestem and bottom rot on cauliflower only. REI: 12-hour. FRAC 14.

**Endura (WG) (boscalid)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 6-9 oz. per acre. Suppression only for bottom rot and powdery mildew. REI: 12-hour. PHI: 14-day for collard, kale and mustard; 0-day for broccoli, Brussels sprouts, cabbage and cauliflower. FRAC 07.

## Club Root of Brassicas - Plasmodiophora Fungus

Club root is a long-surviving pathogen that can live on some grasses, clovers, weeds, and other plants, which makes crop rotation difficult. The disease tends to be more prevalent in soils with acidic pH.

### Non-Pesticide

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use disease-free transplants. Choose resistant varieties. Rotate to a non-Brassica crop for 5-7 years. Avoid poorly drained soils with a history of club root. Serious losses can be avoided by raising the pH to 7.2 -7.3.

## Pesticide

**Blocker 4F (PCNB)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 3 pts. per acre of 4F formulation or 5.15 lbs. per 1,000 feet of linear row of 10G formulation. See label for other application methods and rates. REI: 12-hour. FRAC 14.

**Omega 500F (4.17) (fluazinam)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | Transplant: 6.45 fl. oz. per 100 gal. Soil incorporation: 41.6 fl. oz. per acre. REI: 12-hour. PHI: 2-days for workers conducting hand set irrigation. 12-hours for all other activities. FRAC 29.

## Damping-Off Seed and Seedling Rots of Multiple Crops - Multiple Pathogens

### Non-Pesticide

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Practice good greenhouse sanitation of equipment, tools propagation trays/pots, and surfaces. Avoid excess moisture to the transplants in the greenhouse by monitoring irrigation frequency. Plant in warm field soils. The fungi responsible for

damping-off in field soils cause more loss when the seedling is slow to emerge.

## Pesticide

**phosphite and phosphorous acid products (phosphorous acid, potassium phosphite, mono-dipotassium salts of phosphorous acid, mono- and dibasic sodium, potassium, and ammonium phosphites, fosetyl-aluminum)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | see label. Several phosphite or phosphorus acid products (Aliette, Phostrol, ProPhyt, Rampart) are labeled at various rates. Label includes different crops, PHIs, resistance instructions, and other important information. Some manufacturers recommend tank-mixing. These products may be used in a preventative program until the disease is observed. REI: 4 to 12-hour. PHI: 0-day. FRAC 33.

## Downy Mildew of Brassicas - *Hyaloperonospora Oomycete*

May be seedborne.

## Non-Pesticide

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use disease-free seeds and transplants. Hot water seed treatment may help to reduce this seedborne pathogen. Use temperatures and times of 122 for 25 minutes for Brussels sprouts and cabbage, 122 for 15 minutes for mustard greens, and 122 for 20 minutes for other Brassicas. Resistant broccoli varieties are available. Rotate to a non-Brassica crop for 2-3 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

## Pesticide

**Actigard (0.5WDG) (acibenzolar-s-methyl)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 0.5-1.0 oz. per acre. Suppression only. Do not apply to stressed plants. REI: 12-hour. PHI: 7-day. FRAC P01.

**azoxystrobin products (azoxystrobin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Several formulations are labeled at various rates (Acadia LFC, AZteroid FC 3.3, Heritage, Quadris). Use 3.3 lb. a.i. per gallon formulations at 3.9-9.7 fl. oz. per acre. Use 2 lb. a.i. per gallon formulations at 6.0-15.5 fl. oz. per acre. Use 1.65 lb. a.i. per gallon

formulations at 7.6-19.5 fl. oz. per acre. Use 0.5 lb. a.i. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

**Cabrio EG (20) (pyraclostrobin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 12-16 oz. per acre. Suppression only of wire stem and white mold. REI: 12-hour. PHI: 3-day for collard, kale and mustard; 0-day for all other brassicas. FRAC 11.

**chlorothalonil products (chlorothalonil)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 7-day. FRAC M05.

**Forum (4.17SC) (dimethomorph)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 6 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 40.

**Orondis Opti Premix (SC) (oxathiapiprolin, chlorothalonil)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | 1.75-2.5 pts. per acre. REI: 12-hour. PHI: 7-day. FRAC 49, FRAC M05.

**Orondis Ultra Premix (SC) (oxathiapiprolin, mandipropamid)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | 5.5-8.0 fl. oz. per acre. REI: 4-hour. PHI: 1-day. FRAC 49, FRAC 40.

**phosphite and phosphorous acid products (phosphorous acid, potassium phosphite, mono-dipotassium salts of phosphorous acid, mono- and dibasic sodium, potassium, and ammonium phosphites, fosetyl-aluminum)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | see label. Several phosphite or phosphorus acid products (Aliette, Phostrol, ProPhyt, Rampart) are labeled at various rates. Label includes different crops, PHIs, resistance instructions, and other important information. Some manufacturers recommend tank-mixing. These products may be used in a preventative program until the disease is observed. REI: 4 to 12-hour. PHI: 0-day. FRAC 33.

**Presidio (4SC) (fluopicolide)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 3-4 oz. per acre. REI: 12-hour. PHI: 2-day. FRAC 43.

**Ranman 400SC (34.5) (cyazofamid)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi,*

*Mustard Greens, Turnip Greens* | 2.75 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 21.

**Reason 500SC (4.13) (fenamidone)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 5.5-8.2 fl. oz. per acre. REI: 12-hour. PHI: 2-day. FRAC 11.

**Revus (2.08SC) (mandipropamid)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 8 fl. oz. per acre. REI: 4-hour. PHI: 1-day. FRAC 40.

**Ridomil Gold Bravo SC (mefenoxam, chlorothalonil)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | 1.5 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC 04, FRAC M05.

**Zapro (SC) (ametoctradin, dimethomorph)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 14 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 45, FRAC 40.

## Leaf Spot of Brassicas - *Alternaria* Fungus

### Non-Pesticide

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use disease-free seed and transplants. Hot water seed treatment may help to reduce this seedborne pathogen. Use temperatures and times of 122 for 25 minutes for Brussels sprouts and cabbage, 122 for 15 minutes for mustard greens, and 122 for 20 minutes for other Brassicas. Rotate to a non-Brassica crop for 3-4 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

### Pesticide

**azoxystrobin products (azoxystrobin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Several formulations are labeled at various rates (Acadia LFC, AZteroid FC 3.3, Heritage, Quadris). Use 3.3 lb. a.i. per gallon formulations at 3.9-9.7 fl. oz. per acre. Use 2 lb. a.i. per gallon formulations at 6.0-15.5 fl. oz. per acre. Use 1.65 lb. a.i. per gallon formulations at 7.6-19.5 fl. oz. per acre. Use 0.5 lb. a.i. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

**Cabrio EG (20) (pyraclostrobin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 12-16 oz. per acre. Suppression only of wire stem and white mold. REI: 12-hour. PHI: 3-day for collard, kale and mustard; 0-day for all other brassicas. FRAC 11.

**chlorothalonil products (chlorothalonil)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | Several formulations of chlorothalonil (Bravo, Echo, Equus) are labeled at various rates. See label for directions. REI: 12-hour. PHI: 7-day. FRAC M05.

**Endura (WG) (boscalid)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 6-9 oz. per acre. Suppression only for bottom rot and powdery mildew. REI: 12-hour. PHI: 14-day for collard, kale and mustard; 0-day for broccoli, Brussels sprouts, cabbage and cauliflower. FRAC 07.

**Fontelis (1.67SC) (penthiopyrad)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 14-30 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 07.

**Inspire Super (EW) (difenoconazole, cyprodinil)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 16-20 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 03, FRAC 09.

**Orondis Opti Premix (SC) (oxathiapiprolin, chlorothalonil)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | 1.75-2.5 pts. per acre. REI: 12-hour. PHI: 7-day. FRAC 49, FRAC M05.

**Priaxor (fluxapyroxad, pyraclostrobin)** *Broccoli, Cabbage, Cauliflower, Collards, Kale, Mustard Greens* | 6-8 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 07, FRAC 11.

**Procure 480SC (4) (triflumizole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 6-8 fl. oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 03.

**Quadris Top (SC) (azoxystrobin, difenoconazole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 12-14 fl. oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 11, FRAC 03.

**Reason 500SC (4.13) (fenamidone)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 8.2 fl. oz. per acre. REI: 12-hour. PHI: 2-day. FRAC 11.

**Ridomil Gold Bravo SC (mefenoxam, chlorothalonil)**

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | 1.5 lbs. per acre. REI: 48-hour. PHI: 7-day. FRAC 04, FRAC M05.

**Switch 62.5WG (cyprodinil, fludioxonil)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 11-14 oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 09, FRAC 12.

## **Powdery Mildew of Multiple Crops - Erysiphe Fungus**

### **Non-Pesticide**

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Resistant Brussels sprouts and cabbage varieties are available. Rotate to a non-Brassica crop for 3 years. Avoid over-applying nitrogen and drought stress. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

### **Pesticide**

**azoxystrobin products (azoxystrobin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Several formulations are labeled at various rates (Acadia LFC, AZteroid FC 3.3, Heritage, Quadris). Use 3.3 lb. a.i. per gallon formulations at 3.9-9.7 fl. oz. per acre. Use 2 lb. a.i. per gallon formulations at 6.0-15.5 fl. oz. per acre. Use 1.65 lb. a.i. per gallon formulations at 7.6-19.5 fl. oz. per acre. Use 0.5 lb. a.i. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

**Cabrio EG (20) (pyraclostrobin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 12-16 oz. per acre. Suppression only of wire stem and white mold. REI: 12-hour. PHI: 3-day for collard, kale and mustard; 0-day for all other brassicas. FRAC 11.

**Endura (WG) (boscalid)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 6-9 oz. per acre. Suppression only for bottom rot and powdery mildew. REI: 12-hour. PHI: 14-day for collard, kale and mustard; 0-day for broccoli, Brussels sprouts, cabbage and cauliflower. FRAC 07.

**Fontelis (1.67SC) (penthiopyrad)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi,*

*Mustard Greens, Turnip Greens* | 14-30 fl. oz. per acre. REI: 12-hour. PHI: 0-day. FRAC 07.

**Inspire Super (EW) (difenoconazole, cyprodinil)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 16-20 fl. oz. per acre. REI: 12-hour. PHI: 7-day. FRAC 03, FRAC 09.

**Procure 480SC (4) (triflumizole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 6-8 fl. oz. per acre. REI: 12-hour. PHI: 1-day. FRAC 03.

**Wettable Sulfur (sulfur)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Rates vary by product. Always check the label. Use 80% sulfur products at 3-5 lb. per acre (Sulfur Dry Flowable), or 3-10 lb. per acre (Microthiol Disperss, Sulfur 80 WDG, Thiolut). Use 90% sulfur at 3-5 lb. per acre (Sulfur 90W), or 3-10 lb. per acre (Golden Micronized Sulfur). REI: 24-hour. PHI: 0-day. FRAC M02, IRAC UN.

## **White Mold (Timber Rot, Drop, Stem Rot) of Multiple Crops - Sclerotinia Fungus**

This soil pathogen is long-lived in the soil, and has a wide host range on broadleaved crops and weeds, including beans, vine crops, lettuce, tomatoes, peppers, and cole crops. It goes by other names in other crops, such as Drop, White Mold, Stem Rot, and Timber Rot.

It is more commonly found where humidity and temperatures are high. The fungus often infects flowers, which then drop off and infect the stems that they land on. The stems take on a woody appearance and can split open. On cole crops, the pathogen infects the root crown and stem of the plant, which makes the leaves drop and rot. Inspection of the stems will reveal small black pellets that are the overwintering body of the pathogen.

### **Non-Pesticide**

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Rotate to a non-broadleaf crop, such as grass grains or sweet corn for >3 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

### **Pesticide**

**Cabrio EG (20) (pyraclostrobin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard*

*Greens* | 12-16 oz. per acre. Suppression only of wire stem and white mold. REI: 12-hour. PHI: 3-day for collard, kale and mustard; 0-day for all other brassicas. FRAC 11.

**Endura (WG) (boscalid)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 6-9 oz. per acre. Suppression only for bottom rot and powdery mildew. REI: 12-hour. PHI: 14-day for collard, kale and mustard; 0-day for broccoli, Brussels sprouts, cabbage and cauliflower. FRAC 07.

**Fontelis (1.67SC) (penthiopyrad)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards* | 16 to 30 fl. oz. REI: 12-hour. PHI: 0-day. FRAC 07.

## White Rust of Multiple Crops - *Albugo Oomycete*

### Non-Pesticide

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use disease-free seeds and transplants. Hot water seed treatment may help to reduce this seedborne pathogen. Use temperatures and times of 122 for 25 minutes for Brussels sprouts and cabbage, 122 for 15 minutes for mustard greens, and 122 for 20 minutes for other Brassicas. Resistant varieties are available. Rotate to a non-Brassica crop for 3 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

### Pesticide

**azoxystrobin products (azoxystrobin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Several formulations are labeled at various rates (Acadia LFC, AZteroid FC 3.3, Heritage, Quadris). Use 3.3 lb. a.i. per gallon formulations at 3.9-9.7 fl. oz. per acre. Use 2 lb. a.i. per gallon formulations at 6.0-15.5 fl. oz. per acre. Use 1.65 lb. a.i. per gallon formulations at 7.6-19.5 fl. oz. per acre. Use 0.5 lb. a.i. per gallon formulations (Heritage) on greenhouse transplants only at 0.08-0.18 oz. per 1,000 sq. ft. REI: 4-hour. PHI: 0-day. FRAC 11.

**Cabrio EG (20) (pyraclostrobin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 12-16 oz. per acre. Suppression only of wire stem and white mold. REI: 12-hour. PHI: 3-day for collard, kale and mustard; 0-day for all other brassicas. FRAC 11.

**Priaxor (fluxapyroxad, pyraclostrobin)** *Broccoli, Cabbage, Cauliflower, Collards, Kale, Mustard Greens* | 6-8 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 07, FRAC 11.

**Reason 500SC (4.13) (fenamidone)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 8.2 fl. oz. per acre. REI: 12-hour. PHI: 2-day. FRAC 11.

## Wirestem of Brassicas - *Rhizoctonia Fungus*

This soil disease can form a complex with black leg stem canker pathogen.

### Non-Pesticide

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Clean and sanitize transplant trays, benches, and tools. Rogue infected transplants. Avoid working field under wet conditions. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

### Pesticide

**Blocker 4F (PCNB)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 2.8-3.75 gals. per acre of 4F formulation or 3.4 lbs. per 1,000 feet of linear row of 10G formulation. See label for other application methods and rates. The 10G formulation is labeled for wirestem and bottom rot on cauliflower only. REI: 12-hour. FRAC 14.

**Cabrio EG (20) (pyraclostrobin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 12-16 oz. per acre. Suppression only of wire stem and white mold. REI: 12-hour. PHI: 3-day for collard, kale and mustard; 0-day for all other brassicas. FRAC 11.

**Priaxor (fluxapyroxad, pyraclostrobin)** *Broccoli, Cabbage, Cauliflower, Collards, Kale, Mustard Greens* | 6-8 fl. oz. per acre. REI: 12-hour. PHI: 3-day. FRAC 07, FRAC 11.

## Yellows of Multiple Crops - *Fusarium Fungus*

### Non-Pesticide

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use disease-free seed and transplants. Hot water seed treatment



may help to reduce this seedborne pathogen. Use temperatures and times of 122 for 25 minutes for Brussels sprouts and cabbage, 122 for 15 minutes for mustard greens, and 122 for 20 minutes for other Brassicas. Resistant varieties are available. Rotate to a non-Brassica crop for >6 years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent disease build-up.

## Cole Crops and Brassica Leafy Greens - Insects

Reviewed by Laura Ingwell, Marissa Schuh – Sep 2021

### Aphids

#### Pesticide

**Actara (25WDG) (thiamethoxam)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 1.5-3.0 oz. per acre. Do not exceed 11 oz. per acre per season. REI: 12-hour. PHI: 0-day PHI for broccoli, Brussels sprouts, cabbage, and cauliflower, 7-day PHI for leafy greens. IRAC 04A.

**Admire Pro (4.6SC) (imidacloprid)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | *Soil Application:* 4.4-10.5 fl. oz. per acre. Do not exceed 10.5 fl. oz. per acre per crop. *Foliar Application:* 1.3 fl. oz. per acre. Do not exceed 6.5 fl. oz. per acre per crop. REI: 12-hour. PHI: 21-day for soil application, 7-day for foliar application. IRAC 04A.

**Assail 30SG (acetamiprid)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use 30SG formulations at 2.0-5.3 oz. per acre on leafy cole crops or 2.0-4.0 oz. per acre for heading cole crops and do not exceed 20 oz. per acre per season. Use 70WP formulations at 0.8-2.3 oz. per acre on leafy cole crops or 0.8-1.7 oz. per acre on heading cole crops and do not exceed 8.5 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 3-day for leafy cole crops, 7-day for heading cole crops. IRAC 04A.

**Beleaf (50SG) (flonicamid)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.0-2.8 oz. per acre. Do not exceed 8.4 oz. per acre per season. REI: 12-hour. PHI: 0-day PHI. IRAC 29.

**Closer SC (2) (sulfoxaflor)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower* | 1.5-2.0 fl. oz. per acre. Do not make

applications less than 7 days apart or consecutively on the same crop. No more than four applications per crop. Maximum of 17 fl. oz. per acre per year. REI: 12-hour. PHI: 3-day. IRAC 04C.

**Dimethoate 4EC (dimethoate)** *Kale, Mustard Greens* | Use 2.67EC formulations at 0.75 pt. per acre on kale and mustard greens or 0.75-1.0 pt. per acre on broccoli, Brussels sprouts, or cauliflower and do not exceed 1.5 pts. per acre per season on kale and mustard greens, or 4.5 pts. per acre for broccoli, Brussels sprouts, or cauliflower. Use 4EC, LV-4, and 400 EC formulations at 0.5 pt. per acre on kale and mustard greens or 0.5-1.0 pt. per acre on broccoli and cauliflower and do not exceed 1 pt. per acre per season on kale and mustard greens or 3 pts. per acre per season on broccoli and cauliflower. REI: 48-hour. PHI: 7-day for heading cole crops, 14-day for leafy cole crops. IRAC 01B.

**Fulfill (50WDG) (pymetrozine)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.75 oz. per acre. Do not exceed 5.5 oz. per acre per crop per season. Allow a minimum of 7 days between applications. REI: 12-hour. PHI: 7-day PHI. IRAC 09B.

**Harvanta (0.42SL) (cyclaniliprole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 10.9-16.4 fl. oz. per acre. Use with adjuvant. Do not exceed 65.6 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

**Hero (bifenthrin, zeta-cypermethrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 4.0-10.3 fl. oz. per acre. Do not exceed 46.35 fl. oz. per acre per season. Allow a minimum of 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 03A. RUP.

**M-Pede (3.8) (potassium salts of fatty acids)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 1-2% volume. Must contact aphids to be effective. Works best in tank mix with other insecticide. REI: 12-hour. PHI: 0-day. IRAC UN, FRAC NC. *OMRI-listed.*

**Movento (2SC) (spirotetramat)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 4-5 fl. oz. per acre. Do not exceed 10 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 23.

**Mustang Maxx (0.8) (zeta-cypermethrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 3.2-4.0 fl. oz. per acre. Do not exceed 24 oz. per acre per season. Allow a

minimum of 7 days between applications. REI: 12-hour. PHI: 1-day. IRAC 03A. *RUP.*

**Orthene 97 (S) (acephate)** *Brussels sprouts, Cauliflower* | 0.5-1.0 lb. per acre. Do not exceed 4 1/8 lbs. per acre per season. REI: 24-hour. PHI: 14-day. IRAC 01B.

**Platinum 2SC (thiamethoxam)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 04A.

**Sivanto 200 (1.67SL) (flupyradifurone)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 7-12 fl. oz. per acre. For foliar application. Do not exceed 28 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 04D.

## Caterpillars

### Thresholds for Broccoli and Cauliflower

*From transplant to early head or first curd:*

Diamondback Moth: 40% infested

Cabbageworms and loopers: 25% infested

*From early head or first curd to harvest:*

Diamondback Moth: 10% infested

Cabbageworms and loopers: 10% infested

### Thresholds for Fresh Market Cabbage

*Transplant to cupping:*

Diamondback Moth: 50% with >4 larvae per plant

Cabbageworms and loopers: 30% infested

*Cupping to early head*

Diamondback Moth: 50% with >4 larvae per plant

Cabbageworms and loopers: 20% infested

*Early head to harvest*

Diamondback Moth: 10% with >1 larvae per plant

Cabbageworms and loopers: 10% infested

## Pesticide

**Asana XL (0.66EC) (esfenvalerate)** *Broccoli, Cabbage, Cauliflower, Collards, Mustard Greens* | 2.9-9.6 fl. oz. per acre. For armyworms, cabbageworms, and loopers. Heading crops: Do not exceed 77.5 fl. oz. per acre per season. Collards and mustard greens: Do not exceed 38.7 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 03A. *RUP.*

**Avaunt (30WDG) (indoxacarb)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.5-3.5 fl. oz. per acre. For armyworms, cabbageworms, diamondback moth, and loopers.

Do not exceed 14 oz. per acre per season. REI: 12-hour. PHI: 3-day. IRAC 22.

**Baythroid XL (1EC) (beta-cyfluthrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 0.8-3.2 fl. oz. per acre. For armyworms, cabbageworms, cutworms, diamondback moths, and loopers. Do not exceed 12.8 fl. oz. per acre per crop. REI: 12-hour. PHI: 0-day. IRAC 03A. *RUP.*

**Brigade 2EC (bifenthrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.1-6.4 fl. oz. per acre. For armyworms, cabbageworms, cutworms, diamondback moths, and loopers. Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on heading cole crops or 25.6 fl. oz. per acre per season for leafy cole crops. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre on heading cole crops only and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 03A. *RUP.*

**Bt (Bacillus thuringiensis) products for caterpillars (Bacillus thuringiensis aizawai strain ABTS-1857, Bacillus thuringiensis aizawai strain GC-91, Bacillus thuringiensis kurstaki strain ABTS-351, Bacillus thuringiensis kurstaki strain EVB-113-19, Bacillus thuringiensis kurstaki strain SA-11)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | See labels. For cabbageworms, diamondback moths, and loopers. Various Bt products are available for control of young caterpillars (Agree, Biobit, Dipel, Javelin, etc.) Different Bt subspecies have different control properties. Check labels for rates, timing of application and required safety equipment. REI: 4-hour. PHI: 0-day. IRAC 11A.

**Confirm 2F (tebufenozide)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 6.0-8.0 fl. oz. per acre. For armyworms, cabbageworms, and loopers. Do not exceed 40 fl. oz. per season. REI: 4-hour. PHI: 7-day. IRAC 18.

**Coragen (1.67SC) (chlorantraniliprole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 3.5-7.5 fl. oz. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. Can be applied as a foliar spray or soil treatment. Allow 3 days between foliar applications and 10 days between soil applications. Do not apply more than twice within a generation or two successive generations. Do not exceed 15.4 fl. oz. per acre per season. REI: 4-hour. PHI: 3-day. IRAC 28.

**Entrust SC (2) (spinosad)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 1.5-6.0 fl. oz. per acre. For cabbageworms, diamondback moths, and loopers. Use 2SC formulations at 1.5-6.0 fl. oz. per acre and do not exceed 29 fl. oz. per acre per season. Use 80WP formulations at 0.5-2.0 oz. per acre and do not exceed 9 oz. per acre per season. Allow 4 days between applications. Do not apply more than twice within a generation or two successive generations. REI: 4-hour. PHI: 1-day. IRAC 05. *OMRI-listed.*

**Exirel (0.83SE) (cyantraniliprole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 7-17 fl. oz. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. Do not apply more than twice within a generation or two successive generations. Do not exceed 61 fl. oz. per acre per crop. REI: 12-hour. PHI: 1-day. IRAC 28.

**Harvanta (0.42SL) (cyclaniliprole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 10.9-16.4 fl. oz. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. Do not apply more than twice within a generation or two successive generations. Do not exceed 49.2 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

**Hero (bifenthrin, zeta-cypermethrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 4.0-10.3 fl. oz. per acre. For cabbageworms, diamondback moths, and loopers. Do not exceed 46.35 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 03A. *RUP.*

**Intrepid 2F (methoxyfenozide)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 4-10 fl. oz. per acre. For armyworms, cabbageworms, and loopers. Do not exceed 64 fl. oz. per acre per season REI: 4-hour. PHI: 1-day. IRAC 18.

**Mustang Maxx (0.8) (zeta-cypermethrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.24-4.0 fl. oz. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. Do not apply more than twice within a generation or two successive generations. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 14-day. IRAC 03A. *RUP.*

**Orthene 97 (S) (acephate)** *Brussels sprouts, Cauliflower* | 1 lb. per acre. For cabbageworms, diamondback moths, and loopers. Do not exceed 4 1/8 lbs. per acre per season. REI: 24-hour. PHI: 14-day. IRAC 01B.

**Perm-Up 25DF (permethrin)** *Broccoli, Brussels sprouts, Cauliflower, Mustard Greens* | For armyworms, cabbageworms, diamondback moths, and loopers. Use 25W, 25WP, and 25DF formulations at 3.2-12.8 oz. per acre for cabbage, or 3.2-6.4 oz. per acre for broccoli, brussels sprouts and cauliflower, and do not exceed 25.6 oz. per acre per season on broccoli or 12.8 oz. for Brussels sprouts, cabbage and cauliflower. Use 3.2EC formulations at 2-8 fl. oz. per acre for cabbage, or 2-4 fl. oz. per acre for broccoli, Brussels sprouts and cauliflower, and do not exceed 32 fl. oz. per acre on broccoli or 16 fl. oz. per acre for Brussels sprouts, cabbage and cauliflower. *For use on collards in Illinois only at 2-6 fl. oz. per acre, not to exceed 18 fl. oz. per acre per season.* REI: 12-hour. PHI: 1-day. IRAC 03A. *RUP.*

**Proclaim (5SG) (emamectin benzoate)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.4-4.8 fl. oz. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. Do not exceed 28.8 oz. per acre per season. REI: 12-hour. PHI: 7-day for heading cole crops, 14-day for leafy cole crops. IRAC 06. *RUP.*

**Radiant 1SC (spinetoram)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 5-10 fl. oz. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. An adjuvant can improve control. Do not exceed 34 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 05.

**Rimon 0.83EC (novaluron)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | 6-12 fl. oz. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 15.

**Sevin XLR Plus (4SC) (carbaryl)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 1-2 qts. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. Do not apply more than twice within a generation or two successive generations. Do not exceed 6 qt. per acre per crop. REI: 12-hour. PHI: 3-day for heading cole crops, 14-day for leafy cole crops. IRAC 01A.

**Verimark (1.67SC) (cyantraniliprole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Apply 5-10 fl. oz. per acre to the soil at planting or as a transplant drench within 72 hours of planting. Do not exceed 1 soil application (including transplant drench) or 13.5 fl. oz. per acre per year at planting. Apply through drip chemigation 5-10 fl. oz. per acre. Do not exceed 2 drip chemigation applications per crop. REI: 4-hour. IRAC 28.

**Warrior II (2.08CS) (lambda-cyhalothrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | 0.96-1.92 fl. oz. per acre. For armyworms, cabbageworms, diamondback moths, and loopers. Do not apply more than twice within a generation or two successive generations. Do not exceed 15.36 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 03A. *RUP.*

## Flea Beetles

### Pesticide

**Actara (25WDG) (thiamethoxam)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 1.5-3.0 oz. per acre. Do not exceed 11 oz. per acre per season. REI: 12-hour. PHI: 0-day PHI for broccoli, Brussels sprouts, cabbage, and cauliflower, 7-day PHI for leafy greens. IRAC 04A.

**Asana XL (0.66EC) (esfenvalerate)** *Broccoli, Cabbage, Cauliflower, Collards, Mustard Greens* | 5.8-9.6 fl. oz. per acre. Heading crops: Do not exceed 77.5 fl. oz. per acre per season. Collards and mustard greens: Do not exceed 38.7 fl. oz. per acre per season. REI: 12-hour. PHI: 3-day for heading crops, 7-day for collards and mustard greens. IRAC 03A. *RUP.*

**Baythroid XL (1EC) (beta-cyfluthrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.4-3.2 fl. oz. per acre. Do not exceed 12.8 fl. oz. per acre per crop. REI: 12-hour. IRAC 03A. *RUP.*

**Belay (2.13SC) (clothianidin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | *Soil applications:* 9-12 fl. oz. per acre. *Foliar applications:* 3-4 fl. oz. per acre. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day for soil application, 7-day for foliar application. IRAC 04A.

**Brigade 2EC (bifenthrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on heading cole crops or 25.6 fl. oz. per acre per season for leafy cole crops. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre on heading cole crops only and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 03A. *RUP.*

**Exirel (0.83SE) (cyantraniliprole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 13.5-20 fl. oz. per acre. Do

not exceed 61 fl. oz. per acre per crop. REI: 12-hour. PHI: 1-day. IRAC 28.

**Harvanta (0.42SL) (cyclaniliprole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 10.9-16.4 fl. oz. per acre. Use high rate for flea beetles. Do not exceed 65.6 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

**Hero (bifenthrin, zeta-cypermethrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 4.0-10.3 fl. oz. per acre. Do not exceed 46.35 fl. oz. per acre per season. Allow a minimum of 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 03A. *RUP.*

**Mustang Maxx (0.8) (zeta-cypermethrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.24-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 03A. *RUP.*

**Perm-Up 25DF (permethrin)** *Cabbage* | Use 25W, 25WP, and 25DF formulations at 6.4-12.8 oz. per acre and do not exceed 25.6 fl. oz. per acre per season. Use 3.2EC formulations at 4-8 fl. oz. per acre and do not exceed 16 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 03A. *RUP.*

**Platinum 2SC (thiamethoxam)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 04A.

**Sevin XLR Plus (4SC) (carbaryl)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 0.5-1 qt. per acre. Do not exceed 6 qts. per acre per crop. REI: 12-hour. PHI: 3-day for heading cole crops, 14-day for leafy cole crops. IRAC 01A.

**Verimark (1.67SC) (cyantraniliprole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Apply 6.75-13.5 fl. oz. per acre to the soil at planting or as a transplant drench within 72 hours of planting. Do not exceed 1 soil application (including transplant drench) or 13.5 fl. oz. per acre per year at planting. Apply through drip chemigation 6.75-13.5 fl. oz. per acre. Do not exceed 2 drip chemigation applications per crop. REI: 4-hour. IRAC 28.

**Warrior II (2.08CS) (lambda-cyhalothrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | 1.28-1.92 fl. oz. per acre. Do not exceed 15.36 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 03A. *RUP*.

## Leafminers

### Pesticide

**Entrust SC (2) (spinosad)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use 2SC formulations at 4.0-10.0 fl. oz. per acre and do not exceed 29 fl. oz. per acre per season. Use 80WP formulations at 1.25-3.0 oz. per acre and do not exceed 9 oz. per acre per season. Adjuvants can improve leafminer control. Allow 4 days between applications. REI: 4-hour. PHI: 1-day. IRAC 05. *OMRI-listed*.

**Exirel (0.83SE) (cyantraniliprole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 13.5-20 fl. oz. per acre. Do not exceed 61 fl. oz. per acre per crop. REI: 12-hour. PHI: 1-day. IRAC 28.

**Harvanta (0.42SL) (cyclaniliprole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 10.9-16.4 fl. oz. per acre. Use high rate for flea beetles. Do not exceed 65.6 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

**M-Pede (3.8) (potassium salts of fatty acids)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 1-2% by volume. Works best in tank mix with other insecticide. REI: 12-hour. PHI: 0-day. IRAC UN, FRAC NC. *OMRI-listed*.

**Mustang Maxx (0.8) (zeta-cypermethrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 3.2-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 03A. *RUP*.

**Radiant 1SC (spinetoram)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 6-10 fl. oz. per acre. Control may be improved with the use of an adjuvant. Do not exceed 24 fl. oz. per acre per season. REI: 4-hour. PHI: 7-day. IRAC 05.

**Rimon 0.83EC (novaluron)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | 6-12 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 15.

**Scorpion 35SL (3.24) (dinotefuran)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower* | *Soil treatment*: 9.0-10.5 oz. per acre. *Foliar treatment*: 2.0-7.0 oz. per acre. Allow 7 days between applications. REI: 12-hour. PHI: 21-day for soil applications, 1-day for foliar applications. IRAC 04A.

**Trigard (75WP) (cyromazine)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.66 oz. per acre. Do not exceed 6 applications per season. REI: 12-hour. PHI: 7-day. IRAC 17.

**Venom 70SG (dinotefuran)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | *Soil treatment*: 5.0-7.5 oz. per acre. *Foliar treatment*: 1-4 oz. per acre. Allow 7 days between applications. REI: 12-hour. PHI: 21-day for soil applications, 1-day for foliar applications. IRAC 04A.

## Seed and Root Maggots

### Non-Pesticide

*Broccoli, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Rotate as far in physical distance as possible from last year's cole crops. Do not use brassica cover crops between cole crop plantings. Brassica weeds like shepherd's purse, yellow rocket, and wild mustard can host later generations of cabbage maggot and should be managed in rotation years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent population build-up. Avoid planting into fields with high organic matter residues. Decomposing organic matter serves as an attractant to females who are laying eggs. Refer to pest degree day models and delay planting until after the first generation has emerged and laid eggs. Row covers can exclude adults when placed over crops that have been rotated to a field free of over-wintering populations, which emerge from the soil and would then be trapped under the covers.

### Pesticide

**Capture LFR (1.5) (bifenthrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Can be used banded at-plant, pre-plant, or incorporated shortly after planting. See label. REI: 12-hour. IRAC 03A. *RUP*.

**Diazinon AG500 (4ES) (diazinon)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | Use 50W formulations at 4-6 lbs. per acre as a pre-plant broadcast or 0.5-1.0 lbs per 100 gallons of transplant water at planting, and do not exceed 8 lbs. per acre per season. Use AG500 formulations at 64-96 fl. oz. per acre as a pre-plant broadcast or 8-16 fl. oz. per acre in 100 gallons of transplant water at

planting, and do not exceed 128 fl. oz. per acre per season. Use AG600 formulations at 51-76.5 fl. oz. per acre as a pre-plant broadcast or 6.5-12.0 fl. oz. per acre in 100 gallons of transplant water at planting, and do not exceed 102 fl. oz. per acre per season. Water treatments may reduce stands due to plants stress at time of transplanting. Cabbage maggot exhibit resistance to diazinon. REI: 2 to 4-day. IRAC 01B. *RUP*.

**Entrust SC (2) (spinosad)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | For Cabbage Maggot control. Use 2SC formulations at 5.0-10.0 fl. oz. per acre and do not exceed 29 fl. oz. per acre per season. See label for specific use requirements. Observe resistance management restrictions. REI: 4-hour. PHI: 1-day. IRAC 05. *OMRI-listed*.

**Radiant 1SC (spinetoram)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | For Cabbage Maggot control. 5-10 fl. oz. per acre. *Suppression only*. See label for specific use directions. Do not exceed 10 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 05.

**Verimark (1.67SC) (cyantraniliprole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | For Cabbage Maggot control. Apply 10-13.5 fl. oz. per acre to the soil at planting or as a transplant drench within 72 hours of planting. Do not exceed 1 soil application (including transplant drench) or 13 fl. oz. per acre per year. REI: 4-hour. IRAC 28.

## Slugs

Occasionally, slugs and snails seriously damage seedlings; tender, low-growing leafy vegetables; or ripening fruit that are on the ground. Slug and snail feeding damage (hollowed-out areas) can be found anywhere on fruit, but is usually concentrated near the stem. Slugs leave behind telltale slime trails (silvery trails) on the surfaces of fruit or leaves. Slugs and snails are active at night or cloudy days.

Slugs and snails favor continuously moist soil and organic mulch. They lay eggs in groups in moist soil, and overwinter in organic mulch. Slugs can complete their entire life cycle in a field.

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. Apply in evening after a rain or irrigation. Avoid contact with edible product.

## Non-Pesticide

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Slug hiding places should be eliminated - such as, boards, stones, weedy areas, or heavy mulch - so the soil can become warm and dry. Raised beds that can dry out more readily than flat beds reduce slug problems. Using black plastic mulch discourages slug build-up because it causes the soil to heat up and dry out.

## Pesticide

**Deadline M-Ps (4P) (metaldehyde)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 25 lbs. per acre. Scatter bait around the perimeter of plantings or between rows. Apply in evening after a rain or irrigation. Avoid contact with edible product. Allow 14 days between applications. Maximum 3 applications per season. REI: 12-hour. PHI: 0-day. IRAC UN.

**Sluggo 1B (iron phosphate)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 20-44 lbs. per acre, or at 05.-1 lb. per square ft. 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. Apply in evening after a rain or irrigation. REI: 0-hour. PHI: 0-day. IRAC UN. *OMRI-listed*.

## Stink Bugs

### Pesticide

**Azera (C) (azadirachtin, pyrethrins)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 16-56 fl. oz. per acre. Use lower rates for nymphs. Use 48 fl. oz. per acre for adults. Use higher rates (56 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. REI: 12-hour. PHI: 0-day. IRAC UN, IRAC 03A. *OMRI-listed*.

**Baythroid XL (1EC) (beta-cyfluthrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.4-3.2 fl. oz. per acre. Do not exceed 12.8 fl. oz. per acre per crop. REI: 12-hour. PHI: 0-day. IRAC 03A. *RUP*.

**Belay (2.13SC) (clothianidin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | *Soil applications*: 9-12 fl. oz. per acre. *Foliar applications*: 3-4 fl. oz. per acre. Do not exceed 12 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day for soil applications, 7-day for foliar applications. IRAC 04A.

**Brigade 2EC (bifenthrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on heading cole crops or 25.6 fl. oz. per acre per season for leafy cole crops. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre on heading cole crops only and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 03A. RUP.

**Harvanta (0.42SL) (cyclaniliprole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 10.9-16.4 fl. oz. per acre. For suppression of nymphs only. Do not exceed 65.6 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 28.

**Malathion 5EC (malathion)** *Collards* | *Harlequin Bugs only.* Use 5EC formulations at 1.0 pt. per acre and 57EC formulation at 1.5 pts. per acre. Do not exceed 3 applications per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 01B.

**Mustang Maxx (0.8) (zeta-cypermethrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 3.2-4 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 7-day. IRAC 03A. RUP.

**Rimon 0.83EC (novaluron)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | 12 fl. oz. per acre. Do not exceed 24 oz. or 2 applications per acre per season. REI: 12-hour. PHI: 7-day. IRAC 15.

**Scorpion 35SL (3.24) (dinotefuran)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower* | *Soil treatment:* 9.0-10.5 oz. per acre. *Foliar treatment:* 2.0-7.0 oz. per acre. Allow 7 days between applications. REI: 12-hour. PHI: 21-day for soil applications, 1-day for foliar applications. IRAC 04A.

**Sevin XLR Plus (4SC) (carbaryl)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 0.5-2 qts. per acre. Use low rates for Harlequin bugs. Use higher rates for other stink bugs. Do not exceed 6 qts. per acre per crop. REI: 12-hour. PHI: 3-day for heading cole crops, 14-day for leafy cole crops. IRAC 01A.

**Venom 70SG (dinotefuran)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | 1-4 oz. per acre. Allow 7 days between applications. Do not apply more than 12 oz. per acre per season. REI: 12-hour. IRAC 04A.

**Warrior II (2.08CS) (lambda-cyhalothrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | 1.28-1.92

fl. oz. per acre. Do not exceed 15.36 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 03A. RUP.

## Swede Midge

Swede midge is most attracted to heading cole crops (broccoli, cauliflower, cabbage, and Brussels sprouts), though distortion and yield loss in leafy crops is possible. Some products that control flea beetles and caterpillars in cole crops work well on Swede midge, but may not have Swede midge explicitly on their label. Take advantage of this implied rotation to prevent resistance if your state does not require 2(ee) labels for specific pests. Products include Admire Pro (IRAC 4A), Coragen (IRAC 28), Exirel (IRAC 28), Orthene (IRAC 1B), Verimark (IRAC 28), and Warrior II (IRAC 3A).

## Non-Pesticide

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Rotate away from cole crops for three years. Do not use brassica cover crops between cole crop plantings. Brassica weeds like shepherd's purse, yellow rocket, and wild mustard can host Swede midge and should be managed in rotation years. Prompt destruction of the finished crop with tillage to rapidly breakdown tissue is an important method to prevent population build-up.

## Pesticide

**Assail 30SG (acetamiprid)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use 30SG formulations at 4.0-5.3 oz. per acre on leafy cole crops or 4.0 oz. per acre for heading cole crops and do not exceed 20 oz. per acre per season. Use 70WP formulations at 1.7-2.3 oz. per acre on leafy cole crops or 1.7 oz. per acre on heading cole crops and do not exceed 8.5 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 3-day for leafy cole crops, 7-day for heading cole crops. IRAC 04A.

**Movento (2SC) (spirotetramat)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 4-5 fl. oz. per acre. Do not exceed 10 fl. oz. per acre per season. REI: 24-hour. PHI: 1-day. IRAC 23.

## Thrips

### Non-Pesticide

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Varieties tolerant of thrips include Bantly, Bravo, Brutus, King Cole, Little Rock, Manrico, Rio Granda, Rio Verde, Ruby

Perfection, Starski, Stonar, SuperKraut, Titanic 90, Zerlina, and others.

## Pesticide

**Actara (25WDG) (thiamethoxam)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 3.0-5.5 oz. per acre. Do not exceed 11 oz. per acre per season. REI: 12-hour. PHI: 0-day for broccoli, Brussels sprouts, cabbage, and cauliflower, 7-day for leafy greens. IRAC 04A.

**Admire Pro (4.6SC) (imidacloprid)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Soil application: 4.4-10.5 fl. oz. per acre. Do not exceed 10.5 fl. oz. per acre per season. REI: 12-hour. PHI: 21-day. IRAC 04A.

**Assail 30SG (acetamiprid)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use 30SG formulations at 4.0-5.3 oz. per acre on leafy cole crops or 4.0 oz. per acre for heading cole crops and do not exceed 20 oz. per acre per season. Use 70WP formulations at 1.7-2.3 oz. per acre on leafy cole crops or 1.7 oz. per acre on heading cole crops and do not exceed 8.5 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 3-day for leafy cole crops, 7-day for heading cole crops. IRAC 04A.

**Baythroid XL (1EC) (beta-cyfluthrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 0.8-1.6 fl. oz. per acre. Do not exceed 12.8 fl. oz. per acre per crop. REI: 12-hour. IRAC 03A. RUP.

**Brigade 2EC (bifenthrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use 2EC formulations at 2.1-6.4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on heading cole crops or 25.6 fl. oz. per acre per season for leafy cole crops. Use 10DF, 10WP, or 10WSB formulations at 5.3-16 oz. per acre on heading cole crops only and do not exceed 80 oz. per acre per season. Allow 7 days between applications. REI: 12-hour. PHI: 7-day. IRAC 03A. RUP.

**Closer SC (2) (sulfoxaflor)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 5.75 fl. oz. per acre. *Suppression only.* Do not make applications less than 7 days apart or consecutively on the same crop. No more than four applications per crop. Maximum of 17 fl. oz. per acre per year. REI: 12-hour. PHI: 3-day. IRAC 04C.

**Entrust SC (2) (spinosad)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use 2SC formulations at 4.0-10.0 fl. oz. per acre and do not exceed 29 fl. oz. per acre per season. Use 80WP formulations at 1.25-3.0 oz. per acre and do not exceed 9 oz. per acre per season. Adjuvants can improve leafminer control. Allow 4 days between applications. REI: 4-hour. PHI: 1-day. IRAC 05. *OMRI-listed.*

**Exirel (0.83SE) (cyantraniliprole)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 13.5-20 fl. oz. per acre. Do not exceed 61 fl. oz. per acre. REI: 12-hour. PHI: 1-day. IRAC 28.

**Mustang Maxx (0.8) (zeta-cypermethrin)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 3.2-4.0 fl. oz. per acre. Do not exceed 24 fl. oz. per acre per season. REI: 12-hour. PHI: 1-day. IRAC 03A. RUP.

**Perm-Up 25DF (permethrin)** *Broccoli, Brussels sprouts, Cauliflower* | Use 25W, 25WP, and 25DF formulations are 3.2-6.4 oz. per acre and do not exceed 25.6 oz. per acre per season on broccoli or 12.8 oz. per acre per season on Brussels sprouts or cauliflower. Use 3.2EC formulations at 2-4 fl. oz. per acre and do not exceed 32 fl. oz. per acre per season on broccoli or 16 fl. oz. per acre per season on Brussels sprouts or cauliflower. REI: 12-hour. PHI: 7-day. IRAC 03A. RUP.

**Platinum 2SC (thiamethoxam)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Use 2SC formulations as a soil treatment at 5-11 fl. oz. per acre and do not exceed 11 fl. oz. per acre per season. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre and do not exceed 3.67 oz. per acre per season. REI: 12-hour. PHI: 30-day. IRAC 04A.

**Radiant 1SC (spinetoram)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 6-10 fl. oz. per acre. Do not exceed 34 fl. oz. per acre per season. REI: 4-hour. PHI: 1-day. IRAC 05.

**Torac (1.29SC) (tolfenpyrad)** *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Mustard Greens, Turnip Greens* | 21 fl. oz. per acre. Do not apply until 14 days after transplanting. Do not exceed 42 fl. oz. per crop per cycle. REI: 12-hour. PHI: 1-day. IRAC 21A, FRAC 39.



# Cole Crops and Brassica Leafy Greens - Weeds

Reviewed by Stephen Meyers – Sep 2023

## All Weeds

Cole crops are cool-season plants, but are nearly always started as transplants. When growers transplant cole crops into plastic mulch, no herbicides are labeled for use under the plastic because of the risk of damaging the crop. Early season plantings into cool soils are at greater risk of herbicide injury. There are several herbicides labeled for the control of weeds preemergence, applied before cole crops are transplanted, or directed between the rows only after transplanting.


For specific weeds controlled by each herbicide, check the Relative Effectiveness of Herbicides for Vegetable Crops table.


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



## Non-Pesticide



*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Design bed and row spacing to match equipment that will be used and other crops with similar space requirements. A stale seedbed can be prepared prior to transplanting with flame weeding or very shallow cultivation to control emerged weeds, instead of herbicides. Mulches provide good weed control when planted into, when used for between row spaces, or in combination in-row and between-row. Materials include landscape cloth, plastic, biodegradable plastic, or straw applied before weeds emerge. Weeds between beds and along the edges of beds can be controlled with a combination of cultivation, mowing, or hand hoeing/pulling. Weeds along the edge of the mulches can be a particular challenge to avoid ripping the mulch.



## Pesticide



**Aim EC (2) (carfentrazone)** POST  *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 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. REI: 12-hour. HRAC 14.

**clethodim products (clethodim)** POST  *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | Use 2EC formulations at 6-8 fl. oz. per acre 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 Select Max at 9-16 fl. oz. per acre 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. Use low rates for annual grasses, the high rates for perennial grasses. Spray on actively growing grass. Wait at least 14 days between applications. REI: 24-hour. PHI: 14-day for leafy brassicas, 30-day for heading cole crops. HRAC 01.

**Command 3ME (clomazone)** PRE   *Broccoli, Cabbage* | 0.67-1.3 pts. per acre. For **cabbage**: apply before seeding or transplanting or after seeding before crop emerges. Use low rate for seeded cabbage. For **broccoli**: apply low rate within 48 hours of transplanting. May cause early stunting or discoloration. REI: 12-hour. PHI: 45-day for cabbage. HRAC 13.

**Dacthal Flowable (6F) (DCPA)** PRE   *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 6-14 pts. per acre. Apply at seeding or transplanting. May be incorporated. May be applied over top of transplants. REI: 12-hour. HRAC 03.

**Devrinol DF-XT (50) (napropamide)** PRE   *Broccoli, Brussels sprouts, Cabbage, Cauliflower* | 2 lbs. per acre. 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 GoalTender. REI: 24-hour. HRAC NC.

**Dual Magnum (7.62EC) (s-metolachlor)** PRE   *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | *Illinois, Indiana, Michigan, Minnesota, and Ohio 24c label only.* For **heading cole crops**: apply 0.5-1.3 pts. per acre to soil surface before transplanting or within 48 hours of 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 tank-mix with pendimethalin for post-transplant application. For **leafy brassicas**: apply 0.67-1.3 pts. per acre 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. REI: 24-hour. PHI: 30-day for leafy brassicas, 60-day for heading cole crops. HRAC 15.

**glyphosate products (glyphosate)** POST  



*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | See product labels for rates, application volume, and adjuvants. 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. REI: 4-hour to 12-hour. PHI: 14-day. HRAC 9.

**GoalTender (4) (oxyfluorfen)** PRE  *Broccoli,*



*Cabbage, Cauliflower* | Apply GoalTender at 0.5-1 pt. per acre after preparing soil but before transplanting, or Goal 2X at 1-2 pts. per acre. Transplant within 7 days of application. *With Michigan 24c label only* another application of GoalTender is allowed at 4-8 fl. oz. per acre to well-established transplants at least 2 weeks in the field, or to direct-seeded plants with at least 4 true leaves. Do not exceed 16 fl. oz. pre- and postemergence. Use lower rate on coarse-textured soils. Do not add adjuvant. REI: 24 to 48-hour. PHI: 35-day for postemergence application in Michigan only. HRAC 14.

**Optogen (bicyclopyrone)** POST PRE   *Broccoli* |

3.5 fl. oz. per acre. For **broccoli**: apply after emergence or after transplanting as a row middle or post-directed application, avoiding contact with crop foliage. If weeds are present, add 0.5 pt. NIS (0.25% v/v) or 1 qt. COC (1% v/v) per 25 gal. of spray solution. Spray grade ammonium sulfate (AMS) may also be added to improve weed control consistency. Apply to weeds less than 2 inches. Do not exceed 1 application per year. Do not exceed 3.5 fl. oz. per acre per year. Do not apply preemergence on mineral soils. REI: 24-hour. PHI: 14-day. HRAC 27.


**paraquat products (paraquat)** POST   *Broccoli,*

*Cabbage, Cauliflower, Collards* | 2-4 pts. per acre. 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. REI: 12 to 24-hour. HRAC 22. RUP.

**pendimethalin products (pendimethalin)** PRE  

*Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards,*



*Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Apply formulations with 3.8 lbs. active ingredient per gallon at 1.0-2.1 pts. per acre to soil as a broadcast before transplanting, or apply between the rows of established transplants and direct-seeded crops with 2-4 leaves for heading cole crops, or 4-5 leaves for leafy brassicas. Spray contact with plants may cause crop stunting. Do not use the roots from treated turnip greens for food. REI: 24-hour. PHI: 21-day for leafy brassicas; 60-day for broccoli; 70-day for Brussels sprouts, cabbage, cauliflower, and kohlrabi. HRAC 03.

**Poast (1.5EC) (sethoxydim)** POST  *Broccoli, Brussels*

*sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 1-1.5 pts. per acre. Include 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. REI: 12-hour. PHI: 14-day for turnip greens. 30-day for all others. HRAC 01.

**Prefar 4E (bensulide)** PRE   *Broccoli, Brussels*

*sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 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. REI: 12-hour. HRAC NC.


**Spartan 4F (sulfentrazone)** PRE   *Cabbage* | 2.25-



12 fl. oz. per acre. *Transplanted cabbage for processing only. Do not use on cabbage for fresh market or on direct seeded cabbage.* 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. REI: 12-hour. HRAC 14.

**Spartan Charge (SE) (carfentrazone, sulfentrazone)**



POST PRE  *Cabbage* | 2.9-15.2 fl. oz. per acre.

*Transplanted cabbage only.* Apply up to 60 days before transplanting as a broadcast on emerged weeds, or band between rows within 72 hours after transplanting. May also 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. REI: 12-hour. HRAC 14.

**Spur (3) (clopyralid)** POST  *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 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. REI: 12-hour. PHI: 30-day. HRAC 04.

**Sulfen 4SC (sulfentrazone)** PRE   *Broccoli, Brussels sprouts, Cabbage, Collards, Kale, Kohlrabi, Mustard Greens* | For **broccoli, Brussels sprouts, cauliflower, and kohlrabi**: Apply 2.25-9.0 fl. oz. per acre in the spring, up to 72 hours before transplanting. For **transplanted cabbage** in *Michigan and Minnesota only*: Apply 2.25-12.0 fl. oz. per acre 60 days prior to transplanting as a broadcast application or up to 72 hours after transplanting as a directed spray between rows. For **collards, kale, and mustard greens**: Apply 2.25-6.4 fl. oz. per acre in the spring,

up to 72 hours before transplanting. Do not use on sandy soil with <1% organic matter (OM). Observe label rates for soil type. Use lower rate for soil with pH >7. REI: 12-hour. HRAC 14.

**trifluralin products (trifluralin)** PRE   *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 0.5-0.75 lb. a.i. per acre. Use 4EC formulations at 1-1.5 pts. per acre for seeded crops, up to 2 pts. per acre for transplanted crops. Use 10G formulations at 5-7.5 lbs. per acre for seeded crops, up to 10 lbs. per acre for transplanted crops. Apply before planting and incorporate 2-3 inches immediately. Use low rate on coarse soils with less than 2% organic matter. Not effective on muck or high organic matter soils. The 4D and HFD formulations are labeled for direct-seeded kohlrabi at 1-1.5 pts. per acre. REI: 12-hour. HRAC 03.