

Cole Crops and Brassica Leafy Greens - Horticulture

Major update by Ben Phillips, Liz Maynard – Oct 2020

Reviewed by Dan Fillius and Liz Maynard – Oct 2024

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 to 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. Varieties have been bred to perform in each of these situations, with some performing best with heat at a young age and cooler conditions at maturity while others perform best with cool conditions early and tolerating heat at maturity.

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. Varieties have been bred for storage as well. Cold storage allows growers to hold these for later sale into early spring.

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.

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

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 or more rows 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. Doing this less than 60 days before harvest evens out the bud sizes up and down the stalk.

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 P₂O₅ per acre, and 0 to 250 pounds K₂O 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 P₂O₅, and 0 to 200 pounds K₂O 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, cut the main head with 8 to 10 inches of stem. Sometimes a second harvest of side shoots can be obtained. Broccoli for processing should be cut with a shorter 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 or twist-ties. 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. Varieties bred for storage can maintain optimal texture at a larger size, though any larger than a softball can intimidate customers. Kohlrabi allowed to grow past the optimal size is often 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 F for 25 minutes for Brussels sprouts and cabbage, 122 F for 15 minutes for mustard greens, and 122 F 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 F for 25 minutes for Brussels sprouts and cabbage, 122 F for 15 minutes for mustard greens, and 122 F

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 (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.

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 (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 (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: 7-day for cabbage, 20-day for collards, kale, and mustard greens; 50-day for broccoli, Brussels sprouts, cauliflower, and kohlrabi. 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 F for 25 minutes for Brussels sprouts and cabbage, 122 F for 15 minutes for mustard greens, and 122 F 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 (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 (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 (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 (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 (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 (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 (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 (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 (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.

Zampro (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 F for 25 minutes for Brussels sprouts and cabbage, 122 F for 15 minutes for mustard greens, and 122 F 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 (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 (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 (penthioopyrad) *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 (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 (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 (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 (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 (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.

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Endura (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 (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 (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 (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, Thiolux). 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. *OMRI-listed.*

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 (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 (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 (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 F for 25 minutes for Brussels sprouts and cabbage, 122 F for 15 minutes for mustard greens, and 122 F 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 (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 (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 (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 F for 25 minutes for Brussels sprouts and cabbage, 122 F for 15 minutes for mustard greens, and 122 F 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

Major update by Laura Ingwell, Marissa Schuh – Sep 2021
Reviewed by Raymond Cloyd – Aug 2024

Aphids

Pesticide

Actara (thiamethoxam) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 1.5-3.0 oz. per acre. REI: 12-hour. PHI: 0-day PHI for broccoli, Brussels sprouts, cabbage, and cauliflower, 7-day PHI for leafy greens. IRAC 04A.

Admire Pro (imidacloprid) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | *Soil Application:* 4.4-10.5 fl. oz. per acre. *Foliar Application:* 1.3 fl. oz. per acre. 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. 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. REI: 12-hour. PHI: 3-day for leafy cole crops, 7-day for heading cole crops. IRAC 04A.

Beleaf (flonicamid) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.0-2.8 oz. per acre. REI: 12-hour. PHI: 0-day. IRAC 29.

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. 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. REI: 48-hour. PHI: 7-day for heading cole crops, 14-day for leafy cole crops. IRAC 01B.

Fulfill (pymetrozine) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.75 oz. per acre. REI: 12-hour. PHI: 7-day PHI. IRAC 09B.

Harvanta (cyclaniliprole) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 10.9-16.4 fl. oz. per acre. Use with adjuvant. 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. REI: 12-hour. PHI: 7-day. IRAC 03A. *RUP.*

M-Pede (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 (spirotetramat) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 4-5 fl. oz. per acre. REI: 24-hour. PHI: 1-day. IRAC 23.

Mustang Maxx (zeta-cypermethrin) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 3.2-4.0 fl. oz. per acre. REI: 12-hour. PHI: 1-day. IRAC 03A. *RUP.*

Orthene 97 (acephate) *Brussels sprouts, Cauliflower* | 0.5-1.0 lb. per acre. 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. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre. REI: 12-hour. PHI: 30-day. IRAC 04A.

Sequoia (sulfoxaflor) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 1.5-2.0 fl. oz. per acre. REI: 12-hour. PHI: 3-day. IRAC 04C.

Sivanto 200 (flupyradifurone) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 7-12 fl. oz. per acre. Apply as foliar spray. 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 (esfenvalerate) *Broccoli, Cabbage, Cauliflower, Collards, Mustard Greens* | 2.9-9.6 fl. oz. per acre. For armyworms, cabbageworms, and loopers. REI: 12-hour. PHI: 7-day. IRAC 03A. *RUP.*

Avant (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. REI: 12-hour. PHI: 3-day. IRAC 22.

Baythroid XL (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. 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. Use 10DF, 10WP, or 10WSB formulations on heading cole crops only at 5.3-16 oz. per acre. 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 (Agree, Biobit, Dipel, Javelin, etc.) are available for control of young caterpillars however, different Bt products can vary in the effectiveness against caterpillars. 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. REI: 4-hour. PHI: 7-day. IRAC 18.

Coragen (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. REI: 4-hour. PHI: 3-day. IRAC 28.

Entrust SC (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. Use 80WP formulations at 0.5-2.0 oz. per acre. Allow 4 days between applications. REI: 4-hour. PHI: 1-day. IRAC 05. *OMRI-listed.*

Exirel (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. REI: 12-hour. PHI: 1-day. IRAC 28.

Harvanta (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. 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. 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. REI: 4-hour. PHI: 1-day. IRAC 18.

Mustang Maxx (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. REI: 12-hour. PHI: 14-day. IRAC 03A. *RUP.*

Orthene 97 (acephate) *Brussels sprouts, Cauliflower* | 1 lb. per acre. For cabbageworms, diamondback moths, and loopers. 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. 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. *For use on collards in Illinois only at 2-6 fl. oz. per acre.* REI: 12-hour. PHI: 1-day. IRAC 03A. *RUP.*

Proclaim (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. 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. 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. REI: 12-hour. PHI: 7-day. IRAC 15.

Sevin XLR Plus (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. REI: 12-hour. PHI: 3-day for heading cole crops, 14-day for leafy cole crops. IRAC 01A.

Verimark (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, as a transplant drench within 72 hours of planting, or throughdrip chemigation. REI: 4-hour. IRAC 28.

Warrior II (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. REI: 24-hour. PHI: 1-day. IRAC 03A. *RUP.*

Flea Beetles

Pesticide

Actara (thiamethoxam) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 1.5-3.0 oz. per acre. REI: 12-hour. PHI: 0-day PHI for broccoli, Brussels sprouts, cabbage, and cauliflower, 7-day PHI for leafy greens. IRAC 04A.

Asana XL (esfenvalerate) *Broccoli, Cabbage, Cauliflower, Collards, Mustard Greens* | 5.8-9.6 fl. oz. per acre. REI: 12-hour. PHI: 3-day for heading crops, 7-day for collards and mustard greens. IRAC 03A. *RUP.*

Baythroid XL (beta-cyfluthrin) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.4-3.2 fl. oz. per acre. REI: 12-hour. IRAC 03A. *RUP.*

Belay (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. 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. Use 10DF, 10WP, or 10WSB formulations on heading cole crops only at 5.3-16 oz. per acre. REI: 12-hour. PHI: 7-day. IRAC 03A. *RUP.*

Exirel (cyantraniliprole) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 13.5-20 fl. oz. per acre. REI: 12-hour. PHI: 1-day. IRAC 28.

Harvanta (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. 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. REI: 12-hour. PHI: 7-day. IRAC 03A. *RUP*.

Mustang Maxx (zeta-cypermethrin) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.24-4.0 fl. oz. per acre. 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. Use 3.2EC formulations at 4-8 fl. oz. per acre. 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. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre. REI: 12-hour. PHI: 30-day. IRAC 04A.

Sevin XLR Plus (carbaryl) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 0.5-1 qt. per acre. REI: 12-hour. PHI: 3-day for heading cole crops, 14-day for leafy cole crops. IRAC 01A.

Verimark (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, as a transplant drench within 72 hours of planting, or through drip chemigation. REI: 4-hour. IRAC 28.

Warrior II (lambda-cyhalothrin) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | 1.28-1.92 fl. oz. per acre. REI: 24-hour. PHI: 1-day. IRAC 03A. *RUP*.

Leafminers

Pesticide

Entrust SC (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. Use 80WP formulations at 1.25-3.0 oz. per acre. Adjuvants can improve leafminer control. REI: 4-hour. PHI: 1-day. IRAC 05. *OMRI-listed*.

Exirel (cyantraniliprole) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 13.5-20 fl. oz. per acre. REI: 12-hour. PHI: 1-day. IRAC 28.

Harvanta (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. REI: 4-hour. PHI: 1-day. IRAC 28.

M-Pede (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 (zeta-cypermethrin) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 3.2-4.0 fl. oz. per acre. 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. REI: 4-hour. PHI: 7-day. IRAC 05.

Rimon 0.83EC (novaluron) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | 6-12 fl. oz. per acre. REI: 12-hour. PHI: 7-day. IRAC 15.

Scorpion 35SL (dinotefuran) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | *Soil application:* Use Scorpion 35SL at 9.0-13.0 fl. oz. per acre, or Venom 70SG at 5.0-7.5 oz. per acre. *Foliar application:* Use Scorpion 35SL at 2.0-7.0 fl. oz. per acre, or Venom 70SG at 1.0-4.0 oz. per acre. REI: 12-hour. PHI: 21-day for soil applications, 1-day for foliar applications. IRAC 04A.

Trigard (cyromazine) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.66 oz. per acre. REI: 12-hour. PHI: 7-day. IRAC 17.

Seed and Root Maggots

Non-Pesticide

Broccoli, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Rotate as far as possible from the previous year's cole crops. Avoid using brassica cover crops between cole crop plantings. Brassica weeds, such as shepherd's purse, yellow rocket, and wild mustard can harbor later generations of cabbage maggot. Consequently, remove all weeds from planting areas. Destroy the finished crop by tilling and remove all plant debris from the area. Avoid planting into areas with high organic matter residues or wait to plant until residues have degraded. Delay planting until after the first generation of adult females have

emerged and laid eggs based on growing degree days. Row covers can be placed over crops to exclude adult females.

Pesticide

Capture LFR (bifenthrin) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 3.4-6.8 fl. oz. per acre. Can be used pre-plant broadcast, pre-plant incorporated, or banded at-plant. REI: 12-hour. PHI: 7-day. IRAC 03A. *RUP.*

Diazinon AG500 (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. 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. 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. 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 (spinosad) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | Use 2SC formulations at 5.0-10.0 fl. oz. per acre. 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. REI: 4-hour. PHI: 1-day. IRAC 05.

Verimark (cyantraniliprole) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | Apply 10-13.5 fl. oz. per acre to the soil at planting or as a transplant drench within 72 hours of planting. REI: 4-hour. IRAC 28.

Slugs and Snails

Slugs and snails may occasionally damage seedlings, low growing leafy vegetables, and/or ripening fruit. Slug and snail feeding causes hollowed out areas, which can be found on fruit, but the damage is usually on the stem. Slugs and snails produce a silvery trail on the surface of leaves and fruit. Slugs and snails are active at night and they inhabit moist soil and organic mulch. Slugs and snails overwinter as eggs in moist soil.

Bait products can be placed on the soil surface around the perimeter of the planting area. Bait products can also be placed on the soil surface in a band between rows. Apply bait

products in the evening after a rain or irrigation. Avoid contacting edible crops with bait products.

Non-Pesticide

Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Slug and snail hiding places, such as, boards, stones, weedy areas, and mulch should be eliminated. Raised beds will dry out faster than flat beds, which will reduce problems with slugs and snails. Black plastic mulch can be used to reduce problems with slugs and snails.

Pesticide

Deadline M-Ps (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. 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 0.5-1 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 (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 56 fl. oz. per acre when pest pressure is extreme or plant canopy is dense. REI: 12-hour. PHI: 0-day. IRAC UN, IRAC 03A. *OMRI-listed.*

Baythroid XL (beta-cyfluthrin) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 2.4-3.2 fl. oz. per acre. REI: 12-hour. PHI: 0-day. IRAC 03A. *RUP.*

Belay (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. 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. Use 10DF, 10WP, or 10WSB formulations on heading cole crops only at 5.3-16 oz. per acre. REI: 12-hour. PHI: 7-day. IRAC 03A. RUP.

Harvanta (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. 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. REI: 12-hour. PHI: 7-day. IRAC 01B.

Mustang Maxx (zeta-cypermethrin) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 3.2-4 fl. oz. per acre. REI: 12-hour. PHI: 7-day. IRAC 03A. RUP.

Rimon 0.83EC (novaluron) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | 12 fl. oz. per acre. REI: 12-hour. PHI: 7-day. IRAC 15.

Scorpion 35SL (dinotefuran) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | *Soil application:* Use Scorpion 35SL at 9.0-13.0 fl. oz. per acre, or Venom 70SG at 5.0-7.5 oz. per acre. *Foliar application:* Use Scorpion 35SL at 2.0-7.0 fl. oz. per acre, or Venom 70SG at 1.0-4.0 oz. per acre. REI: 12-hour. PHI: 21-day for soil applications, 1-day for foliar applications. IRAC 04A.

Sevin XLR Plus (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. REI: 12-hour. PHI: 3-day for heading cole crops, 14-day for leafy cole crops. IRAC 01A.

Warrior II (lambda-cyhalothrin) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kohlrabi* | 1.28-1.92 fl. oz. per acre. REI: 24-hour. PHI: 1-day. IRAC 03A. RUP.

Swede Midge

Swede midge feeds on broccoli, cauliflower, cabbage, and Brussels sprout. Some insecticides labeled for use against flea beetles and caterpillars may inadvertently manage swede midge populations.

Products include Admire Pro, Coragen, Exirel, Orthene, Verimark, and Warrior II.

Non-Pesticide

Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | Rotate as far as possible from the previous year's cole crops. Avoid using brassica cover crops between cole crop plantings. Brassica weeds, such as shepherd's purse, yellow rocket, and wild mustard can harbor populations of the Swede midge. Consequently, remove all weeds from planting areas. Destroy the finished crop by tilling and remove all plant debris from the area.

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. 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. REI: 12-hour. PHI: 3-day for leafy cole crops, 7-day for heading cole crops. IRAC 04A.

Movovento (spirotetramat) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens* | 4-5 fl. oz. per acre. REI: 24-hour. PHI: 1-day. IRAC 23.

Thrips

Pesticide

Actara (thiamethoxam) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 3.0-5.5 oz. per acre. REI: 12-hour. PHI: 0-day for broccoli, Brussels sprouts, cabbage, and cauliflower, 7-day for leafy greens. IRAC 04A.

Admire Pro (imidacloprid) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 4.4-10.5 fl. oz. per acre. Apply as a soil treatment. 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. 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.

REI: 12-hour. PHI: 3-day for leafy cole crops, 7-day for heading cole crops. IRAC 04A.

Baythroid XL (beta-cyfluthrin) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 0.8-1.6 fl. oz. per acre. 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. Use 10DF, 10WP, or 10WSB formulations on heading cole crops only at 5.3-16 oz. per acre. REI: 12-hour. PHI: 7-day. IRAC 03A. *RUP.*

Entrust SC (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. Use 80WP formulations at 1.25-3.0 oz. per acre. Adjuvants can improve leafminer control. REI: 4-hour. PHI: 1-day. IRAC 05. *OMRI-listed.*

Exirel (cyantraniliprole) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 13.5-20 fl. oz. per acre. REI: 12-hour. PHI: 1-day. IRAC 28.

Mustang Maxx (zeta-cypermethrin) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 3.2-4.0 fl. oz. per acre. 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. Use 3.2EC formulations at 2-4 fl. oz. per acre. 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. Use 75SG formulations as a soil treatment at 1.66-3.67 oz. per acre. 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. REI: 4-hour. PHI: 1-day. IRAC 05.

Sequoia (sulfoxaflor) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens* | 5.75 fl. oz. per acre. *Suppression only.* REI: 12-hour. PHI: 3-day. IRAC 04C.

Torac (tolfenpyrad) *Broccoli, Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Mustard Greens, Turnip Greens* | 21 fl. oz. per acre. 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 (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.

clopyralid products (clopyralid) POST  *Broccoli,*

Brussels sprouts, Cabbage, Cauliflower, Collards, Kale, Kohlrabi, Mustard Greens, Turnip Greens | 4-8 fl. oz. per acre. Apply Spur or Stinger (40.9% formulations only) 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.

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.

Devrinol DF-XT (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 (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 (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 (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 (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.

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.