

# COLE CROPS Varieties(Broccoli, Brussels Sprouts, Cabbage, Cauliflower)

For Asian Cole Crops see [Specialty Vegetables](#) section of this guide.

## Broccoli

**Fresh Market:**Greenbelt (trial), Emerald City (fall harvest), Patron, General (early), Denali, Diplomat, Ironman and Imperial.

**Process Market:**Greenbelt, Arcadia, Decathlon (trial), Emerald City (fall harvest), Patriot (fall harvest).

## Brussels Sprouts

### Fresh market:

- **Early**— Oliver, Brilliant, Confident.
- **Mid**—Vancouver, Brigitte, Cummulus.
- **Mid/late**—Lunet.

Process market: Brigitte (mechanical harvesting), Vancouver (mechanical harvesting), Lunet, Cummulus.

## Cabbage

**Green:** Early—Parel, Balbro, Surprise, Farao, BC63. Mid-season— Castello, Charmant, Bronco, Fast Vantage. Late (storage)— Bartolo, Loughton, Shelton.

**Red:**Ruby Perfection, Sombrero, Rona, Primero, Lectro.

**Savoy:** Clarissa, Wirosa, Famosa, Ermosa, Melissa.

## Cauliflower

### Fresh market:

- **Early**— Ravella, Venus.
- **Mid-season**— Ravella, Fremont, Cumberland, Phoenix, Concert.
- **Late**— Ravella, Shasta, Fremont, Absolute, Artica

**Process market:** Shasta, Artica.

**Overwintering:** See end of Cole Crops section.

## Seed and Seed-bed Treatments

Use seed treated with **Thiram** seed protectant. Hot-water seed treatment is a safeguard against seed-borne diseases such as black rot, blackleg and *Alternaria* leaf spot.

When seedlings are to be grown in a seed-bed for production of transplants, choose a site where cole crops have not been grown before or fumigate prior to seeding with:

**Vapam** at 550 to 900 L/ha (220 to 360 L/acre).

To help prevent damping-off, wire stem and downy mildew, the young seedlings should also be drenched, using 1,000 to 2,000 L/ha (400 to 800 L/acre) of water every 5 to 7 days with one of the following:

**Bravo 500** at 2.5 to 4.8 L/ha (1 to 1.9 L/acre).

For more information on seed-bed treatments see [Disease Control](#) section of this chapter.

# Seeding

Seed in a greenhouse for an early crop, in a cold frame for a less early crop, and in outdoor seed-beds or directly in the field when the weather is warm enough for germination and growth (above 10°C). In each case, seed 4 to 6 weeks ahead of when the plants are wanted for transplanting.

## Greenhouse

Seed directly into styrofoam or plastic plug trays or blocks of a growing medium. The smaller the cell the lower the cost per plant, but the more demanding the management requirements.

Temperatures should be maintained above 7°C at night and below 30°C during the day. Seven days before transplanting start the hardening off process. (See below, under “Transplanting.”)

Follow the same process in a cold frame, or seed directly into the soil after it has been limed, fertilized and fumigated as for outdoor seed-beds.

## Seed-beds

Locate seed-beds in an open, well-drained area free of clubroot. Soil test prior to planting. Fertilize according to soil test recommendations. Fumigate prior to seeding if the area has been planted to cole crops in the past (see [Planting](#) section of this guide).

**Caution:** For spring fumigation and planting, fertilize with nitrate sources of nitrogen (calcium nitrate) rather than ammonia based fertilizers (ammonium nitrate, urea).

100M (100,000) seeds will provide enough seedlings to plant about 2 ha (5 acres) at a field spacing of 45 X 95 cm. Traditionally, a push-drill with a scatter shoe is used to drop 20 seeds every 25 cm in rows spaced 25 – 30 cm apart. Alternatively, use a precision seeder with a 3-line shoe to deliver a similar plant population. This will provide better seed placement and more uniform, stronger transplants.

## Fields

For direct-seeding, soil should be of fine tilth, free of trash, firm and level. If a Stanhay seeder is used, seed must be size graded. Seed requirement is about 0.6 to 1.2 kg/ha (0.25 to 0.5 kg/acre) depending on spacing. Depth of seeding should be 12 mm under most conditions (see “Precision Seeding of Vegetables” in [Planting](#) section of this guide.).

Direct-seeded plants mature about 2 weeks earlier than plants sown at the same time in seed-beds.

# Transplanting

Transplant 30 to 50 days after seeding (depending on growing temperature) when plants are 15 cm high, have 6 to 8 true leaves and have been hardened off.

Seedlings from a greenhouse or cold frame require hardening off more than those from outdoor seed-beds. Five to seven days prior to transplanting, reduce the number of waterings but water thoroughly each time. Provide more ventilation, and where practical move seedlings onto a trailer which can be left out during the day and pulled under cover for the night. The seedlings should not be allowed to wilt.

For outdoor seed-bed plants, thoroughly water the plants prior to pulling or loosen by undercutting so they will come out easily when pulled with minimal root breakage. Discard seedlings that are weak or have blackened stems (wirestem).

Set plants slightly deeper in the field especially if the plants are large. Irrigate before and after planting if weather is hot and soil is dry. Add a starter solution if the weather is cold.

## Spacing

Factors such as variety, equipment, market (fresh vs. processing) and time of planting will determine the spacing used. The following spacings are common:

	<b>Between Rows</b>	<b>Within Row</b>
Brussel sprouts, cauliflower	90 - 100 cm	35 - 45 cm
Cabbage, broccoli	75 - 90 cm	25 - 40 cm

On mineral soils, cabbage and broccoli are often grown in a 3-row bed on 1.8 m centres with plants 30 to 40 cm apart in the row. On Cloverdale mucks, early cabbage is grown on 4-row raised beds on 1.7 to 1.8 m centres with 40 cm between plants in the row.

Broccoli is also often grown in a high density double-row arrangement for production of small centre heads for the fresh market. Double-rows are spaced 30 cm apart with pairs of rows on 60 – 70 cm centres, plants 25 – 30 cm within the row.

## Fertilizer

A soil test is necessary to determine phosphate and potash requirements. See [Nutrient Management](#) section for recommendations based on soil test results.

If a mineral soil pH is below 6.2 or an organic soil is below 5.5, lime should be applied. (See also “Clubroot” in this section).

Broadcast and disc in, or band at time of seeding or transplanting, 75 kg/ha (30 kg/acre) nitrogen, all of the phosphate and potash.

On sandy soils, or where magnesium is deficient, add: **Sul-Po-Mag** at 170 to 225 kg/ha (68 to 90 kg/acre)

In addition, for both direct-seeded and transplanted crops, side-dress 45 to 110 kg/ha (18 to 44 kg/acre) of nitrogen at time of last cultivation. Use the higher rate for broccoli and cauliflower and the lower rate for Brussels sprouts and cabbage. At the higher rates, particularly on light, sandy soils, two applications should be made 2 to 3 weeks apart.

These crops are heavy users of boron. Soil should be tested for boron and if necessary it should be added to the main fertilizer mix. See “Boron” in [Nutrient Management](#) section of this guide.

## Integrated Pest Management (IPM)

Cole crops are susceptible to severe losses from many pests. IPM practices can assist growers in harvesting crops free of pest contamination and damage while minimizing the number and cost of pesticide applications. Commercial monitoring services are available in the Fraser Valley.

Refer to [Pest Management](#) section of this guide for information on general IPM principles. In addition, for cole crops, practice the following as part of the IPM program:

1. Ensure crops are healthy through good soil and crop management. This will result in less weed, insect and disease pressure.
2. Rotate crops to reduce the buildup of diseases, herbicide-resistant weeds and insect pests.
3. Control weeds (particularly those in the mustard family) that can act as hosts of insects and diseases in and around the field.
4. After a field is harvested it should be disced under and seeded to a cover crop to limit pest and weed reservoirs.
5. Fields should be thoroughly scouted at least once per week to check for pests.
6. At the seedling or transplant stage, preventive sprays must be applied for root maggots. Once the crop is established it can tolerate some feeding damage from caterpillars or aphids. Sprays may not be necessary during this period unless insect pressure is severe. Products such as Dipel will reduce caterpillar levels without killing beneficial insects.

When the marketable portion of the crop begins to form (heads/sprouts), scouting must be very thorough, and if pests are detected, sprays must be applied without delay to prevent damage and/or contamination of marketable portions.

For further information on IPM in cole crops contact the BCAGRI or a commercial monitoring service.

## Weed Control

Cole crop weed control is very difficult because of the limited selection of registered herbicides and the many aggressive weeds (mustards, shepherd's purse, galinsoga, nightshade). Growers must practice overall farm weed control (see "Weed Management" in the [Pest Management](#) section of this guide). Transplanted crops are easier than direct-seeded crops to keep weed-free because they are quicker to establish. In addition to the herbicides listed in [Table 1 \(Cole Crops \(Broccoli, Brussels Sprouts, Cabbage, Cauliflower\) Weed Control\)](#), effective, timely cultivation is critical in preventing weed losses.

# Insect Control

## Swede Midge

This pest is not currently known to occur in British Columbia. It is, however, present in eastern cole crop growing regions of N. America. Symptoms include galling on seedlings and transplants, swollen or twisted stalks and stems, crinkled leaves, scarring, blind heads and multi-headed plants. Damage can create entry points for disease. Symptoms can be confused with nutrient deficiency, herbicide damage, seed variability, bolting caused by heat stress or buttoning caused by frost damage. Broccoli, gai lan and brussels sprouts sustain the worst damage, but Swede midge can infest any brassicae plants including rutabagas, canola, ornamentals and weeds. Check suspect damage for presence of maggots within the plant tissue. Surveillance of BC cole crops is currently underway. Please report any suspect damage to your local BCAGRI office. Swede midge can be prevented from entering BC by:

- ensuring transplants are pest-free; and
- employing good field sanitation practices.

## Root Maggots

The adult is a gray fly, half the size of a housefly, which lays white eggs at the base of plants. Legless white maggots hatch and tunnel roots causing rotting of the roots and wilting of the plant. This pest is especially destructive in seed-beds and to young plants after setting in field.

## Broccoli Greenhouse Transplant Drench

Apply **Entrust SC** (Registration # 30382) using the rate of 25 mL in 2 L of water per 1000 plants as a drench before transplanting. Immediately after applying, apply 2 L of water per 1000 plants to rinse the product off the plants and into the soil. Do not rinse the product out of the transplant medium. Make one application per year. Do not re-enter treated area for 24 hours after applying.

Or:

Apply **Success** (Registration # 26835) using the rate of 12.5 mL in 2 L of water per 1000 plants as a drench before transplanting. Immediately after applying, apply 2 L of water per 1000 plants to rinse the product off the plants and into the soil. Do not rinse the product out of the transplant medium. Make one application per year. Do not re-enter treated area for 24 hours after applying.

## Control

**Note: Root maggot resistance to chlorpyrifos (Lorsban /Pyrinex) has been reported in the Lower Mainland and Vancouver Island. Use these products with caution. Check to see if emergency use products are registered.**

## Seed-bed

If no granular chlorpyrifos treatment was used, apply **Lorsban 4E**, **Lorsban NT** or **Pyrinex 480 EC** at 210 mL per 1000 m of row. Apply in one drench spray in 1000 L/ha (400 L/acre) spray solution, 10 cm on each side of the plant, 7 to 10 days after seeding.

## Field

Growers have the option of applying a granular insecticide or a post-planting liquid drench. Use of granules is the normal practice for direct-seeded crops while for transplants the drench is preferred.

### Granules:

Using a granular applicator, apply the insecticide in a band in front of the seed coulter so that the seeding operation incorporates the chemical. Application directly in the furrow puts a high concentration of chemical in direct contact with the seed and may reduce the stand or stunt seedlings.

Lorsban 15 G at 0.6 to 1.0 kg/1000 m of row. The following lists rates of Lorsban 15G at various row spacings:

Row Spacing	Lorsban 15 G
60 cm (24 in.)	10.0 to 16.7 kg/ha (4.0 to 6.7 kg/acre)
75 cm (30 in.)	8.0 to 13.3 kg/ha (3.2 to 5.3 kg/acre)
90 cm (36 in.)	6.7 to 11.1 kg/ha (2.7 to 4.5 kg/acre)
105 cm (42 in.)	5.7 to 9.5 kg/ha (2.3 to 3.8 kg/acre)

To protect wildlife, every effort should be made to completely incorporate granules. Granule deposits from spills and accumulation at row ends should be covered with soil.

## Postplanting Drench:

“Drench” means to spray the insecticide in at least 1000 L/ha (400 L/acre) water, 10 cm on each side of the plants in the row. Drench within 3 days of transplanting (after plant recovery) or 7 to 10 days after seeding (if granular treatment was not applied) with:

**Lorsban 4E**, **Lorsban NT** or **Pyrinex 480 EC** at 1.68 L in 1000 L of finished spray. Apply 12.5 L of this solution to 100 m of row on the soil.

**Note:** The second application should not be made to transplanted broccoli as the crop may mature before the required days to harvest waiting period. A repeat drench may be applied 21 days after the transplant drench or 28 days after seeding if a granular treatment was not applied. However, where establishment and early growth are good, a repeat drench should not be necessary.

**Lorsban 4E**, **Lorsban NT** or **Pyrinex 480EC** must not be applied within 32 days of harvest. If no granular chlorpyrifos application was made, do not apply more 2 times per season on **broccoli**, **cabbage** or

**cauliflower.** If no granular chlorpyrifos application was made, do not apply more than three times per season on **Brussels sprouts**.

If a granular chlorpyrifos treatment was made, do not make a follow-up application of **Lorsban 4E, Lorsban NT or Pyrinex 480EC** more than 1 time per season on **broccoli, cabbage or cauliflower**; and do not follow up with more than 2 applications per season on **Brussels sprouts**.

Do not re-enter treated area for 24 hours. For cauliflower, do not re-enter treated area for 10 days.

## Cabbage Aphids

These small, soft, gray, winged or wingless sucking insects are found clustered on the new leaves and growing point. If present in high numbers they will cause yellowing, distortion and stunting of the crop. They are a serious contaminant and if not controlled will cause the crop to be unmarketable.

### Control

See [Table 2, Cole Crops Insect Control](#).

## Loopers, Climbing Cutworms, and other Caterpillars

The most common and damaging species are the imported cabbageworm, diamondback moth, cabbage and alfalfa looper. These pests chew holes in leaves and contaminate heads. Even if damage is light, low levels of caterpillars or loopers in the harvested crop can result in rejection by buyers.

### Control

Aphids and caterpillars should be controlled within an overall management and spray program. See IPM section for information on cultural controls and monitoring.

Adequate spray coverage (high pressure and volume) is necessary to obtain good control. Cole crop leaves are very waxy so use a spreader recommended on the pesticide label to improve coverage. Use drop pendant nozzles (see [Spray Equipment](#) section of this guide) for effective control on Brussels sprouts when plants are over 50 cm high.

To deter insects from developing resistance, do not rely on a single insecticide but alternate between the chemical groups listed in [Table 2 \(Cole Crops Insect Control\)](#). Note that some materials will control only aphids, some only caterpillars and some will control both. Choose products according to which pests are present in the field. Tank-mixes may be necessary. Follow product label guidelines or local experience.

When planning a spray program, pay particular attention to the days to harvest restrictions. Products such as **Lorsban** must only be used well in advance of harvest. If pests need to be controlled close to harvest, products such as **Decis or Dibrom** should be used.

**Note:** Days to harvest restrictions are the waiting period necessary between application and harvest to ensure that pesticide residues on the marketed produce are below legal tolerance. These numbers are not equivalent to the length of time a product will provide pest control.

## Flea Beetles

These small, active, black or bronze, jumping beetles eat holes in leaves causing shot-holes. They are especially damaging to young plants.

### Control

Sprays applied for root maggot, aphid and looper control will usually keep flea beetles in check.

## Lygus Bugs

See [Pest Management](#) section of this guide.

## Red Turnip Beetles

These red and black beetles are a pest in the Interior and Peace River areas. The dark-brown immature larvae eat foliage.

### Control

This pest will be controlled if a regular root maggot control program is followed.

## Slugs

Slow-moving, soft-bodied, slimy creatures found in various sizes up to 10 cm. They can be a serious problem on Brussels sprouts as the heavy canopy provides them with a cool, moist environment. They feed directly on the forming sprouts causing them to be unmarketable. Damage most often occurs on the field edges. They are most severe in fields which were previously in grass, clover or weeds.

### Control

Growers should monitor fields by applying bait stations early in the season prior to plowing. If high numbers of slugs are found, treatments should be applied before plowing or when plants are small and first damage occurs. If slugs are not controlled before early August, they will escape treatment with bait or sprays and serious crop damage will occur.

Apply metaldehyde (**Deadline**) or apply ferric phosphate (**Sluggo, Ferramol or Slug & Snail Bait**) to soil surface at label rates. Treatments should be made in the evening to the soil between the rows and the headlands. Avoid direct application to plants.

**Lannate TOSS-N-GO** is registered to control slugs on Brussels sprouts. Apply at 775g/ha (310g/acre) Apply when plants are small and slugs are first detected. Spray must directly contact slugs so application should be made at night when slugs are up on plants. Apply only once per season at this rate. Do not apply within 30 days of harvest. Do not enter the treated area for 12 hours. (**Lannate** is registered at a lower rate for use on loopers and caterpillars. At the lower rate, days to harvest restriction is 7 with a maximum of 3 applications per season).

## Thrips

Thrips are very small (1 mm), slender, yellowish to brown insects which may be either winged or wingless. They rasp and puncture plant tissue and may cause scattered blister-like growths on leaves and heads of cabbage. Thrips often move into cabbage fields after hay is cut. They are worse in hot, dry summers.

## Control

Good weed control will minimize thrips populations. Cabbage varieties vary in their tolerance to thrips. Over-mature cabbage is prone to thrips damage - harvesting at the proper maturity will help reduce injury.

Apply **Mako (formerly Ripcord 400 EC)** or **Up-Cyde 2.5 EC** at label rates for control of thrips. Do not apply within 3 days of harvest. Do not use on muck soils. Maximum of 3 applications per season.

Begin spraying when cabbage leaves cup prior to heading or when thrips appear. Synthetic pyrethroid insecticides ([See Table 2 Cole Crops Insect Control](#)) applied for caterpillar control will also control thrips.

# Disease Control

## Alternaria Leaf Spot

Small to large black spots appear on leaves. They may lead to discoloration and decay of cauliflower and cabbage heads and spotting on Brussels sprouts under very wet conditions.

### Control

1. Incorporate diseased crop refuse promptly at end of season or rotate fields to avoid carryover.
2. A single application of **Rovral WP** (see [Table 3, Cole Crops \(Broccoli, Brussels Sprouts, Cabbage, Cauliflower\) Disease Control](#)) is registered for storage cabbage. **Bravo** is recommended for Brussels sprouts and for late cabbage being grown for winter storage. Do not apply either **Bravo** or **Rovral** on cabbage within 7 days of harvest.
3. Hot-water seed treatment is recommended to reduce seed-borne disease.

## Bacterial Leaf Spot

(Pseudomonas)

Tiny, brown to purplish spots appear on the outer leaves of Brussels sprouts, broccoli and cauliflower. Yellow halos appear around the spots and they eventually grow together to form light brown papery areas.

### Control

1. Use hot-water-treated seed.
2. Avoid sprinkler irrigation.
3. Shred and turn under diseased crop refuse promptly after harvest.
4. Do not replant cole crops in the same field the following year.
5. **Tri-basic copper sulphate** used for control of downy mildew will also give some control of bacterial leaf-spot.

## Bacterial Soft Rot

(Erwinia, Pseudomonas)

This bacterium causes small, water-soaked areas on broccoli florets and on cabbage in storage. As these areas rapidly increase in size, the tissue becomes soft and mushy with an offensive odour. Boron and calcium deficiencies and frost damage may be contributing factors.

## Control

1. Keep injuries to plant parts to a minimum.
2. Over-fertilization with nitrogen may result in heavy growth and more rot.
3. Overhead irrigation may encourage infection.
4. Broccoli varieties such as Arcadia which form tall, dome shaped heads are usually less susceptible.
5. Avoid using wetting agents on broccoli late in the season as the water-repellent bloom may be damaged.
6. Application of copper through the heading period as for downy mildew may provide some control.
7. For cabbage, clean and disinfect storage walls and floors (see the [Planting](#) section of this guide). Keep storage house dry and the temperature below 4°C.
8. Eliminate crop residues and cull piles by discing deep or burning.

## Boron Deficiency

Boron deficiency causes browning of stem pith, excess leaf-curling and, sometimes, a failure to head. Cauliflower shows brown curd and broccoli shows corky scars on stalks.

## Control

Soil should be tested for boron and if necessary it should be added to the main fertilizer mix.

If symptoms of boron deficiency appear in the planted crop, spray the foliage with Solubor at 500 to 1,000 g/ha (200 to 400 g/acre) in at least 1,000 L/ha (400 L/acre) of water. One or two foliar applications of boron are good insurance in case the soil boron is not available to the crop.

**Note:** In the Interior, fields to which boron has been applied should not normally be planted to beans or cucumbers the following year, as both these crops are extremely sensitive to boron. See also “Boron”, [Nutrient Management](#) section of this guide.

## Clubroot

Clubroot is a soil-borne fungus which causes large, irregular swellings on roots and yellow and stunted plants. The fungus can survive in soil for years following an infected crop and may be spread by infected seedlings, contaminated manure, drainage water, farm implements, wind-borne soil and on the feet of animals and people.

## Control

1. Plant in soil known to be free of clubroot.

2. For transplant production, ensure that the seed-bed is free of clubroot or thoroughly fumigated before seeding. The seed-bed may be treated with **Basamid** or **Vapam** prior to seeding, but clubroot infested land should still be avoided as the fumigants may not be 100% effective. See [Planting](#) section of this guide for method of application. Lime (as discussed in point 5) should not be used in the seed-bed for clubroot control as it will only mask symptoms and result in clubroot spread to the field.
3. In the field, plant in well-drained soils.
4. Where clubroot is known to occur, rotate with crops other than cole crops at least three out of every four years.
5. At least 6 weeks prior to planting in light, sandy soils, thoroughly disc in enough lime to increase the soil pH to 7.0. An application of at least 11 tonnes/ha (4.5 tonnes/acre) of ground limestone is required to raise the pH of an “Abbotsford Airport” soil type from pH 6.0 to 7.0. Hydrated lime may be used but high rates may “burn out” the organic matter in the soil. Finely ground limestone is preferred. Lime is not as effective on muck soils or soils with a high clay content. A high pH may also cause scab problems in following crops such as beets and potatoes.
6. On organic (muck) soils, a side-dressing of calcium nitrate at 90 kg N/ha, 3 weeks after transplanting has reduced clubroot significantly in preliminary research trials.

**Note:** Application of additional boron and other minor elements (Zn, Mn) may be necessary on heavily limed soils. Soil applied boron may damage following crops of beans and cucumbers particularly in dry interior regions.

## Downy Mildew

(Hyaloperonospora)

Shows as a white, fuzzy fungus in patches on leaves, stems, and heads. It may cause browning and black streaking in stems, and black spotting on heads of broccoli and cauliflower. Moderate temperatures of 15°C and high humidity or wet conditions favour this disease.

## Control

1. Avoid thick or heavy seedings, excessive nitrogen fertilizer and over-watering.
2. Use tolerant varieties such as Emerald City broccoli when available.
3. In the seed-bed, spray seedlings at germination and repeat twice weekly until transplanted, with one of the products in [Table 3, Cole Crop \(Broccoli, Brussels Sprouts, Cabbage, Cauliflower\) Disease Control](#).
4. In the field, when wet weather conditions favor disease development, apply one of the products in [Table 3](#).
5. Plow in crop remains as soon as harvest is complete. Obtain good soil coverage of plowed refuse to ensure early breakdown of crop remains.

## White Mould

(Sclerotinia)

This fungus disease can cause losses to Brussels sprouts, particularly when wet conditions occur in August. First symptoms are a water-soaking of the leaf tips followed by the appearance of a white, cottony mould. The fungus grows down the leaf petioles and attacks the sprouts causing rot. In severe situations the stalk may be affected causing the plant to collapse.

### Control

1. Rotate with corn, cereals, forages, onions or potatoes. Avoid fields with a history of the disease.
2. Varieties differ in susceptibility. Lunet and Vancouver have some tolerance.

## Wirestem

Seedling stems are discoloured and constricted, finally becoming hard and brittle. Plants are stunted and may fall over and die.

### Control

1. Measures used to avoid downy mildew in the seed-bed will help to prevent wirestem.
2. When transplanting from a seed-bed, discard all seedlings exhibiting a dark, constricted area near the base of the stem.

## Root Rot

**RootShield WP** (*Trichoderma harzianum* Rifai strain KRL-AG2) is a biological fungicide for the suppression of Root Rot in greenhouse vegetable transplants. When applied to transplants, greenhouse planting mix or soil, the product grows into plant roots as they develop to protect roots against *Pythium*, *Rhizoctonia* and *Fusarium*.

### Suppression

1. Suspend **RootShield WP** using a spray volume of 30 to 45 g/100 L and apply at the rate of 55 to 110 g per cubic metre (loose) of greenhouse potting mix, soil or planting beds.
2. Apply using hand-held backpack or ground spray equipment.
3. Becomes active when soil temperatures are above 10 degrees C and is not effective while soils remain cold.
4. More effective at suppression of root rot in neutral or acidic soils.

5. Should be used within 12 months of the date of manufacture.
6. Contains the allergens wheat and sulfites.



**RootShield WP** is used in organics. It is OMRI-USA listed. OMRI-USA = Organic Materials Review Institute of USA. Check with your certification body before using in an organic operation.

## Other Problems

### Internal Browning of Brussels Sprouts (Centre Rot)

Internal sprout leaves discolour and rot. The problem is most severe on large and/or overmature sprouts at the bottom of the stalk. The cause is believed to be a lack of calcium in the developing sprouts brought on by stressful environmental conditions. Crops on sandy soils are more susceptible than those on loams or clay loams.

#### Control

1. Lime to maintain soil pH over 6.0.
2. Do not promote excessive growth by over fertilization with nitrogen.
3. Avoid moisture stress while sprouts are sizing.
4. Harvest before sprouts are over mature and/or oversize.

### Premature Head Formation

*(Buttoning of Cauliflower, Bolting of Broccoli)*

Small heads are formed before plants have enough leaf area to support the development of marketable size heads. Premature head formation usually occurs when transplants are exposed to stress after being set in the field. Early varieties are most susceptible.

#### Control

Do everything possible to ensure rapid crop establishment and growth after transplanting.

1. Do not use old, oversize or overly hardened transplants.
2. Ensure soil fertility is adequate at planting time. Use a high phosphorus starter solution in cold, wet weather.
3. Transplants set before May 1 are most prone to buttoning or bolting. Plant the early crop in well-drained fields. Block or plug transplants are recommended for the early crop as they establish faster.
4. In hot, dry weather irrigate both before and after transplanting.

### Cabbage Splitting

Mature heads may split if rain or a heavy irrigation follows a prolonged dry spell. Splitting results when the outer frame of the head has difficulty in accommodating the rapid internal growth due to the increased moisture. Early varieties split if not harvested on time.

## Control

Splitting may be reduced by “checking” the plant growth through deep cultivation between the rows to break some of the roots. Adequate soil moisture at all stages of the plant’s development will also help reduce splitting by maintaining steady growth.

## Oedema

Under certain conditions, usually in the fall, cabbage left standing in the field following wet weather or over-irrigation will develop clusters of white to brown, puffy eruptions on the outer surface of leaves near the outside of the head. This is due to water being trapped between the leaves for a prolonged period of time. When severe, several outer leaves may have to be stripped off before the head is marketable. Feeding by thrips may aggravate the condition.

## Control

Harvesting prior to the onset of fall rains and cool night temperatures which favour condensation of water vapour between the leaves will usually prevent this disorder. There are also differences in varietal susceptibility. Control of thrips may lessen but will not prevent oedema.

# Harvesting

## Broccoli:

Cut the centre heads (crowns) with 12 - 15 cm of stem attached while the buds are still green and tight. Under favourable conditions, side shoots are then harvested with 15 - 20 cm stalks for bunching over a period of several weeks. However, the side shoots never produce as heavily as the crowns and the market for them is limited. For a continuous supply of crowns for the fresh market, seed and/or transplant every 2 to 3 weeks from early spring until mid-July.

## Cauliflower:

Maintaining the white colour of the cauliflower curd (known as blanching) is critical to harvesting a premium product. Some cultivars with large wrapper leaves are self-blanching under favourable growing conditions. However, there are times when the curds must be protected against the sun for the final 5 to 10 days prior to harvest. This can be done by breaking leaves over the curd or tying leaves together with elastic bands. Different coloured elastics can be used to indicate which heads are ready to harvest next.

## Brussels sprouts:

Begin harvesting early sprouts for the fresh market as soon as the lower ones are mature. This will allow the upper sprouts to continue enlarging for later harvest. For once-over harvest of the late crop, pinch out the growing point when bottom sprouts are about 2 cm in diameter to encourage uniform size and maturity of the sprouts. De-leaf the plants just prior to harvest.

# OVER-WINTERED CAULIFLOWER (COASTAL AREAS ONLY)

## Varieties

Only winter-hardy varieties should be grown for harvesting in March to May. The crop should survive the winter an average of four out of five years. Contact seed company reps for up-to-date varieties. The earliest varieties tend to produce small, marginal quality heads. Generally, yield and quality improve with later varieties.

## Soils

Over-wintered cauliflower must be grown on well-drained soils and must not be subjected to high water tables or flooding at any time.

## Protection

At Abbotsford, over-wintered cauliflower has tolerated temperatures as low as  $-19^{\circ}\text{C}$  if covered with snow. Crops in the Fraser Valley have survived temperatures of  $-14^{\circ}\text{C}$  without snow cover. The crop should be grown in a sheltered location as strong, cold, dry winds can do more damage than low temperatures alone. Windbreaks are commonly used in Europe. Ridging is highly recommended as it protects against wind whipping and promotes good drainage around the plants.

## Seeding and Transplanting

Over-wintered cauliflower is highly sensitive to date of seeding. If seeded too soon, plants may become too large in the fall and be too tender to survive the winter. If seeded too late, plants may be too small going into winter and may produce only small, unmarketable heads in spring. The optimum date for direct-seeding is mid-July. Soil blocks or containerized transplants should be seeded in mid-July for transplanting in mid-August. Outdoor seedbeds should be started the first week of July for transplanting in early August. Use of transplants often results in better stand establishment as field conditions in mid-July may not be ideal for direct-seeding.

## Fertilizers

At planting time, fertilize as for summer cauliflower. Following a crop which was heavily fertilized, little or no initial fertilizer may be necessary.

Avoid too much nitrogen in the fall, but a heavy side-dressing with nitrogen is recommended when plants begin to leaf out in February. Nitrogen up to 300 kg/ha (120 kg/acre) may be applied in a split application on a 14 day interval.

## Weed, Insect and Disease Control

Follow recommendations outlined earlier in this section. In most cases, insects are not a problem in the spring.

# Table 1 Cole Crops Weed Control

Table 1 Cole Crops (Broccoli, Brussels sprouts, cabbage, cauliflower) Weed Control

Product	Rate	PHI*	Comments
<b>Pre-plant Incorporation</b>			
<b>Bonanza 480</b>  (trifluralin)  Group 3	1.25 to 2.3 L/ha (500 to 900mL/acre)  <i>Apply in a minimum of            100 L/ha (40 L/acre) of            water at 275 kPa</i>	N/A	<ul style="list-style-type: none"> <li>● <b>REGISTERED ON DIRECT-SEEDED CABBAGE OR CAULIFLOWER, OR TRANSPLANTS OF CABBAGE, CAULIFLOWER, BROCCOLI AND BRUSSELS SPROUTS.</b></li> <li>● Rates vary with soil types see label for details.</li> <li>● Some stunting or reduced stands may occur to direct-seeded crops.</li> <li>● Apply treatment from 3 weeks before planting and incorporate thoroughly within 24 hours to 8 to 10 cm deep.</li> <li>● Controls seedling grasses and some broadleaved weeds.</li> <li>● Lady's-thumb, nightshades, groundsel, hairy galinsoga, cudweed, shepherd's-purse and mustards are not controlled.</li> <li>● Use the lowest rate on sandy soil, the higher rate on heavier soils.</li> <li>● Effectiveness is reduced on cold, wet soils or on mineral soils with less than 2% or greater than 15% organic matter.</li> <li>● Applications at high rates late in the season may carry-over and damage following crops of corn, grass or grain.</li> <li>● If manure is spread prior to application ensure it has been thoroughly mixed into soil with at least 2 tillage operations prior to application.</li> </ul>

			<ul style="list-style-type: none"> <li>Do not enter treated area for 12 hours.</li> </ul>
<p><b>Devrinol 50-DF</b> (napropamide) Group 15</p>	<p>2.25 to 4.5 kg/ha (0.9 to 1.8 kg/acre)</p>	60	<ul style="list-style-type: none"> <li>Apply in 200 to 900 L/ha (80 to 365 L/acre) of water.</li> <li>Apply once per year.</li> <li>Apply before planting and incorporate as for trifluralin above.</li> <li>Will control many seedling broadleaf and grassy weeds, but not shepherd's-purse or lady's-thumb.</li> <li>Use the lower rate on light soils (sands and sandy-loams).</li> <li>Do not apply to soils with over 10% organic matter.</li> <li>Use at the high label rates may result in temporary crop stunting, but crops will outgrow injury and yield is unaffected.</li> <li>Observe a 12 month plant back interval for crops not found on the label.</li> <li>Do not enter treated area for 12 hours.</li> </ul>
<p><b>Devrinol 2-XT</b> (napropamide) Group 15</p>	<p>4.69 to 9.38 L/ha (1.90 to 3.80 L/acre)</p>		
<p><b>Goal 2XL</b> (oxyfluorfen) Group 14</p>	<p>Coarse-textured soil (&lt;1% O.M.): 1.13 L/ha (460 mL/acre) Medium to fine textured soils (&gt;1% O.M.): 2.0 L/ha (810 mL/acre)  <i>Apply in 200 L/ha (80 L/acre) of water</i></p>	60	<ul style="list-style-type: none"> <li><b>REGISTERED ON TRANSPLANTED CABBAGE, CAULIFLOWER AND BROCCOLI.</b></li> <li><b>NOT REGISTERED ON BRUSSELS SPROUTS.</b></li> <li>Do not apply to direct-seeded crops.</li> <li>Pre-emergence control of redroot pigweed and common purslane.</li> <li>Pre-emergence <b>suppression only</b> of lady's thumb and Eastern nightshade.</li> <li>Do not apply more than once per year.</li> <li>Do not apply to sandy soil.</li> </ul>

			<ul style="list-style-type: none"> <li>● Use on muck soils may result in partial control or suppression of listed weeds.</li> <li>● Apply after completion of soil preparation but prior to transplanting.</li> <li>● Transplanting should be completed with minimal soil disturbance.</li> <li>● Leave treated surfaces undisturbed after transplanting during the time period for which weed control is desired.</li> <li>● Timely cultivation after weed emergence will assist in weed control.</li> <li>● Can cause temporary leaf cupping or crinkling. Severity of crop response can be enhanced if crop leaves come in direct contact with treated soil. Avoid using young, extremely succulent transplants in containers less than 2.5 cm<sup>2</sup> in size. Check label for more detail.</li> <li>● Do not apply if an acetanide herbicide such as <b>Dual II Magnum</b> has been applied during the current growing season.</li> <li>● Do not apply post-transplant or post-emergence (over the top) of crop.</li> <li>● Do not enter treated area for 12 hours.</li> </ul>
<b>Early Pre-Plant (Spring Application)</b>			
<p><b>Authority 480</b> (sulfentrazone) Group 14</p>	<p>0.292 L/ha (0.118 L/acre) <i>Apply in 100 L/ha (40 L/acre) of water at 175 kPa</i></p>	<p>N/A</p>	<ul style="list-style-type: none"> <li>● Apply as a broadcast or banded treatment to the harvested crop stubble in the spring up to 72 hours prior to transplanting.</li> <li>● When applied as a banded treatment, see label to calculate rate and volume, and apply only once per year.</li> <li>● <b>Authority 480</b> requires adequate rainfall or irrigation to activate.</li> <li>● <u>Do not</u> mechanically incorporate after application.</li> </ul>

			<ul style="list-style-type: none"> <li>● Do not use on coarse-textured soils classified as sand that have less than 1% organic matter.</li> <li>● Do not use on fine-textured soils with less than 1.5% organic matter.</li> <li>● Do not apply on soils with an organic matter content greater than 6%.</li> <li>● Do not use on soils with a pH of 7.8 or greater.</li> <li>● Do not apply</li> <li>● Do not enter treated area for 12 hours.</li> <li>● Observe a plantback interval of 24 months for sweet corn and 16 months for winter wheat.</li> <li>● Controls <b>redroot pigweed, lamb's quarters, Eastern black nightshade and common groundsel.</b></li> </ul>
<b>Pre-emergence</b>			
<b>Devrinol 50-DF</b>  (napropamide)  Group 15	2.25 to 4.5 kg/ha (0.9 to 1.8 kg/acre)	60	<ul style="list-style-type: none"> <li>● Apply in 200 to 900 L/ha (80 to 365 L/acre) of water</li> <li>● Apply only once per year.</li> <li>● Apply to a clean, moist field after seeding or transplanting, but before weed emergence.</li> <li>● On dry soils, light rain or irrigation within 2 days is essential.</li> <li>● Will control many seedling broadleaf and grassy weeds, but not shepherd's-purse or lady's-thumb.</li> <li>● Use the lower rate on light soils, sands and sandy-loams).</li> <li>● Do not apply to soils with over 10% organic matter.</li> <li>● Use at the high label rates may result in temporary crop stunting, but crops will outgrow injury and yield is unaffected.</li> <li>● Observe a 12 month plant back interval for crops not found on the label.</li> </ul>
<b>Devrinol 2-XT</b>  (napropamide)  Group 15	4.69 to 9.38 L/ha (1.90 to 3.80 L/acre)		

			<ul style="list-style-type: none"> <li>Do not enter treated area for 12 hours.</li> </ul>
<p><b>Dual II Magnum</b>  (s-metolachlor)  Group 15</p>	<p>1.25 to 1.75 L/ha (500 to 700 mL/acre)  <i>Apply in 300 L/ha (120 L/acre) of water</i></p>	N/A	<ul style="list-style-type: none"> <li><b>REGISTERED ON TRANSPLANTED CABBAGE, CAULIFLOWER, AND BROCCOLI ONLY.</b></li> <li>Controls annual grasses and nightshade, and to suppress pigweed.</li> <li>Cannot be used on seeded cole crops.</li> <li>Apply within 2 days of transplanting.</li> <li>Do not incorporate.</li> <li>Do not apply to soils with less than 1% or more than 10% organic matter.</li> <li>Do not make more than 1 application per year.</li> <li>Do not tank mix with fluid fertilizers, oils, oil concentrates or surfactants.</li> <li>Rain is required within 10 days of application, or a shallow cultivation.</li> <li>Only one application per year is permitted.</li> <li>Do not enter treated area for 12 hours.</li> </ul>
<p><b>Frontier Max</b>  (dimethenamid-P)  Group 15</p>	<p>756 to 963 mL/ha (306 to 390 mL/acre)  <i>Apply using 200 to 300 kPa spray pressure.</i></p>	60	<ul style="list-style-type: none"> <li><b>REGISTERED ON TRANSPLANTED CABBAGE ONLY.</b></li> <li>Apply as a soil application prior to transplanting and before weeds emerge.</li> <li>Controls annual grass weeds and certain broadleaf weeds.</li> <li>Use high rate to control redroot pigweed, eastern black nightshade and yellow nutsedge.</li> <li>Apply no more than once per season.</li> <li>On mineral soils, observe a plantback interval of 11 months for all crops not listed on label.</li> </ul>

			<ul style="list-style-type: none"> <li>● On muck soils, observe a plantback interval of 11 months for carrots, transplanted celery and onions. See label precaution for other crops on muck soils.</li> </ul>
<p><b>Chateau</b> (flumioxazin)  Group 14</p>	<p>Coarse and medium-textured soil with &lt;5% organic matter: 210 g/ha (85 g/acre)</p>	N/A	<ul style="list-style-type: none"> <li>● <b>Registered on transplanted broccoli only.</b></li> <li>● <b>Controls redroot pigweed, green pigweed, common ragweed, lamb's quarter, nightshade and dandelion.</b></li> <li>● <b>Suppression only of green foxtail.</b></li> <li>● Apply to with hooded or shielded equipment to row middles prior to transplanting.</li> <li>● Do not apply after transplanting</li> <li>● Apply ½ cm of water prior to transplanting if rainfall does not occur between application and transplanting in order to activate <b>Chateau</b>.</li> <li>● Control will be reduced if there is mechanical incorporation into soil or if emerged weeds are cultivated.</li> <li>● Crop should be grown on raised beds or plastic mulched beds that are 10 cm higher than the treated middle row. Mulched beds must be at least 60 cm wide.</li> <li>● The spray must remain between the raised beds with minimal contact with plastic mulch.</li> <li>● The spray must contact no more than the bottom 2.5 cm of the raised bed.</li> <li>● Do not apply to soils with &gt;5% organic matter or fine-textured mineral soils.</li> <li>● Do not apply more than 210 g/ha (85 g/acre) in a season.</li> </ul>
<b>Post-emergence</b>			
<p><b>Venture L</b> (fluazifop-P-butyl)</p>	<p>Barnyard Grass (2–5 leaf): 0.8 L/ha (320 mL/acre)</p> <p>Proso Millet (2–5 leaf):</p>	40	<ul style="list-style-type: none"> <li>● Annual bluegrass is resistant.</li> <li>● Apply in 50 to 200 L water/ha (20 to 80 L water/acre) at 200 to 300 kPa.</li> </ul>

<p>Group 1</p>	<p>1.0 L/ha (400 mL/acre)</p> <p>Foxtails (2–4 leaf): 1.4 L/ha (565 mL/acre)</p> <p>Quackgrass (3–5 leaf): 2.0 L/ha (0.8 L/acre)</p>		<ul style="list-style-type: none"> <li>Do not make more than 1 application per season.</li> <li><b>Warning:</b> Women capable of bearing children should avoid exposure to <b>Venture</b>.</li> </ul>						
<p><b>Aim EC</b> (carfentrazone-ethyl) Group 14</p>	<p>37 to 117 mL/ha (15 to 47 mL/acre)</p> <p><i>Apply in 100 L/ha (40 L/acre) of water</i></p>	<p>1</p>	<ul style="list-style-type: none"> <li>Controls annual weeds.</li> <li>Must be applied using hooded sprayers to weeds <u>between the rows</u> of the emerged crop.</li> <li>Use an adjuvant such as <b>Agral 90</b> or <b>Agral-Surf</b> at 0.25% v/v (0.25 L/100 L of spray solution) or <b>Merge</b> at 1% v/v (1 L/100 L of spray solution).</li> <li><b>PRECAUTION:</b> crop injury will occur when spray drift is allowed to come in contact with green stem tissue or leaves.</li> <li>Apply only once per growing season.</li> </ul>						
<p><b>Poast Ultra plus Merge</b> at the following rates:</p>		<p>70</p>	<ul style="list-style-type: none"> <li>The maximum rate on broccoli is 450 mL/ha (182 mL/acre).</li> <li>Do not make more than one application per season on <b>Brussels sprouts</b>.</li> <li>Apply when annual weeds are in the 1 to 6 leaf stage and when quackgrass is in the 1–3 leaf stage.</li> <li>Annual bluegrass is not controlled.</li> <li>Pressure varies with water volume see label for detail.</li> <li>Group 1 herbicide.</li> <li>Do not enter treated area for 12 hours.</li> <li>There is a 30 day plant back restriction on crops not found on the label.</li> </ul>						
	<table border="1"> <thead> <tr> <th></th> <th><b>Poast Ultra</b></th> <th><b>Merge</b></th> </tr> </thead> <tbody> <tr> <td>Annual grasses (incl volunteer cereals)</td> <td>320 mL/ha (130 mL/ac)</td> <td>0.5-1.0 L/ha (0.2-0.4 L/ac)</td> </tr> </tbody> </table>			<b>Poast Ultra</b>	<b>Merge</b>	Annual grasses (incl volunteer cereals)	320 mL/ha (130 mL/ac)	0.5-1.0 L/ha (0.2-0.4 L/ac)	
	<b>Poast Ultra</b>	<b>Merge</b>							
Annual grasses (incl volunteer cereals)	320 mL/ha (130 mL/ac)	0.5-1.0 L/ha (0.2-0.4 L/ac)							
	<table border="1"> <tbody> <tr> <td>Annual grasses &amp; quackgrass suppression</td> <td>470 mL/ha (190 mL/ac)</td> <td>0.5-1.0 L/ha (0.2-0.4 L/ac)</td> </tr> <tr> <td>Quackgrass</td> <td>1.1L/ha (445 mL/ac)</td> <td>1.0–2.0 L/ha (0.4-0.8 L/ac)</td> </tr> </tbody> </table>	Annual grasses & quackgrass suppression	470 mL/ha (190 mL/ac)	0.5-1.0 L/ha (0.2-0.4 L/ac)	Quackgrass	1.1L/ha (445 mL/ac)	1.0–2.0 L/ha (0.4-0.8 L/ac)		
Annual grasses & quackgrass suppression	470 mL/ha (190 mL/ac)	0.5-1.0 L/ha (0.2-0.4 L/ac)							
Quackgrass	1.1L/ha (445 mL/ac)	1.0–2.0 L/ha (0.4-0.8 L/ac)							

<p><b>Excel Super</b>  (fenoxaprop-p-ethyl)  Group 1</p>	<p>670 mL/ha (270 mL/acre)  <i>Apply in at least 110 L/ha (45 L/acre) of water at 275 kPa</i></p>	<p>Broccoli: 44  Cabbage: 35  Cauliflower: 43</p>	<ul style="list-style-type: none"> <li>● DO NOT USE ON BRUSSELS SPROUTS.</li> <li>● Apply between the 1 to 6 leaf stage of weedy grasses.</li> <li>● Controls foxtails, barnyard grass, crabgrass, fall panicum, proso millet and old witch grass.</li> <li>● Does not control quackgrass, sedges or perennial grasses.</li> <li>● Do not apply any other pesticides or chemicals 4 days before or after applying Excel Super.</li> </ul>
<p>*PHI = Pre-harvest interval                  BUFFERS – Refer to product label for buffer requirements. See also <a href="#">Pesticide Regulations and Safety</a> section of this guide.                  PESTICIDE GROUP DETAILS – see <a href="#">Pesticide Toxicity Table</a> of this guide.</p>			

## Table 2 Cole Crops Insect Control

Table 2 Cole Crops Insect Control

Pest	Product	Rate	PHI*	Comments
<b>Organophosphates</b>				
<b>Aphids</b>	<b>Lagon 480 E</b> (dimethoate)  Group 1B	0.7 to 1.0 L/ha (280 to 405 mL/ acre)	Broccoli: <u>4</u> Br. Sprouts: <u>21</u> Cauliflower: <u>4</u>	<ul style="list-style-type: none"> <li>● <b>NOT REGISTERED ON CABBAGE.</b></li> <li>● Apply no more than 3 applications per season.</li> <li>● Use sufficient water for good coverage.</li> </ul>
<b>Aphids &amp; Caterpillars</b>	<b>Orthene 75 SP</b> (acephate)  Group 1B	563 to 825 g/ha (228 to 335 g/acre)  <i>Apply in 225 to 1650 L/ha (91 to 668 L/acre) water</i>	<u>28</u> Cauliflower, Cabbage, Br. Sprouts	<ul style="list-style-type: none"> <li>● <b>NOT REGISTERED ON BROCCOLI.</b></li> <li>● Do not apply more than 4 times per season.</li> <li>● Do not irrigate crop for 48 hours.</li> <li>● Do not apply if rainfall is expected within 48 hours of application.</li> <li>● Do not feed crop refuse to livestock.</li> <li>● Do not enter treated area for 12 hours.</li> </ul>
	<b>Dibrom</b> (naled)	1.1 L/ha (445 mL/acre)	4	<ul style="list-style-type: none"> <li>● To prevent crop injury do not apply in temperatures over 32°C.</li> </ul>
<b>Cabbage Looper</b>	<b>Dibrom</b> (naled)  Group 1B	1.1 to 2.2 L/ha (445 to 890 mL/ acre)		<ul style="list-style-type: none"> <li>● Apply in 100 to 300 L/ha (40 to 120 L/acre) of water.</li> <li>● Do not enter treated area for 48 hours.</li> </ul>

<b>Cutworms</b>	<b>Lorsban 4E / Lorsban NT</b> (chloropyrifos)	<u>Pre-Plant:</u> 2.4 L/ha (1 L/acre)	32	<ul style="list-style-type: none"> <li>● Best control of cutworms is obtained when the application is made during the afternoon or early evening.</li> <li>● Apply 3 to 7 days before planting or at 2 to 5 leaf stage of crop</li> <li>● For pre-plant do not incorporate into soil.</li> <li>● Apply in 200 to 400 L/ha (80 to 160 L/acre) of water.</li> <li>● Do not re-enter treated area for 24 hours.</li> <li>● For cauliflower, do not re-enter treated area for 10 days.</li> </ul>
	<b>Pyrinex 480EC</b> (chloropyrifos)  Group 1B	Or  <u>In Seedling:</u> 1.2 to 2.4 L/ha (0.5 to 1 L/ac)		
<b>Carbamates</b>				
<b>Caterpillars</b>	<b>Lannate Toss-N-Go</b>  (methomyl)  Group 1A	270 to 540 g/ha (110 to 220 g/acre)	Broccoli: <u>7</u> Br. Sprouts: <u>7</u> Cauliflower: <u>7</u> Cabbage: <u>1</u>	<ul style="list-style-type: none"> <li>● Use the lower rate when plants are small.</li> <li>● Repeat at 5 to 7 day intervals as needed.</li> <li>● Early morning or late evening sprays are recommended.</li> <li>● Apply in 250 to 850 L/ha (100 to 345 L/acre of water).</li> </ul>
<b>Synthetic Pyrethroids</b>				

Caterpillars	<b>Pounce EC</b> (permethrin)  Group 3	90 to 175 mL/ha (35 to 70 mL/acre)	Broccoli: <u>7</u> Br. Sprouts: <u>3</u> Cauliflower: <u>3</u> Cabbage: <u>3</u>	<ul style="list-style-type: none"> <li>● Apply in 400 to 650 L/ha (160 to 260 L/acre) of water.</li> <li>● Add <b>Agral 90</b> wetting agent at 300mL per 1000L to improve coverage</li> <li>● Very toxic to bees, avoid spraying when bees are foraging.</li> <li>● Repeat at a 7 to 10 day spray interval.</li> </ul>
	<b>Perm-Up EC</b> (permethrin)  Group 3	90 to 180 mL/ha (35 to 70 mL/acre)		
	<b>Decis 5 EC</b> (deltamethrin)  Group 3	150 to 200 mL/ha (60 to 80 mL/acre)	Broccoli: <u>3</u> Cabbage: <u>3</u> Cauliflower: <u>3</u> Br. Sprouts: <u>1</u>	<ul style="list-style-type: none"> <li>● Do not make more than 1 application per year to muck soils.</li> <li>● Apply prior to Aug. 1 on muck soils.</li> <li>● Apply in 350 to 550 L/ha (140 to 220 L/acre) water.</li> </ul>
	<b>Mako (Ripcord)</b> (cypermethrin)  Group 3	87.5 to 125 mL/ha (35 to 50 mL/acre)	3	<ul style="list-style-type: none"> <li>● Do not use on muck soils.</li> <li>● Use <b>Mako (Ripcord)</b> at the higher rate if larvae are greater than 2 cm in size.</li> </ul>
	<b>Up-Cyde 2.5 EC</b> (cypermethrin)  Group 3	140 mL/ha (60 mL/acre)		<ul style="list-style-type: none"> <li>● Use at 2 week intervals up to a maximum of 3 applications per season.</li> <li>● <b>Up-Cyde 2.5 EC</b> should be used with <b>Agral 90</b> as a surfactant.</li> <li>● Apply in 300 to 500 L/ha (120 to 200 L/acre) of water.</li> <li>● Very toxic to bees.</li> </ul>
	<b>Matador 120EC</b> (lambda-cyhalothrin)	42 to 83 mL/ha (17 to 34 mL/acre)	Broccoli: <u>3</u> Br. Sprouts: <u>3</u> Cauliflower: <u>3</u> Cabbage: <u>1</u>	<ul style="list-style-type: none"> <li>● Use the high rate when <b>cabbage or alfalfa loopers</b> are present.</li> <li>● Do not use more than 3 applications per year.</li> <li>● Allow a 7 day interval between treatments.</li> </ul>
	<b>Silencer 120 EC</b> (lambda-cyhalothrin)			

				<ul style="list-style-type: none"> <li>• Do not enter treated areas for 24 hours.</li> <li>• Group 3 insecticides</li> </ul>
<p><b>Neonicotinoids / Chloronicotines / Sulfoximines</b></p>				

<p><b>Aphids</b></p>	<p><b>Actara 240 EC</b> (thiamethoxam)</p> <p>Group 4</p>	<p>375 to 625 mL/ha (152 to 253 mL/acre)</p>	<p>N/A</p>	<ul style="list-style-type: none"> <li>● Make an in-furrow application at the seeding or transplant depth or a narrow surface band above the seedline during planting.</li> <li>● For a surface application, incorporate to the seeding depth with irrigation within 24 hours after planting.</li> <li>● Do not apply more than 625 mL/ha (253 mL/acre) per year.</li> <li>● Do not follow with any subsequent foliar applications of a group 4 insecticide.</li> <li>● Do not re-enter treated area for 12 hours.</li> <li>● <b>Also provides early suppression of flea beetles.</b></li> </ul>
	<p><b>Assail 70 WP</b> (acetamiprid)</p> <p>Group 4</p>	<p>56 to 86 g/ha (23 to 35 g/acre)</p> <p><i>Apply in at least 200 L/ha (80 L/acre) of water</i></p>	<p>7</p>	<ul style="list-style-type: none"> <li>● Do not treated area for 12 hours following applications.</li> <li>● Do not enter treated area for 2 days for scouting activities or 4 days for all other activities.</li> <li>● Do not exceed a total of 430 g of product per hectare (174 g/acre) per season.</li> <li>● Apply at 7 day intervals.</li> <li>● Do not use more than 5 times per season.</li> </ul>
	<p><b>Admire 240 F</b> (imidacloprid)</p> <p>Group 4</p>	<p><u>Pre-plant or post-transplant field drench:</u></p> <p>6.5 mL per 100 m row</p> <p>(see Rate Conversion Chart of label for row</p>	<p>21</p>	<ul style="list-style-type: none"> <li>● Use one of the following methods:</li> <li>● Apply specified dosage in 2000 L/ha (800 L/ac) of water as a narrow (5 cm or less) surface band over the seedline at least 14 before planting.</li> <li>● <u>Seedlings or established transplants:</u> apply in 200 L/ha (80 L/ac) of water as a subsurface side-dress on both sides of each row.</li> </ul>

	spacing calculations)		<p>Product must be incorporated into the root zone.</p> <ul style="list-style-type: none"> <li>● <u>Post-seeding drench or transplant-water drench</u>: use higher water volumes to thoroughly wet the soil.</li> <li>● Do not apply more than once per season.</li> <li>● Do not follow with any subsequent foliar application of a group 4 insecticide.</li> </ul>
	<u>Foliar</u> : 200 mL/ ha (80 mL/acre)	7	<ul style="list-style-type: none"> <li>● Repeat using a 7 day interval.</li> <li>● Do not make more than 2 applications.</li> <li>● Do not apply following a soil, in-furrow or seed treatment application of a group 4 insecticide.</li> <li>● Toxic to bees. Do not apply if bees are visiting the treatment area.</li> <li>● Do not re-enter treated area for 24 hours.</li> </ul>
<b>Alias 240 SC</b> (imidacloprid)  Group 4	<u>Side-dress (soil injection)</u> : 730 mL/ha (295 mL/ acre)	21	<ul style="list-style-type: none"> <li>● The sidedress application is more effective than foliar.</li> <li>● Do not make more than 1 sidedress application per season.</li> <li>● Do not follow with any subsequent foliar application of a group 4 insecticide.</li> </ul>
	<u>Foliar</u> : 200 mL/ha (80 mL/acre)	7	<ul style="list-style-type: none"> <li>● Repeat using a 7 day interval.</li> <li>● Do not make more than 2 applications.</li> <li>● Do not apply following a soil, in-furrow or seed treatment application of a group 4 insecticide.</li> </ul>

				<ul style="list-style-type: none"> <li>● Toxic to bees. Do not apply if bees are visiting the treatment area.</li> <li>● Do not re-enter treated area for 24 hours.</li> </ul>
	<p><b>Closer SC</b> (sulfoxaflor)</p> <p>Group 4C</p>	<p>100 to 150 mL/ha (40 to 60 mL/acre)</p> <p><i>Apply in at least 100 L/ha (40 L/acre) of water</i></p>	3	<ul style="list-style-type: none"> <li>● Do not use in greenhouses.</li> <li>● Do not make more than 2 applications per growing season.</li> <li>● Repeat at a 7 day interval.</li> <li>● Do not apply more than 300 mL/ha (120 mL/acre) per growing season.</li> <li>● Do not apply during crop flowering period or when flowering weeds are present in treatment area.</li> <li>● Observe a plantback interval of 30 days for crops not on this label.</li> <li>● Do not enter treated area for 12 hours.</li> </ul>
	<p><b>Sivanto Prime</b> (flupyradifurone)</p> <p>Group 4D</p>	<p>500 to 750 mL/ha (200 to 300 mL/acre)</p> <p><i>Apply in at least 100 L/ha (40 L/acre) of water</i></p>	1	<p>Do not use in greenhouses.</p> <p>Repeat at a 7 day interval.</p> <p>Do not exceed a total of 2000 mL/ha (810 mL/acre) of product per season.</p> <p>Do not use in the greenhouse.</p> <p>Toxic to bees. Do not apply if flowering weeds are present and bees are visiting the treatment area.</p> <p>Do not enter treated areas for 12 hours.</p>
				<ul style="list-style-type: none"> <li>●</li> </ul>

Caterpillars	<b>Concept</b> (imidacloprid & deltamethrin)  Group 3 & 4	650 mL/ ha (265 mL/acre)  <i>Apply in 100 to 200 L/ha (40 to 80 L/acre) of water</i>	7	<ul style="list-style-type: none"> <li>● <b>Also controls crucifer flea beetle and aphids.</b></li> <li>● Repeat at 5 day intervals.</li> <li>● Do not apply more than 3 times/ year.</li> <li>● Do not apply following a soil application of a Group 4 insecticide.</li> <li>● Observe a plant back interval of 9 months for peas and beans and 1 year for all other crops not listed on label.</li> <li>● Highly toxic to bees.</li> <li>● Do not re-enter for 24 hours.</li> </ul>
<b>Tetronic and Tetramic Acid Derivatives</b>				
Aphids	<b>Movento 240 SC</b> (spirotetramat)  Group 23	220 to 365 mL/ ha (90 to 150 mL/ acre)	1	<ul style="list-style-type: none"> <li>● Apply in 300 L/ha (120 L/acre) of water.</li> <li>● Repeat at 7 day intervals.</li> <li>● Maximum allowed per crop season: 730 mL/ha (295 mL/acre).</li> <li>● Do not re-enter for 12 hours.</li> <li>● Use with one of the following adjuvants: non-ionic (eg. Agral 90 or Ag-Surf) or methylated seed oil (eg. Hasten).</li> </ul>
<b>Diamides</b>				
Caterpillars	<b>Coragen</b> (chlorantraniliprole)  Group 28	250 mL/ha (100 mL/acre)  <i>Apply in 100 L per ha (40 L per acre) of water</i>	3	<ul style="list-style-type: none"> <li>● For optimum control, apply with a modified seed oil adjuvant (see label.)</li> <li>● Repeat at 3 day intervals.</li> <li>● Do not make more than 4 applications per season.</li> </ul>

				<ul style="list-style-type: none"> <li>Do not re-enter for 12 hours.</li> </ul>
<p><b>Aphids, Caterpillars, Cutworms &amp; Flea Beetles</b></p>	<p><b>Exirel</b> (cyantraniliprole)  Group 28</p>	<p><b><u>Aphids:</u></b> 500 to 1500 mL/ha (200 to 600 mL/ acre)  <b><u>Caterpillars:</u></b> 250 to 500 mL/ ha (100 to 200 mL/ acre)  <b><u>Cutworms:</u></b> 500 to 750 mL/ ha (200 to 305 mL/ acre)  <b><u>Flea beetles:</u></b> 500 to 1000 mL/ha (200 to 400 mL/ acre)  <i>Apply in 100 L/ha (40 L/acre) of water</i></p>	<p>1</p>	<ul style="list-style-type: none"> <li>Do not make more than 4 applications per growing season.</li> <li>Do not apply for 60 days following a soil treatment application of a group 28 insecticide.</li> <li>For aphid control, repeat using a 5 day interval.</li> <li>For cutworm and caterpillar control, repeat using a 7 day interval.</li> <li>Do not apply more than 4.5 L/ha (1.8 L/acre) per season.</li> <li>For early season cutworm control, apply when rain is not expected in the next 24 hours.</li> <li>For cutworms, ensure adequate coverage of lower portions of plant.</li> <li>Use with an adjuvant such as <b>Hasten NT</b> at a rate of 0.25% v/v or <b>MSO Concentrate with Leci-Tech</b> at a rate of 0.5% v/v.</li> <li>Toxic to bees and certain beneficial insects. Apply early in the morning or late in the evening when bees are not active.</li> <li><b>Note:</b> Do not tank-mix or apply in sequence with strobilurin-, copper- or captan-containing fungicides.</li> <li>Observe a plantback interval of 30 days for legume vegetables, cereals, grass, crop group 1A (including beets, carrots, radish, parsnip, turnip) and crop group 2 (including beet greens and turnip greens).</li> </ul>

				<ul style="list-style-type: none"> <li>● Observe a plantback interval of 1 year for crops not on this label.</li> <li>● Do not enter treated area for 12 hours.</li> </ul>
<p><b>Caterpillars, Cabbage Loopers &amp; Flea Beetles</b></p>	<p><b>Verimark</b> (cyantraniliprole)</p> <p>Group 28</p>	<p>750 to 1000 mL/ha (300 to 400 mL/acre)</p>	<p>N/A</p>	<ul style="list-style-type: none"> <li>● <b>For flea beetles, provides early season damage reduction only.</b></li> <li>● Apply as an in-furrow spray, in the transplant water or as a banded surface application at the time of transplanting.</li> <li>● Do not make more than 1 soil application per season.</li> <li>● Adjust the pH of the spray tank to approximately 4 to 6 using a commercially available acidifier. See label for directions.</li> <li>● Do not make subsequent foliar applications of a group 28 insecticide for 60 days following a soil application.</li> <li>● Observe a plantback interval of 30 days for legume vegetables, cereals, grass, crop group 1A (including beets, carrots, radish, parsnip, turnip) and crop group 2 (including beet greens and turnip greens).</li> <li>● Observe a plantback interval of 1 year for crops not on this label.</li> <li>● Do not re-enter treated area for 12 hours.</li> </ul> <p><b>In-Furrow:</b></p> <ul style="list-style-type: none"> <li>● Apply as a narrow band spray into the furrow at the seeding depth.</li> </ul> <p><b>Transplant water treatment:</b></p>

				<ul style="list-style-type: none"> <li>● Transplants should be adequately watered before transplanting.</li> <li>● At transplanting, use a minimum of 45 mL of treatment solution per transplant.</li> <li>● Use sufficient water volume to thoroughly wet the root zone.</li> </ul> <p><b>Surface band at planting:</b></p> <ul style="list-style-type: none"> <li>● Apply as a narrow (5cm or less) surface band spray above the seed line at planting.</li> <li>● Incorporate within 24 hours of application using sufficient irrigation to reach the seed depth.</li> </ul>
<b>Insect Growth Regulators</b>				
<b>Caterpillars</b>	<b>Rimon 10 EC</b> (novaluron)  Group 15	410 to 820 mL/ha (165 to 330 mL/acre)  <i>Apply in 200 to 400 L/ha (80 to 160 L/acre) of water</i>	2-4	<ul style="list-style-type: none"> <li>● Repeat at 7 to 10 day intervals.</li> <li>● Maximum of 3 applications per season.</li> <li>● Do not apply more than 2460 mL/ha (995 mL/acre) per season.</li> <li>● Do not re-enter for 12 hours.</li> <li>● May be toxic to bees.</li> </ul>
	<b>Intrepid</b> (methoxyfenozide)  Group 18	300 to 600 mL/ha (120 to 240 mL/acre)  <i>Apply in 300 L/ha (120 L/acre) of water</i>	1	<ul style="list-style-type: none"> <li>● Apply at first sign of feeding damage.</li> <li>● Tank-mix with a nonionic surfactant such as <b>Agral 90</b> at 0.25% v/v.</li> <li>● Repeat at 7 to 14 day intervals.</li> <li>● Do not re-enter for 12 hours.</li> </ul>
<b>Selective Homopteran Feeding Blockers</b>				

<p><b>Aphids</b></p>	<p><b>Beleaf</b> (flonicamid)  Group 29</p>	<p>120 to 160 g/ha (50 to 60 g/acre)</p>	<p>0</p>	<ul style="list-style-type: none"> <li>● Apply in 94 L/ha (38 L/acre) of water.</li> <li>● Repeat at 7 day intervals.</li> <li>● Do not apply more than 3 times per year.</li> <li>● Do not apply more than 480 g/ha (200 g/acre) per season.</li> <li>● Do not re-enter treated area for 12 hours.</li> </ul>
<p><b>Microbials</b></p>				

Caterpillars	<p><b>Dipel 2X DF</b> (<i>Bacillus thuringiensis</i>)</p> <p> Used in organics</p>	<p>55 to 550 g/ha (22 to 220 g/acre)</p> <p>Apply in 400 L/ha (162 L/acre) of water</p>	<p>0 Broccoli, Cauliflower, Cabbage</p>	<ul style="list-style-type: none"> <li>● <b>Dipel 2X DF is not registered for use on Brussels sprouts.</b></li> <li>● Different rates area required for listed pests, when using <b>Dipel 2X DF</b> (check label).</li> <li>● A spreader sticker is recommended on cabbage for <b>Dipel 2X DF</b>.</li> <li>● Most effective when pests are young.</li> <li>● Must be eaten by the caterpillars.</li> <li>●  <b>Dipel</b> products are OMRI-USA listed. Check with your certification body before using in an organic operation.</li> </ul>
	<p><b>Bioprotec CAF</b> (<i>Bacillus thuringiensis</i>)</p> <p>Group 11</p>	<p>1.4 to 2.8 L/ha (0.6 to 1.1 L/acre)</p> <p>Apply in at least 300 L/ha (121 L/acre) of water</p>	<p>0</p>	
	<p><b>Thuricide-HPC</b> (<i>Bacillus thuringiensis</i>)</p> <p> Used in organics</p>	<p>2.0 to 4.25 L/ha (0.8 to 1.7 L/acre)</p> <p>Apply in 200 L/ha (80 L/acre) water.</p>	<p>0</p>	
	<p><b>XenTari WG</b> (<i>Bacillus thuringiensis</i>, subsp. <i>aizawai</i>)</p> <p>Group 11</p> <p> Used in organics</p>	<p>500 to 1000 g/ha (200 to 400 g/acre)</p> <p>Use <u>up to</u> 500 L/ha (200 L/acre) of water</p>	<p>0</p>	

				<ul style="list-style-type: none"> <li>When used in the greenhouse, do not re-enter treated area until the spray is dried.</li> <li> <b>Xen Tari</b> products are OMRI-USA listed. Check with your certification body before using in an organic operation.</li> </ul>
<b>Spinosyns</b>				
<b>Caterpillars</b>	<b>Delegate WG</b> (spinetoram)  Group 5	140 to 200 g/ha (60 to 80 g/acre)	1	<ul style="list-style-type: none"> <li>Apply at egg hatch or to small larvae.</li> <li>Repeat at 5 day intervals.</li> <li>Maximum of 3 applications per year.</li> <li>Toxic to bees. Avoid spraying when bees are foraging.</li> </ul>
	<b>Entrust 80W</b> (spinosad)   <i>Used in organics</i>	109 g/ha (44 g/acre)	3	<ul style="list-style-type: none"> <li><b>Entrust 80 W</b> and <b>Entrust SC</b> also <b>suppresses crucifer flea beetle and thrips</b>.</li> <li><b>For suppression of thrips</b>, use <b>Entrust 80 W</b> at the rate of 87.5 g/ha (35.4 g/acre) <u>or</u> <b>Entrust SC</b> at the rate of 292 mL/ha (118 mL/acre) in 300 to 500 L/ha (120 to 200 L/acre) of water.</li> <li>Use the <b>caterpillar</b> rate for <b>suppression of crucifer flea beetle</b>.</li> <li>Do not apply more than 3 times per year.</li> <li>Repeat at 7 to 10 day intervals.</li> <li>Do not enter treated area for 3 days for activities which involve contact with treated areas.</li> </ul>
	<b>Entrust SC</b> (spinosad)   <i>Used in organics</i>	364 mL/ha (147 mL/acre)		
	<b>Success 480SC</b> (spinosad)	182 mL/ha (74 mL/acre)		

				<ul style="list-style-type: none"> <li>● Highly toxic to bees. Harmful to parasitoids and predatory mites. Slightly harmful to foliage-dwelling predators.</li> <li>●  <b>Entrust</b> products are OMRI-USA listed. Check with your certification body before using in an organic operation.</li> <li>● Group 5 insecticides.</li> </ul>
--	--	--	--	---

\*PHI = Pre-harvest interval.

 = Very Toxic

BUFFERS – Refer to product label for buffer requirements. See also [Pesticide Regulations and Safety](#) section of this guide.

PESTICIDE GROUP DETAILS - see [Pesticide Toxicity Table](#) of this guide.

 OMRI-USA = Organic Materials Review Institute of USA

## Table 3 Disease Control

Table 3 Cole Crops Disease Control

Product	Rate	PHI*	Comments
<b>Alternaria Leaf Spot</b>			
<b>Rovral WP</b> (iprodione)  Group 2	3.0 kg/ha (1.2 kg/acre)	Cabbage: <u>7</u> Cauli: <u>5</u>	<ul style="list-style-type: none"> <li>● <b>REGISTERED ON STORED CABBAGE AND CAULIFLOWER ONLY.</b></li> <li>● For stored cabbage, apply 7 to 14 days before harvest.</li> <li>● For cauliflower, apply 1 to 2 days prior to tying.</li> <li>● Do not make more than 1 application per season.</li> </ul>
<b>Switch 62.5 WG</b> (cyprodinil & flu-dioxonil)  Group 9 & 12	775 to 975 g/ha (310 to 390 g/acre)  <i>Apply in at least 200 L/ha (80 L/acre) of water</i>	7	<ul style="list-style-type: none"> <li>● <b>Suppression only.</b></li> <li>● <b>REGISTERED ON CABBAGE ONLY.</b></li> <li>● Apply at first appearance of disease and continue on 7 to 10 day intervals.</li> <li>● Do not make more than 2 sequential applications of <b>Switch</b> or other fungicides in the same group (9 or 12) in a season.</li> <li>● Do not apply more than 2.9 kg of product/ha/year.</li> <li>● Do not apply more than 3 times per year.</li> <li>● Observe a 30 day plantback interval for crops not listed.</li> <li>● Do not enter treated area for 12 hours.</li> </ul>
<b>Inspire</b> (difenoconazole)  Group 3	364-512 mL/ha (147 to 207 mL/acre)  <i>Apply in at least 150 L/ha</i>	3	<ul style="list-style-type: none"> <li>● Do not apply more than 2.04 L/ha per crop per season.</li> <li>● Repeat at a 10 day interval.</li> <li>● Do not apply more than 2 sequential treatments without switching to another mode of action.</li> </ul>

	<i>(60 L/acre) of water</i>		<ul style="list-style-type: none"> <li>● Observe a plantback interval of 8 months for crops not on label.</li> <li>● Do not enter treated area for 3 days for hand harvesting, 1 day for scouting, and for all other activities 12 hours.</li> <li>● May be tankmixed with <b>Revus</b> or <b>Bravo 500</b> or <b>Matador 120EC</b> for labeled pests. Follow the most restrictive directions including rate, PHI, maximum applications and re-entry interval.</li> </ul>
<b>Quadris Top</b> (azoxystrobin/ difenoconazole) Group 11 & 3	710 to 1000 mL/ ha (290 to 400 mL/ acre) <i>Apply in at least 150 L/ha (60 L/acre) of water.</i>	3	<ul style="list-style-type: none"> <li>● Repeat at 10 to 14 day intervals</li> <li>● Do not apply more than 4 times per year.</li> <li>● Do not re-enter treated areas for hand-harvesting for 3 days, or for scouting for 1 day. For all other activities do not re-enter for 12 hours.</li> <li>● Observe a plant back interval of 60 days for crops not listed on this label or the <b>Inspire</b> label.</li> </ul>
<b>Sercadis</b> (fluxapyroxad) Group 7	250 to 333 mL/ ha (101 to 135 mL/acre) <i>Apply in 100 L/ha (40 L/acre) of water</i>	3	<p><b>Suppression only.</b></p> <p>Repeat at 7 to 14 day intervals.</p> <p>Do not make more than 3 applications per season.</p> <p>Do not apply more than 1.0 L/ha (405 mL/acre) per season</p> <p>No more than 2 consecutive applications before alternating with a fungicide with a different mode of action.</p> <p>Do not enter treated area for 12 hours.</p> <p>For crops not listed, observe a plant back interval of 1 year.</p>
<b>Downy Mildew</b>			

<p><b>Serenade Opti</b> (<i>Bacillus subtilis</i>)</p> <p>😊 Used in organics</p>	1.7 to 3.3 kg/ha (690 to 1300 g/acre)	0	<ul style="list-style-type: none"> <li>● <b>Suppression only.</b></li> <li>● Make first application immediately at emergence or immediately following transplanting.</li> <li>● Repeat using a 10 to 14 day interval.</li> <li>● <b>Also suppresses white mould.</b> See White Mould section of this table.</li> <li>● 😊 <b>Serenade Opti and Serenade Max</b> (PCP# 31666, 28549) are OMRI-Canada listed. Check with your certification body before using in an organic operation.</li> </ul>
<p><b>Serenade Max</b> (<i>Bacillus subtilis</i>)</p> <p><i>Note: no longer produced</i></p> <p>😊 Used in organics</p>	2.0 to 3.0 kg/ha (800 to 1200 g/acre)		
<p><b>Aliette WDG</b> (fosetyl-aluminum)</p> <p>Group U</p>	2.25 to 3.12 kg/ha (0.9 to 1.25 kg/acre)	7	<ul style="list-style-type: none"> <li>● Maximum of 5 applications per crop season.</li> <li>● Repeat at 7 to 14 day intervals.</li> <li>● Do not enter treated area for 12 hours.</li> <li>● Do not use within one week of a copper application.</li> </ul>
<p><b>Orondis</b> (oxathiapiprolin)</p> <p>Group 49</p>	175 to 350 mL/ha (70 to 140 mL/acre)	0	<ul style="list-style-type: none"> <li>● do not use in the greenhouse.</li> <li>● Repeat at 5 to 10 day intervals.</li> <li>● Where multiple crop cycles are produced in the same year, do not make more than 6 applications/ha/year.</li> <li>● Do not apply more than 1.40 L/ha (570 mL/acre) per season.</li> <li>● Do not re-enter treated area for 12 hours.</li> </ul>
<p><b>Revus</b> (mandipropamid)</p> <p>Group 40</p>	400 to 600 mL/ha (160 to 240 mL/acre)	1	<ul style="list-style-type: none"> <li>● Use a non-ionic adjuvant (0.125% v/v).</li> <li>● Repeat at 7 to 10 day intervals.</li> <li>● Do not apply more than 4 times per year.</li> <li>● Do not enter treated area for 12 hours.</li> </ul>

			<ul style="list-style-type: none"> <li>● May be tank-mixed with <b>Bravo 500</b>. Observe most restrictive directions including rate, PHI and re-entry interval.</li> </ul>
<p><b>Presidio</b> (fluopicolide)  Group 43</p>	<p>220 to 292 mL/ha (89 to 118 mL/acre)</p> <p><i>Apply in 200 to 1000 L/ha (80 to 400 L/acre) of water</i></p>	2	<ul style="list-style-type: none"> <li>● Tank-mix with a product that has a group number that is listed in this table for downy mildew. Observe most restrictive directions including rate, PHI and re-entry interval.</li> <li>● Do not use in greenhouses.</li> <li>● Repeat at 7 to 10 day intervals.</li> <li>● Do not make more than 4 applications per season.</li> <li>● Do not apply more than 880 mL/ha (356 mL/acre) per season.</li> <li>● Do not enter treated area for 12 hours.</li> </ul>
<p><b>Pristine WG</b> (boscalid and pyraclostrobin)  Group 7 &amp; 11</p>	<p>1.0 kg/ha (400 g/acre)</p>	4	<ul style="list-style-type: none"> <li>● <b>Suppression only.</b></li> <li>● Repeat at 7 to 10 day intervals.</li> <li>● Maximum of 4 applications per season</li> <li>● Do not re-enter until residues have dried.</li> </ul>
<p><b>Reason 500 SC</b> (fenamidone)  Group 11</p>	<p>400 to 600 mL/ha (160 to 240 mL/acre)</p>	2	<ul style="list-style-type: none"> <li>● <b>Suppression only.</b></li> <li>● Repeat at 5 to 10 day intervals.</li> <li>● Maximum 3 applications per season.</li> <li>● Observe a plantback interval of 30 days for all crops.</li> <li>● Do not enter treated area for 48 hours.</li> </ul>
<p><b>Forum</b> (dimethomorph)  Group 40</p>	<p>450 mL/ha (180 mL/acre)</p> <p>Apply in at least 200 L/ha (80 L/acre) of water.</p>	7	<ul style="list-style-type: none"> <li>● <b>Suppression only.</b></li> <li>● Apply as a tank mix with another fungicide in this table that is active against downy mildew. Observe most restrictive directions including rate, PHI and re-entry interval.</li> <li>● Apply in at least 200 L/ha (80 L/acre) of water.</li> <li>● Repeat at 7 day spray intervals.</li> </ul>

			<ul style="list-style-type: none"> <li>● Maximum of 5 applications per season</li> <li>● Do not re-enter to perform hand-harvesting or irrigation for 7 days, or for scouting for 5 days. For all other activities, do not re-enter for 12 hours.</li> <li>●</li> </ul>
<p><b>Zampro</b> (ametoctradin &amp; dimethomorph) Group 40 &amp; 45</p>	<p>0.8 to 1.0 L/ha (300 to 400 mL /acre)</p> <p><i>Apply in at least 200 L/ha (80 L/acre) of water.</i></p>	0	<ul style="list-style-type: none"> <li>● Repeat at 7 day intervals.</li> <li>● Do not apply more than 3 times per season.</li> <li>● Use a spreading/penetrating adjuvant at the rate of 0.125% v/v.</li> <li>● Do not use non-ionic surfactants such as <b>Agral 90</b> or <b>Induce</b>.</li> <li>● Do not re-enter for hand harvesting or irrigation for 6 days, or for scouting for 4 days. For all other activities, do not re-enter for 12 hours.</li> <li>● Do not use in greenhouses.</li> <li>● Observe a plantback interval of 30 days for all crops not on the label.</li> </ul>
<p><b>Phostrol</b> (mono- and dibasic sodium, potassium, and ammonium phosphites) Group 33</p>	<p>2.9 to 5.8 L/ha (1.2 to 2.3 L/acre)</p> <p><i>Apply in 225 L/ha (90 L/acre) of water.</i></p>	0	<ul style="list-style-type: none"> <li>● <b>Suppression only.</b></li> <li>● Repeat at 7 to 21 day intervals.</li> <li>● Do not make more than 4 applications per season.</li> <li>● Do no re-enter treated area for 12 hours.</li> </ul>
<p><b>Rampart</b> (mono- and dipotassium salts of phosphorous acid) Group 33</p>	<p>3 to 7 L/ha (1.2 to 2.8 L/acre)</p> <p><i>Apply in 300 to 500 L/ha (120 to 200 L/acre) of water.</i></p>	1	<ul style="list-style-type: none"> <li>● <b>Suppression only.</b></li> <li>● Repeat at 1 to 3 week intervals.</li> <li>● For brassicas with <b>one</b> crop cycle per season, do no make more than 8 applications.</li> <li>● For brassicas with <b>multiple</b> crop cycles per season, do not make more than 3 applications per crop cycle; and do not make more than 12 applications per season.</li> </ul>

			<ul style="list-style-type: none"> <li>Do not apply to plants that are dormant or heat stressed.</li> <li>Do not apply to plants treated with copper-based compounds at less than 20 day intervals.</li> <li>Do not apply when conditions favour wet tissue for periods longer than 4 hours.</li> <li>Do not re-enter treated area for 4 hours.</li> </ul>
<p><b>Confine Extra</b> (mono- and di-potassium salts of phosphorous acid)  Group 33</p>	<p>3 to 6 L/ha (1.2 to 2.4 L / acre)  <i>Apply in 100 L/ha (40 L/acre) of water.</i></p>	1	<ul style="list-style-type: none"> <li><b>Suppression only.</b></li> <li>Repeat using a 7 to 21 day interval.</li> <li>Do not make more than 6 applications per growing season.</li> <li>Tankmixing with pesticide products containing a metal base and/or micronutrients may not be compatible and could potentially cause plant injury. See label for details.</li> </ul>
<p><b>Cyazofamid 400SC</b> (formerly Ranman 400SC) (cyazofamid)</p>	<p>0.2 L/ha (80 mL /acre)  <i>Apply in 300 to 500 L/ha (120 to 200 L/acre) of water</i></p>	1	<ul style="list-style-type: none"> <li><b>Suppression only.</b></li> <li>Repeat as a foliar broadcast at 7 to 10 day intervals.</li> <li>Do not apply more than 5 times per crop per year.</li> <li>Tankmix with a non-ionic or organosilicone surfactant such as <b>Sylgard 309</b> at a the rate of 0.15 L/ha (60 mL/acre).</li> <li>Do not enter treated area for 12 hours.</li> <li><b>Also controls Pythium Root Rot and Pythium damping-off when applied as a soil drench to greenhouse transplants for field production.</b> See Pythium Root Rot section of this table for details.</li> <li>Group 21 fungicides.</li> </ul>
<p><b>Torrent 400SC</b> (cyazofamid)</p>			
<b>Alternaria Leaf Spot and Downy Mildew</b>			

<b>Bravo 500</b> (chlorothalonil) Group M	2.5 to 4.8 L/ha (1.0 to 1.9 L/acre)	7	<ul style="list-style-type: none"> <li>● Apply on a 7 to 10 day schedule.</li> <li>● Do not enter treated area for 48 hours.</li> </ul>
<b>Copper 53W</b> (tri-basic copper sulphate) Group M	4.0 kg/ha (1.6 kg/acre)	1	<ul style="list-style-type: none"> <li>● <b>ALSO REGISTERED FOR BACTERIAL LEAF SPOT (PSEUDOMONAS SPP.) ON BRUSSELS SPROUTS.</b></li> </ul> <p><b>For Brussels Sprouts:</b></p> <ul style="list-style-type: none"> <li>● Apply no more than 2 times per season.</li> <li>● Repeat at a 14 to 21 day interval</li> <li>● Apply in 1000 L/ha (405 L/acre) of water.</li> </ul>
<b>Echo 90 DF</b> (chlorothalonil) Group M	1.4 to 2.7 kg/ ha (600 to 1100 g/acre)	7	<ul style="list-style-type: none"> <li>● Repeat at 7 to 10 day intervals.</li> <li>● Do not apply more than 5 times per season.</li> <li>● Do not enter treated area for 48 hours.</li> <li>● Do not apply within 10 days before or after an oil application.</li> <li>● Apply in 50 to 1600 L/ha (20 to 650 L/acre) of water</li> </ul>
<b>Echo 720</b> (chlorothalonil) Group M	1.7 to 3.3 L/ha (700 to 1300 mL/acre)		
<b>Clubroot (<i>Plasmodiophora brassicae</i>)</b>			

<b>Allegro 500F</b> (fluazinam)  Group 29	Transplant Treatment: 50 mL	65	<ul style="list-style-type: none"> <li>● Apply 100 mL of solution per plant immediately after transplanting.</li> <li>● Do not follow with a pre-transplant treatment.</li> <li>● Do not enter treated area for 24 hours.</li> <li>● Apply in 100L of water.</li> </ul>
	Pre-Transplant Treatment: 2.9 L/ha (1.2 L/acre)  <i>Apply in 500 L/ha (200 L/acre) of water</i>	65	<ul style="list-style-type: none"> <li>● Apply in a minimum band of 25cm along the planting row and incorporate to a depth of 15 to 20cm with a precision incorporator in the same operation.</li> <li>● Transplant the seedlings into the treated band. If planting to a bed, a broadcast application could be made prior to forming the bed.</li> <li>● Do not follow with a transplant treatment.</li> <li>● Do not enter treated area for 24 hours</li> </ul>
	Plant-back Interval (PBI): Areas treated can be planted to potatoes as soon as practical. For other root crops & leafy vegetables, the PBI is 30 days. For all other crops, PBI is 70 days.		
<b>White Mould</b>			
<b>Serenade Opti</b> ( <i>Bacillus subtilis</i> )   <i>Used in organics</i>	1.7 to 3.3 kg/ha (690 to 1300 g/acre)	0	<ul style="list-style-type: none"> <li>● <b>Suppression only.</b></li> <li>● Make the first application at emergence, or immediately following transplanting.</li> <li>● Repeat using a 10 to 14 day interval.</li> <li>● <b>Also suppresses downy mildew.</b> See Downey Mildew section of this table.</li> <li>●  <b>Serenade Opti and Serenade Max</b> (PCP# 31666, 28549) are OMRI-Canada listed. Check with your certification body before using in an organic operation.</li> </ul>
<b>Serenade Max</b> ( <i>Bacillus subtilis</i> )   <i>Used in organics</i>	3.0 to 6.0 kg/ha (1.2 to 2.4 kg/acre)		
<b>Pythium Root Rot (<i>Pythium spp.</i>)</b>			

<p><b>Cyazofamid 400SC</b> (formerly Ranman 400SC) (cyazofamid)</p>	<p>30 mL/100L water</p>	<p>60</p>	<ul style="list-style-type: none"> <li>● <b>REGISTERED ON GREENHOUSE BRASSICA LEAFY VEGETABLE (Crop Group 5) TRANSPLANTS FOR FIELD PRODUCTION.</b></li> <li>● <b>Also controls Pythium damping-off.</b></li> <li>● Apply once in the greenhouse as a soil drench to thoroughly wet the growing medium immediately after seeding.</li> <li>● Do not use a surfactant.</li> <li>● Do not enter treated area for 12 hours.</li> <li>● <b>Also suppresses downy mildew when applied as a foliar spray to leafy brassica vegetables (Crop Group 5) in the field.</b> See Downy Mildew section of this table for details.</li> <li>● Group 21 fungicides.</li> </ul>	
<p><b>Torrent 400 SC</b> (cyazofamid)</p>			<p><b>Serenade Soil</b> (QST 713 strain of dried <i>Bacillus subtilis</i>)</p> <p> Used in organics.</p>	<p>2.7 to 14 L/ha (1.1 to 5.7 L/acre)</p>

			<p><b>Post-plant applications:</b></p> <ul style="list-style-type: none"> <li>● Additional applications may be made to the soil as a drench or spray directed towards the base of the plant.</li> <li>● Irrigate to move material into the seed, root or transplant zone within 24 hours.</li> <li>● Repeat at 21 to 28 day intervals.</li> </ul>
<p><b>Aliette WDG</b> (fosetyl-aluminum)  Group 33</p>	<p>20 to 30 g product per 100 m<sup>2</sup> in 20 L water per 100 m<sup>2</sup></p>	<p>7</p>	<ul style="list-style-type: none"> <li>● <b>REGISTERED ON GREENHOUSE BROCCOLI AND CABBAGE TRANSPLANTS ONLY.</b></li> <li>● <b>Controls only damping off caused by <i>Pythium spp.</i></b></li> <li>● Apply as a drench.</li> <li>● Make first application during the propagation stage.</li> <li>● For control of late damping off, repeat 7 days prior to transplanting.</li> <li>● Do not enter treated area for 12 hours.</li> <li>● Do not use within one week of a copper application.</li> </ul>

\*PHI = Pre-harvest interval.

BUFFERS – Refer to product label for buffer requirements. See also [Pesticide Regulations and Safety](#) section of this guide.

PESTICIDE GROUP DETAILS – see [Pesticide Toxicity Table](#) of this guide.



OMRI-Canada = Organic Materials Review Institute of Canada