



This is a section from the

2020/2021

Mid-Atlantic

Commercial Vegetable

Production Recommendations

The recommendations are **NOT** for home gardener use.

The **full manual**, containing recommendations specific to New Jersey, can be found on the Rutgers NJAES website in the Publications section: <http://njaes.rutgers.edu/pubs/publication.asp?pid=E001>.

This manual will be revised biennially. In January 2021, a **critical update** with important updates to the 2020/2021 manual will be communicated through local Extension Agents and Vegetable Specialists.

The **label** is a legally-binding contract between the user and the manufacturer. The user must follow all rates and restrictions as per label directions. The use of any pesticide inconsistent with the label directions is a violation of Federal law.

Cooperating Agencies: Rutgers, The State University of New Jersey, U.S. Department of Agriculture, and County Boards of Chosen Freeholders. Rutgers Cooperative Extension, a unit of the Rutgers New Jersey Agricultural Experiment Station, is an equal opportunity program provider and employer.

F. Commodity Recommendations

Pesticide Use Disclaimer

THE LABEL IS THE LAW

Before using a pesticide, check the label for up to date rates and restrictions.

Labels can be downloaded from: <http://www.cdms.net/>, <https://www.greenbook.net/> or <http://www.agrian.com/labelcenter/results.cfm>

For more information on Pesticide Safety and the Pesticide Label see chapter D.

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

1. Pesticides are listed by **group or code number based on chemical structure and mechanism of action**, as classified by the Weed Science Society of America (WSSA) for herbicides, the Insecticide Resistance Action Committee (IRAC) for insecticides, and the Fungicide Resistance Action Committee (FRAC) for fungicides.
If the number is in bold font, the product may have resistance concerns.
2. For **restricted use pesticides**, the restricted active ingredients are labeled with a *. (See section D 3.2.1 “Restricted Use Classification Statement” for more information).
3. **In addition to the pesticides listed below, other formulations or brands with the same active ingredient(s) may be available. ALWAYS CHECK THE LABEL:**
 - a) to ensure a pesticide is labeled for the same use,
 - b) to ensure the pesticide is labeled for the desired crop, and
 - c) for additional restrictions.
4. All pesticide recommendations are made for spraying a **broadcast area of 1 acre** (43,560 square feet). **Adjust the rate for banded applications** (for more information, see section E 1.3 Calibrating Granular Applicators).
5. Check the label for the maximum amount of pesticide per application and the maximum number of applications per year.
6. **Bee Toxicity Rating (Bee TR):** N=nontoxic; L=minimum impact on bees; M=moderately toxic, can be used if dosage, timing and method of application are correct, but should NOT be applied directly to the crop if bees are present; H=highly toxic, severe losses expected, -- = data not available.

3. Postharvest, Gramoxone, continued

-Spray coverage is essential for optimum effectiveness. See the label for additional information and warnings.
 -Rainfastness 30 min. A maximum of 2 applications for crop desiccation are allowed.
 -**Restricted-use pesticide.** Only certified applicators, who successfully complete the paraquat-specific training, can mix, load or apply paraquat. Application of paraquat "under the direct supervision" of a certified applicator is no longer allowed. Required training link (<http://usparaquattraining.com>); certified applicators must repeat training every three years.

4. Other Labeled Herbicides These products are labeled but limited local data are available; and/or are labeled but not recommended in our region due to potential crop injury concerns.

Group	Product Name	Active Ingredient (*=Restricted Use)
3	Prowl H2O	pendimethalin (broccoli, Brussel sprouts, cabbage, cauliflower)
13	Command	clomazone (broccoli, cabbage)
14	Aim	carfentrazone (broccoli, Brussel sprouts, cabbage, cauliflower, collards, kale, kohlrabi)
14	Spartan Charge	carfentrazone + sulfentrazone (cabbage)
14	Spartan/Zeus	sulfentrazone (cabbage)
14	Vida	pyraflufen (broccoli, Brussel sprouts, cabbage, cauliflower, collards, kale, kohlrabi)

Insect Control

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

Soil Pests

Cabbage Maggots

Cabbage maggots overwinter as pupae. Overwintered adults (flies) emerge when yellow-rocket (mustard) first blooms, then begin laying eggs on roots or soil near roots. All cole crops are affected. Eggs hatch within 3-7 days. As maggots feed on roots, plants begin to wilt. Ultimately, infested plants become severely stunted, or die outright. This pest has 3-4 generations per growing season, although the first generation is often the most economically damaging. The last larval generation is in October, particularly in warmer years. Treatments for cabbage maggot must be done preventively, as once damage is evident, loss of plants is unavoidable. Barriers, such as row covers, may be useful in excluding flies from smaller plantings. Prompt and complete destruction of crop residue is helpful. Chemical treatments should be applied pre-plant, or at planting, depending on the product used.

Apply one of the following formulations:						
Group	Product Name	Product Rate	Active Ingredient(s) (*=Restricted Use) and Crop Restrictions	PHI (d)	REI (h)	Bee TR
1B	Diazinon AG500	2.0 to 3.0 qt/A pre-plant broadcast OR 4.0 to 8.0 fl oz/50 gal transplant water	diazinon* - not labeled for cabbage maggot control on collards and kale	AP	96	H
1B	Lorsban Advanced	See specific rates on label based on method of application (preplant, at-plant, and post-plant) and crop.	chlorpyrifos* - soil (REI on cauliflower 72 h)	30	24/72	H
3A	Pyrethroid insecticides registered for use on Cole Crops: see table at the end of Insect Control.					
21A	Torac	21.0 fl oz/A	tolfenpyrad - soil	1	12	H
28	Verimark	10.0 to 13.5 fl oz/A	cyantraniliprole	AP	4	H

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

Cutworms are moth larvae (caterpillars) that live in the soil and feed on plant roots and stems. Cutworms chew through plant stems at or near the soil line, causing young plants to topple over. Larvae are typically active at night, and spend most of this stage belowground. Conventional tillage and incorporation of crop debris into the soil helps reduce populations. There are several species that are capable of causing injury to young plants. In general, there are two generations per season. If cutworm damage is anticipated, it is best to treat preventively with insecticide.

Apply one of the following formulations:						
Group	Product Name	Product Rate	Active Ingredient(s) (*=Restricted Use) and Crop Restrictions	PHI (d)	REI (h)	Bee TR
1A	Lannate LV	See label for rates and current registration status.	methomyl* - not labeled for kohlrabi	see label	48	H
1B	Lorsban Advanced	Check specific rates on the label	chlorpyrifos* - soil	30	24/72 ¹	H
3A	Pyrethroid insecticides registered for use on Cole Crops: see Group 3A table below.					

¹REI on cauliflower 72 h

Aboveground Pests**Aphids**

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

Apply one of the following formulations:						
Group	Product Name	Product Rate	Active Ingredient(s) (*=Restricted Use) and Crop Restrictions	PHI (d)	REI (h)	Bee TR
1B	Orthene 97	0.5 to 1.0 lb/A	acephate - Brussels sprouts and cauliflower only	14	24	H
4A	Neonicotinoid insecticides registered for use on Cole Crops: see table at the end of Insect Control.					
4C	Closer SC	1.5 to 2.0 fl oz/A	sulfoxaflor	3	12	H
4D	Sivanto Prime or 200SL	7.0 to 14.0 fl oz/A	flupyradifurone	1	4	M
9B	Fulfill 50WDG	2.75 oz/A	pymetrozine	7	12	L
9B	PQZ	2.4 to 3.2 fl oz/A	pyrifluquinazon	1	12	L
9D	Versys	1.5 fl oz/A	afidopyropen	0	12	L
21A	Torac	17.0 to 21.0 fl oz/A	tolfenpyrad	1	12	H
23	Movento	4.0 to 5.0 fl oz/A	spirotetramat	1	24	L
28	Exirel	13.5 to 20.5 fl oz/A	cyantraniliprole	1	12	H
28	Verimark	6.75 to 13.5 fl oz/A	cyantraniliprole	AP	4	H
29	Beleaf 50SG	2.0 to 2.8 oz/A	flonicamid	0	12	L

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

Cole crops may require multiple treatments per season. **Not all materials are labeled for all crops, insects or application methods; be sure to read the label. Due to resistance development, pyrethroid insecticides (Group 3A) are not recommended for control of DBM or beet armyworm (BAW).** Other insecticides may no longer be effective in certain areas due to DBM resistance; consult your county Extension office for most effective insecticides in your area. Rotation of insecticides with different modes of action is recommended to reduce the development of resistance.

Threshold: For fresh-market cabbage, Brussels sprouts, broccoli and cauliflower, treat when 20% or more of the plants are infested with any species during seedling stage, then 30% infestation from early vegetative to cupping stage. From early head to harvest in cabbage and Brussels sprouts use a 5% threshold. For broccoli and cauliflower, use 15% at curd initiation/cupping, then 5% from curd development to harvest. Spray coverage under the leaves is essential for effective control particularly with *Bacillus thuringiensis* and contact materials. With boom-type rigs, apply spray with at least 3 nozzles per row - one directed downward and one directed toward each side. Evaluate effectiveness to consider need for further treatment.

Apply one of the following formulations:						
Group	Product Name	Product Rate	Active Ingredient(s) (*=Restricted Use) and Crop Restrictions	PHI (d)	REI (h)	Bee TR
1A	Lannate LV	See label for rates and registration status.	methomyl* - not labeled for kohlrabi	see label	see label	H
1B	Orthene 97	1.0 lb/A	acephate - only labeled for Brussels sprouts and cauliflower	14	24	H
3A	Pyrethroid insecticides registered for use on Cole Crops: see table at the end of Insect Control.					
5	Entrust SC (OMRI)	3.0 to 10.0 fl oz/A	spinosad	1	4	M
5	Radiant SC	5.0 to 10.0 fl oz/A	spinetoram	1	4	M
6	Proclaim 5SG	3.2 to 4.8 oz/A	emamectin benzoate* (PHI on collards and kale 14 d)	7/14	12	H
11A	XenTari (OMRI)	0.5 to 1.5 lb/A	<i>Bacillus thuringiensis aizawai</i>	0	4	N
11A	Dipel DF, others (OMRI)	0.5 to 2.0 lb/A	<i>Bacillus thuringiensis kurstaki</i>	0	4	N
15	Rimon 0.83EC	6.0 to 12.0 fl oz/A	novaluron - not labeled for collards and kale	7	12	M
18	Confirm 2F	6.0 to 8.0 fl oz/A	tebufenozide	7	4	M
18	Intrepid 2F	10 to 16 fl oz/A	methoxyfenozide	1	4	L

Caterpillar “Worm” Pests - continued on next page

Caterpillar "Worm" Pests - continued

Group	Product Name	Product Rate	Active Ingredient(s) (*=Restricted Use) and Crop Restrictions	PHI (d)	REI (h)	Bee TR
21A	Torac	21.0 fl oz/A	tolfenpyrad	1	12	H
22	Avaunt 30WDG, Avaunt eVo	2.5 to 3.5 oz/A	indoxacarb	3	12	H
28	Coragen 1.67SC	7.5 fl oz/A	chlorantraniliprole - foliar	3	4	L
28	Exirel	7.0 to 17 fl oz/A	cyantraniliprole	1	12	H
28	Verimark	5.0 to 10.0 fl oz/A	cyantraniliprole	AP	4	H
28	Harvanta 50SL	10.9 to 16.4 fl oz/A	cyclaniliprole	1	4	H
28+4A	Durivo	10.0 to 13.0 fl oz/A	thiamethoxam + chlorantranilaprole	30	12	H
28+4A	Voliam Flexi	4.0 to 7.0 oz/A	thiamethoxam + chlorantranilaprole (PHI on collards and kale 7 days)	3/7	12	H
32	Spear Lep	1.0 to 2.0 pt/A	GS-omega/kappa-Hxtx-Hv1a	0	4	L

Flea Beetles

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

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

Harlequin Bugs

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

Apply one of the following formulations:						
Group	Product Name	Product Rate	Active Ingredient(s) (*=Restricted Use) and Crop Restrictions	PHI (d)	REI (h)	Bee TR
1A	Sevin XLR Plus	0.5 to 1.0 qt/A	carbaryl (PHI on leafy brassicas 14 d)	3/14	12	H
3A	Pyrethroid insecticides registered for use on Cole Crops: see table at the end of Insect Control.					
4A	Neonicotinoid insecticides registered for use on Cole Crops: see table at the end of Insect Control.					

Thrips

The small size of thrips, their habit of feeding near growing points, and the waxy nature of cole crop foliage can result in poor control with contact insecticides. The addition of a wetting agent may improve efficacy. Thrips can cause leaf distortions on cabbage.

Apply one of the following formulations:						
Group	Product Name	Product Rate	Active Ingredient(s) (*=Restricted Use) and Crop Restrictions	PHI (d)	REI (h)	Bee TR
3A ¹	Pyrethroid insecticides registered for use on Cole Crops: see table at the end of Insect Control.					
4A	Neonicotinoid insecticides registered for use on Cole Crops: see table at the end of Insect Control.					
4C	Closer SC	5.75 fl oz/A	sulfoxaflor (suppression only)	3	12	H
5	Entrust SC (OMRI)	4.0 to 10.0 fl oz/A	spinosad	1	4	M
5	Radiant SC	6.0 to 10.0 fl oz/A	spinetoram	1	4	M
21A	Torac	21.0 fl oz/A	tolfenpyrad	1	12	H
23	Movento	4.0 to 5.0 fl oz/A	spirotetramat	1	24	L
28	Exirel	13.5 to 20.5 fl oz/A	cyantraniliprole	1	12	H
28	Verimark	10.0 to 13.5 fl oz/A	cyantraniliprole (suppression only)	AP	4	H
28	Harvanta 50SL	10.9 to 16.4 fl oz/A	cyclaniliprole	1	4	H

¹Resistance concerns for tobacco thrips

F Cole Crops

Whiteflies

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

Apply one of the following formulations:						
Group	Product Name	Product Rate	Active Ingredient(s) (*=Restricted Use) and Crop Restrictions	PHI (d)	REI (h)	Bee TR
3A	Pyrethroid insecticides registered for use on Cole Crops: see table at the end of Insect Control.					
4A	Neonicotinoid insecticides registered for use on Cole Crops: see table at the end of Insect Control.					
4C	Closer SC	4.25 to 5.75 fl oz/A	sulfoxaflor	3	12	H
4D	Sivanto Prime or 200SL	10.5 to 14.0 fl oz/A	flupyradifurone	1	4	M
7C	Knack	8.0 to 10.0 fl oz/A	pyriproxifen	7	12	L
9B	PQZ	2.4 to 3.2 fl oz/A	pyrifluquinazon	1	12	L
9D	Versys	5.0 to 7.0 fl oz/A	afidopyropen	0	12	L
15	Rimon 0.83EC	12.0 fl oz/A	novaluron - not labeled for collards and kale	7	12	M
16	Courier SC	9.0 to 13.6 fl oz/A	buprofezin	1	12	L
23	Movento	4.0 to 5.0 fl oz/A	spirotetramat	1	24	L
28	Exirel	13.5 to 20.5 fl oz/A	cyantraniliprole	1	12	H
28	Verimark	6.75 to 13.5 fl oz/A	cyantraniliprole	AP	4	H

Group 3A Pyrethroid Insecticides Registered for Use on Cole Crops

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

Product Name	Product Rate	Active Ingredient(s) (*=Restricted Use)	PHI (d)	REI (h)	Bee TR
Asana XL	2.9 to 9.6 fl oz/A	esfenvalerate* - not labeled for kale	3/7collards	12	H
Baythroid XL	0.8 to 3.2 fl oz/A	beta-cyfluthrin*	0	12	H
Brigade 2EC, others	2.1 to 6.4 fl oz/A	bifenthrin*	7	12	H
Capture LFR	3.4 to 6.8 fl oz/A	bifenthrin*	AP	12	H
Declare	0.77 to 1.54 fl oz/A	gamma-cyhalothrin* - not labeled for kale or collards	1	24	H
Fastac CS	2.2 to 3.38 fl oz/A	alpha-cypermethrin* - not labeled for kale or collards	1	12	H
Lambda-cy IEC, others	2.56 to 3.84 fl oz/A	lambda-cyhalothrin*	1	24	H
Warrior II	0.96 to 1.92 fl oz/A	lambda-cyhalothrin*	1	24	H
Mustang Maxx	2.4 to 4.3 fl oz/A	zeta-cypermethrin*	1	12	H
Hero EC	4.0 to 10.3 fl oz/A	zeta-cypermethrin* + bifenthrin*	7	12	H
Tombstone, others	0.8 to 3.2 fl oz/A	cyfluthrin*	0	12	H
Combo products containing a pyrethroid					
Besiege	5.0 to 9.0 fl oz/A	lambda-cyhalothrin*+chlorantraniliprole (Group 28) (not labeled for kale)	3	24	H
Brigadier	3.8 to 6.1 fl oz/A	bifenthrin* + imidacloprid (Group 4A) - foliar	7	12	H
Endigo ZC	4.0 to 4.5 fl oz/A	lambda-cyhalothrin* + thiamethoxam (Group 4A)	1	24	H
Leverage 360	3.0 fl oz/A	beta-cyfluthrin* + imidacloprid (Group 4A)	7	12	H

Group 4A Neonicotinoid Insecticides Registered for Use on Cole Crops

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

Product Name	Product Rate	Active Ingredient(s) (*=Restricted Use)	PHI (d)	REI (h)	Bee TR
Actara 25WDG	1.5 to 5.5 oz/A	thiamethoxam (PHI on collards, kale, kohlrabi 7 d)	0/7	12	H
Platinum 75SG	1.66 to 3.67 oz/A	thiamethoxam	30	12	H
Admire Pro	4.4 to 10.5 fl oz/A	imidacloprid - soil	21	12	H
Admire Pro	1.3 fl oz/A	imidacloprid - foliar	7	12	H
Assail 30SG	2.0 to 5.3 oz/A	acetamiprid	7/3 (leafy)	12	M
Belay 2.13SC	9.0 to 12.0 fl oz/A	clothianidin - soil	AP	12	H
Belay 2.13SC	3.0 to 4.0 fl oz/A	clothianidin - foliar	7	12	H

Group 4A Neonicotinoid Insecticides Registered for Use on Cole Crops - continued on next page

Group 4A Neonicotinoid Insecticides Registered for Use on Cole Crops - continued

Product Name	Product Rate	Active Ingredient(s) (*=Restricted Use)	PHI (d)	REI (h)	Bee TR
Venom 70SG	5.0 to 7.5 oz/A	dinotefuran - soil	21	12	H
Venom 70SG	1.0 to 4.0 oz/A	dinotefuran - foliar	1	12	H
Combo products containing a neonicotinoid					
Durivo	10.0 to 13.0 fl oz/A	thiamethoxam ¹ + chlorantrilaprole (Group 28)	30	12	H
Brigadier	3.8 to 6.1 fl oz/A	imidacloprid ¹ + bifenthrin* (Group 3A) - foliar	7	12	H
Endigo ZC	4.0 to 4.5 fl oz/A	thiamethoxam ¹ + lambda-cyhalothrin* (Group 3A)	1	24	H
Leverage 360	3.0 fl oz/A	imidacloprid ¹ + beta-cyfluthrin* (Group 3A)	7	12	H
Voliam Flexi	4.0 to 7.0 oz/A	thiamethoxam ¹ + chlorantrilaprole (Group 28) (PHI on collards and kale 7 days)	3/7	12	H

Disease Control

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

Nematodes - See sections E 1.5 Soil Fumigation and E 1.6 Nematode Control in chapter E Pest Management.

Seed Treatment

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

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

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

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

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

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

Apply one of the following formulations:						
Code	Product Name	Product Rate	Active Ingredient(s) (*=Restricted Use)	PHI (d)	REI (h)	Bee TR
After seeding, apply one of the following in a band up to 7 inches wide. See labels for rates based on row spacing.						
Phytophthora and Pythium root rot						
4	Ridomil Gold 4SL	0.5 to 1.0 pt/A	mefenoxam	AP	48	N
Phytophthora, Pythium, and Rhizoctonia root rot						
4 + 11	Uniform 3.66SE	0.34 fl oz/1000 ft row. Avoid direct seed contact, which may cause delayed emergence.	mefenoxam + azoxystrobin	AP	0	N
Rhizoctonia root rot						
11	azoxystrobin 2.08F	0.40 to 0.80 fl oz/1000 ft row	azoxystrobin	AP	4	N

Bacterial and Fungal Diseases

Bacterial Head Rot

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

F Cole Crops

Black Rot

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

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

Blackleg

Blackleg (Phoma Stem Canker) is caused by the fungus, *Phoma lingam*, and can survive in the soil for up to 3 years and on related weed hosts. On seedlings, pale gray lesions develop near the soil line causing the seedling to die off. On infected stems, elongated light brown sunken lesions with purple margins develop. Spores are spread rapidly via rainfall and overhead irrigation. Blackleg can be seed borne, thus purchase certified seed or use hot water seed treatment. For blackleg control, rotate fields to allow 4 years between plantings and control related weeds.

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

¹Some coppers are OMRI-approved and may help suppress some fungal diseases in organic production systems. Copper applied at high rates may cause phytotoxicity for some cabbage cultivars in the form of flecking on the wrapper leaves. ²For Cabrio, PHI=0 d for broccoli, Brussels sprouts, cabbage, tight-heading varieties of Chinese cabbage, cauliflower and kohlrabi; PHI=3 d for Collards and Kale.

For blackleg control in broccoli only: use iprodione 4L at 2.0 lb/A immediately after thinning as a directed spray to the base of the plant and adjacent soil surface. A second application may be made up to the day of harvest.

Clubroot

Use of irrigation water containing clubroot spores is the principal way the disease is spread to other fields. If clubroot occurs, clean and disinfest all equipment. Adjust soil pH with hydrated lime to as close to 7.0 as possible. Improve the drainage in the field and grow the crop on raised beds.

Code	Product Name	Product Rate	Active Ingredient(s) (*=Restricted Use)	PHI (d)	REI (h)	Bee TR
Use Terraclor 75WP in one of the following ways. Do not use the Terraclor 2EC formulation.						
14	Terraclor 75WP	Option 1: Use 30.0 lb/A or 37.0 oz/1000 ft of row. Apply in a 12-15 inch band and incorporate 4-6 inches deep before planting Option 2: Use 40.0 lb/A, broadcast and incorporate 4-6 inches deep before planting. Option 3: Use 2.0 lb/100 gal of solution and 0.5 pt/plant as a transplant solution.	PCNB	AP	12	H
In addition, Ranman 400SC can be used in the following ways, see label for additional instructions.						
21	Ranman 400SC	Option 1: 12.9 to 25.75 fl oz/A use as a transplant soil drench Option 2: 20.0 fl oz/A use incorporated into the soil	cyazofamid	0	0	L

Downy Mildew

Downy mildew can cause serious losses if left uncontrolled. Symptoms include light green, chlorotic spots on the upper leaf surface. During periods of high humidity, grayish white spores may develop on the underside of leaves. High humidity, fog, drizzling rains, and heavy dew favor disease development. Optimum conditions for disease development are night temperatures of 46-61°F for 4 or more successive nights, and day temperature ~75°F or lower. Control related weeds and avoid overhead irrigation. Initiate fungicide applications prior to the onset of

disease symptoms and continue as long as weather conditions favor disease development. Rotate and/or tank mix chlorothalonil 6F with one of the following fungicides. Rotate between fungicides with different modes of action.

Code	Product Name	Product Rate	Active Ingredient(s) (*= Restricted Use)	PHI (d)	REI (h)	Bee TR
M05	chlorothalonil 6F (not labeled for Collards, Kale, and Kohlrabi)	1.5 pt/A	chlorothalonil	7	12	N
11	azoxystrobin 2.08F	6.0 to 15.5 fl oz/A	azoxystrobin	0	4	N
11	Cabrio 20EG	12.0 to 16.0 oz/A	pyraclostrobin	0/3 ²	12	N
21	Ranman 400SC	2.75 fl oz/A	cyazofamid	0	0	L
40	Revus 2.08F	8.0 fl oz/A	mandipropamid	1	4	--
40 + 45	Zampro 5.25SC	14.0 fl oz/A	dimethomorph + ametoctradin	0	12	--
43	Presidio 4SC	3.0 to 4.0 fl oz/A	fluopicolide	2	12	L
P07	Aliette 80WDG	3.0 to 5.0 lb/A (every 14 d)	fosetyl-Al			N
P07	Phosphite	1.0 to 3.0 qt/A	phosphite	0	4	N
Actigard is a plant defense activator. Begin applications 7-10 d after thinning and reapply every 7 d for a total of 4 applications per season.						
P01	Actigard 50WG	1.0 oz/A	acibenzolar-S-methyl	7	12	N

Leaf Spots (Caused by *Alternaria* and *Pseudocercospora*)

Leaf spots can cause serious losses if left uncontrolled. Leaf spots caused by *Alternaria* and *Pseudocercospora* are favored by long extended periods of cool, wet weather and favored by rain, heavy dews, and overhead irrigation. Symptoms of *Alternaria* spp. include yellow, dark-brown to black circular leaf spots with target like, concentric rings. *Pseudocercospora capsallae*, also known as White leaf spot, causes tannish-white, irregular or roundish spots develop on infected leaves, especially near leaf tips and edges, spots later become ash-gray to white with a brownish margin and sometimes have a yellowish halo. Initiate fungicide applications prior to the onset of disease symptoms and continue as long as weather conditions favor disease development. Rotate and/or tank mix chlorothalonil 6F at 1.5 pt/A with one of the following fungicides.

Code	Product Name	Product Rate	Active Ingredient(s) (*= Restricted Use)	PHI (d)	REI (h)	Bee TR
Tank mix one of the following with chlorothalonil at the first sign of disease and continue every 7-10 days. Rotate between fungicides with different modes of action as long as conditions favor disease development.						
M01	copper (OMRI) ¹	at labeled rates	copper	0	48	N
3 + 9	Inspire Super 2.82EW	16.0 to 20.0 fl oz/A	difenoconazole + cyprodinil	7	12	--
3 + 11	Quadris Top 1.67SC	12.0 to 14.0 fl oz/A	difenoconazole + azoxystrobin	1	12	--
4 + M05	Ridomil Gold Bravo 76.5WP	1.5 lb/A (14-day schedule)	mefenoxam + chlorothalonil - not labeled for Collards, Kale and Kohlrabi	7	48	N
7	Endura 70W ²	6.0 to 9.0 oz/A	boscalid	0/14 ¹	12	--
7	Fontelis 1.67SC	14.0 to 30.0 fl oz/A	penthiopyrad	0	12	L
7 + 11	Priaxor 4.17SC	6.0 to 8.2 fl oz/A	fluxapyroxad + pyraclostrobin	3	12	N
9 + 12	Switch 62.5WG	11.0 to 14.0 oz/A	cyprodinil + fludioxonil	7	12	L
11	Cabrio 20EG ³	12.0 to 16.0 oz/A	pyraclostrobin	0/3 ²	12	N

¹There are a number of copper-based products with OMRI labels. See labels for specifics. Copper applications may help suppress some fungal pathogens in organic production systems. ²See Endura label for specific recommendations. ³For Cabrio, PHI=0 d for broccoli, Brussels sprouts, cabbage, tight-heading varieties of Chinese cabbage, cauliflower and kohlrabi; PHI=3 d for Collards and Kale.

White Mold

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

¹See Endura label for specific recommendations.

Yellows (*Fusarium*) Use resistant varieties when possible and practice long crop rotations.

For Immediate Medical Attention

Call 911

**For a Pesticide Exposure Poisoning
Emergency Call**



For All States

This number will automatically connect you to the poison center nearest to you.

Anyone with a poisoning emergency can call the toll-free telephone number for help. Personnel at the Center will give you first-aid information and direct you to local treatment centers if necessary.

For Pesticide Spills

Small Spills: See the product label for cleanup advice.

Large spills: Call the National Response Center at 1-800-424-8802 or CHEMTREC at 800-424-9300 (24 hours) - Industry assistance with emergency response cleanup procedures for large, dangerous spills.

Be aware of your responsibility to report spills to the proper state agency.