

Chapter 6. Cole Crop Production

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Botany and Planting

Broccoli - *Brassica oleraceae* Italica group, Brassicaceae (Cruciferae).

Cabbage - *Brassica oleraceae* Capitata group.

Cauliflower - *Brassica oleraceae* Botrytis group.

Chinese broccoli – gailan or gai lan / kalia or kai lan / flowering kale – *Brassica oleracea* var. alboglabra

Chinese cabbage – napa (tight headed), chi-hili (semi-loose headed) – *Brassica rapa* var. pekinensis

Chinese mustard – bok choy, shanghai choy / baby bok choy / yuchoi / yuchoy / u-choi / choy sum – *Brassica rapa* subsp. Chinensis

Kohlrabi – *Brassica oleracea* var. gongylodes

Oriental radish – Daikon (Japanese) / lobok or lo bok (Chinese) – *Raphanus sativus* var. longipinnatus

Collards - *Brassica oleraceae* Acephala group.

Kale - *Brassica oleraceae* Acephala group.

Mustard - *Brassica juncea*.

Turnip - *Brassica rapa* Rapifera group.

Table 6.1. Planting information for cole crops.

Planting dates	Broccoli	Brussels sprouts	Cabbage ¹	Cauliflower ¹
North Florida	Aug - Feb	Aug - Feb	Aug - Feb	Aug - Feb
Central Florida	Sept - Feb	Sept - Feb	Sept - Feb	Sept - Feb
South Florida	Oct - Jan	Oct - Jan	Sept - Jan	Sept - Jan
Planting information				
Distance between rows (in)	24 - 40	24 - 40	24 - 40	24 - 40
Distance between plants (in)	10 - 15	16 - 24	9 - 16	12 - 18
Seeding depth (in)	0.25 - 0.5	0.25 - 0.5	0.25 - 0.5	0.25 - 0.5
Seeding per acre for field (lb)	1 - 2	1 - 2	1 - 2	1 - 2
Seeding per acre for transplant (lb)	1.25 - 1.5	1.25 - 1.5	1	1.25 - 1.5
Days to maturity from seed	75 - 90	120 - 140	85 - 110	75 - 90
Days to maturity from transplant	50 - 70	90 - 120	70 - 90	50 - 70
Plant populations (acre)	10,400-26,000	Up to 15,500	Up to 29,400	Up to 29,000
Planting dates	Collards	Kale	Mustard	Turnip
North Florida	Aug - Feb	Aug - Feb	Aug - Feb	Aug - Feb
Central Florida	Sept - Feb	Sept - Feb	Sept - Feb	Sept - Feb
South Florida	Sept - Jan	Sept - Jan	Sept - Jan	Sept - Jan
Planting information				
Distance between rows (in)	24 - 36	18 - 24	12 - 36	12 - 36
Distance between plants (in)	12 - 24	8 - 12	5 - 10	2 - 6
Seeding depth (in)	0.25 - 0.5	0.25 - 0.5	0.25 - 0.5	0.25 - 0.5
Seeding per acre for field (lb)	2 - 4	2 - 4	3 - 5	2 - 3
Seeding per acre for transplant (lb)	1.25 - 1.5	N/A ²	N/A ²	N/A ²
Days to maturity from seed	70 - 90	50 - 70	40 - 50	40 - 60
Days to maturity from transplant	50 - 70	—	—	—

¹ It could be planted in double rows (15-24 in between rows; 10-12 in within rows; 40-60 in bed centers).

² Direct seeded.

Cultivars

Table 6.2. Cabbage cultivars.

Green		Red	Savoy
Bravo (H)	Expat (H)	Cairo	Clarissa (H)
Bronco (H)	Grand Vantage (H)	Garnet (H)	Melissa (H)
Bruno (H)	Ramada (H)	Red Dynasty (H)	Savoy Ace (H)
Cheers (H)	Superstar (H)	Red Hawk (H)	Savoy King (H)
	Capture (H)	Red Jewel (H)	
		Rio Grande (H)	

Table 6.3. Broccoli, cauliflower, collard, kale, mustard, and turnip cultivars.

Broccoli	Brussels sprout	Cauliflower	Collards	Kale	Mustard	Turnip	Turnip Greens
DuraPak 19 (H)*	Dagan (H)	Bermeo	Bull Dog (H)	Blue Ridge (H)	Florida Broad Leaf	Just Right (H)	Top Star (H)
Eastern Crown (H)	Marte (H)	Flamenco	Flash (H)	Darkibor (H)	Green Wave	Purple Top	Topper (H)
Emerald Crown (H)		Majestic (H)	Georgia	Starbor (H)	Red Giant	Royal Crown (H)	All Top (H)
Imperial (H)		Whistler (H)	Hi Crop (H)	Vates	Southern Giant Curled	Southern Green	
Green Magic (H)		White Passion (H)	Top Bunch (H)	Winterbor (H)	Tendergreen		
Packman (H)			Vates				

H = hybrid, * = for northeast Florida

Asian Crucifers

The term “Asian Crucifers” is a broad category which encompasses Asian crucifer vegetables grown in the countries that comprise Asia and those eaten mainly by people of Asian extraction or who like Asian cuisine. Since many of the Asian crucifers which are described in this chapter belong to the crucifer family that are covered in depth of this chapter in this volume, that information will not be duplicated elsewhere.

This group of Asian crucifer vegetables include crops with edible leaves like cabbage, broccoli, and bok choy but also kohlrabi, with an edible swollen stem and daikon which is an edible root. The crops can be grown on raised beds with or without mulch and with drip, overhead or subsurface irrigation. Fertilizer recommendations for these crops can be found in chapter 2, Fertilizer Management for Vegetable Production in Florida, for general information. For pest control products, these crops are included under this chapter, with the exception of daikon.

Table 6.4. Planting information for Asian crucifers.

Planting dates	Chinese broccoli	Chinese cabbage	Chinese mustard	Daikon
North Florida	Aug - Feb	Aug - Feb	Aug - Feb	Sept- Mar
Central and South Florida	Sept- Apr	Sept- Apr	Sept- Apr	Sept- Apr
Planting information				
Number of rows/44-inch wide beds (6-ft centers)	3-4	2-3	4	3 (fall/spring); 4 (winter)
Distance between rows (in)	11	14 or 24	14 - mustard 11 - others (below)	11
Distance between plants (in)	3-5	14-18	12-18 (mustard); 8-12 (Shanghai/choy sum); 6-10 (baby bok choy); 2-4 (u-choy)	6-9
Seeding depth (in)	0.25 – 0.5	0.25 – 0.5	0.25 – 0.5	0.25
Plant populations (acre)	116,160	18,671	29,040 (mustard); 43,560 (Shanghai/choy sum); 58,080 (baby bok choy); 174,240 (u-choy)	58,080

Table 6.5 Asian crucifer cultivars.

Bok Choy	Chinese Broccoli	Chinese Cabbage - napa (tight head)	Chinese Cabbage - chihili (semi-loose head)	Chinese Mustard	Kohlrabi	Oriental Radish
Bopak	Dark Green Gailan	Blues Hybrid (H)	Green Rocket (H)	Crown Jewel	Green Beauty	April Cross
Joy choi	Green Lance (H)	China Express	Jade Pagoda	Canton Choice	Kolibri	Daikon (Japanese)
	Green Jade	China Pride	Michihili	Ching-Chiang	Kolibri Hybrid (H)	Everest
	Kaliburi	Minuet	Monument	Dwarf	Peking Purple	Green Meat
	Kichi	SF-65	Rubicon	Dynasty	Purple Vienna	Minowase
	Suiho	WR-70 days (H)	Tainong Nanjing	Extra Dwarf	Winner	Mantanghong Hybrid (H)
	Te You	Emiko		Fortune King		Mikura Cross
		Pacifiko		Lucky Choi		Mino Early
				Long White		Red Meat
				Mei Quing Choi		Relish Lobok / lo bok (Chinese)
				San Fran		Shunko
				Shanghai Green		

H = hybrid

Table 6.6. Herbicides approved for managing weeds in cole crops.

Labels change frequently. Be sure to read a current product label before applying any chemical.

Active ingredient lb. a.i./A	Trade name product/A	MOA code	Crops	Weeds controlled / remarks
*** PREEMERGENCE / PRETRANSPLANT ***				
Bensulide 5.0 - 6.0	(Prefar) 4 E 5 - 6 qt.	8	Head & stem and leafy brassica	Annual broadleaf and grass weeds. Fair to poor control of lambsquarter, purslane, and some amaranth. Mechanically incorporate 1 to 2 in or irrigate 2 to 4 in deep within 36 hrs.
Carfentrazone up to 0.031	(Aim) 2 EC up to 2 fl.oz.	14	Head & stem and leafy brassica	Apply as a preplant burn down for emerged broadleaf weeds. Use crop oil concentrate, methylated seed oil, or nonionic surfactant at recommended rates. Maximum rate of 0.096 lb. a.i./A per season. No pretransplant interval.
Clomazone 0.25 0.25 - 0.38	(Command) 3ME 0.67 pt. direct seeded 0.67 - 1.0 pt. transplanted	13	Cabbage	Annual broadleaf and grass weeds. On coarse soils, use lower rates. Only one application per season. PHI 45 days.
DCPA 4.5 - 10.5	(Dacthal) 75 WP 6 - 14 lb.	3	Broccoli, brussel sprouts, cauliflower, cabbage, and Brassica leafy vegetables	Broadleaf and grass weeds. Can be preplant incorporated. If weeds have emerged they must be cultivated or weeded before application
Glyphosate	(various formulations) consult label	9	Head & stem and leafy brassica	Actively growing broadleaf and grass weeds. Use as a preplant burndown.
Napropamide 2	(Devrinol DF-XT) 4 lb. (Devrinol 2-XT) 4 qt.	15	Broccoli, brussels sprouts, cabbage, cauliflower	Annual broadleaf and grass weeds. Apply in transplanted crops. Irrigate within 24-72 hr. to a soil depth of 4-8 in. Do not exceed 2 lb. a.i./A per season.
Oxyfluorfen 0.25 - 0.5	(Galigan, Goal 2XL) 2 EC 1 - 2 pt. (Galigan, GoalTender) 4 E 0.5 - 1.0 pt.	14	Broccoli, cabbage, cauliflower	Certain annual broadleaf weeds. Transplants less than 5 weeks old or in containers less than 1 in. square may result in more crop injury. Injury will occur as leaf cupping or crinkling. DO NOT apply in fields where acenitilde herbicides (Dual Magnum, Lasso, or Ramrod) have been applied in the same growing season.
Pyraflufen ethyl 0.0008 - 0.003	(ET Herbicide/Defoliant) 0.5 - 2.0 fl. oz.	14	Cole crops	Broadleaf and grass weeds. Burndown preplant application 1 day before planting. Include a NIS or COC in the spray solution. Allow 30 days between applications. Do not exceed 3 applications or 5.5 fl. oz./A per season.
Paraquat 0.5 - 1.0	(Gramoxone) 2 SL 2.0 - 4.0 pt. (Firestorm) 3 SL 1.3 - 2.7 pt.	22	Broccoli, cabbage, cauliflower, cavalo broccoli, Chinese cabbage, turnip	Emerged broadleaf and grass weeds. Use as a preplant burndown. Crop plants that have emerged will be injured.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	27	Broccoli, cabbage, cauliflower, collards, kale, mustard/turnip greens	Emerged broadleaf and grass weeds. Use as a preplant burndown.

Table 6.6. Herbicides approved for managing weeds in cole crops. (continued)

Labels change frequently. Be sure to read a current product label before applying any chemical.				
Active ingredient lb. a.i./A	Trade name product/A	MOA code	Crops	Weeds controlled / remarks
Sulfentrazone 0.07 - 0.09	(Willowood sulfentrazone) 4SC 2.25 - 3.0 fl. oz.	14	Brassica head & stem, Brassica leafy greens	Broadleaf and grass weed control, Nutsedge suppression. Do not apply on sands with less than 1% organic matter. Do not apply more than 6.4 fl. oz./A within a 12 mo. period. Should be trialed on a small area to find suitable rate for the soil type in your area.
S-metolachlor mineral muck 0.64 - 1.91 1.91	(Dual Magnum) 7.62 EC mineral 0.80 - 4.0 pt. muck 4.0 pt.	15	Head & stem brassica	Annual broadleaf and grass control. Apply immediately after planting. Label is a third party registration by TPR, Inc. and grower must sign an indemnification agreement. Use a higher rate on fine textured soils or high in organic matter. Do not apply more than 1.91 lb. a.i./A of Dual Magnum per crop on sandy soils. Chinese varieties are more sensitive to Dual Magnum injury. PHI 60 days.
Trifluralin 0.5 - 0.75	(Treflan HFP, Trifluralin, Trilin) 4 EC 1.0 - 1.5 pt. (Treflan) 4 L 1.0 - 1.5 pt.	3	Broccoli, brussels sprouts, cabbage, cauliflower	Annual broadleaf and grass weeds. Incorporate or irrigate 4 in. within 8 hrs. Results in Florida are erratic on soils with low organic matter and clay contents.
*** POSTEMERGENCE / POSTTRANSPLANT ***				
Carfentrazone up to 0.031	(Aim) 2 EC up to 2 fl. oz. (Aim) 1.9 EC up to 2 fl. oz.	14	Head & steam and leafy brassica	Emerged broadleaf weeds. Apply with a hooded sprayer to row middles. Do not exceed 4.1 fl. oz./A in season as a row middle application. PHI 0 days.
Clethodim 0.09 - 0.13 0.07 - 0.25	(Select) 2 EC 6 - 8 fl. oz. (Select Max) 1 EC 9 - 16 fl. oz.	1	Head & stem and leafy brassica	Emerged grass weeds. Include crop oil concentrate at 1% v/v in finished spray volume. Head & stem brassica PHI 30 days. Leafy brassica PHI 14 days.
Clopyralid 0.09 - 0.19	(Stinger) 3 EC 0.25 - 0.5 pt.	4	Cabbage, Chinese cabbage (bok choy, napa), Chinese mustard cabbage	Broadleaf weeds. Do not apply more than 0.5 pt./A per year. Check plant back dates. PHI 30 days.
DCPA 4.5 - 10.5	(Dacthal) 75 WP 6 - 14 lb.	3	Broccoli, Brussels sprouts, cauliflower, cabbage, and Brassica leafy vegetables	Broadleaf and grass weeds. Spray over transplants without injury. If weeds have emerged they must be cultivated or weeded before application. Can be preplant incorporated.
Glyphosate	(various formulations) consult label	9	Head & steam and leafy brassica	Broadleaf and grass weeds. Use a hooded sprayer and direct to row middles only.
Paraquat 0.3 - 0.5	(Gramoxone) 2 SL 1.2 - 1.9 pt.	22	Cabbage	Emerged broadleaf and grass weeds. Direct spray solution to row middles only. Do not allow spray to contact crop as injury or excessive residues may result. Outer leaves should be stripped at the time of harvest. Do not apply where paraquat products have been used as preplant application.
Pelargonic acid	(Scythe) 4.2 EC 3 - 10% v/v	27	Broccoli, cabbage, cauliflower, collards, kale, mustard/turnip greens	Emerged broadleaf and grass weeds. Apply as hooded spray to row middles only. Include a residual herbicide to broaden spectrum of weed control.
Pendimethalin 0.48 - 0.71	(Prowl H20) 3.8 1.0 - 1.5 pt.	3	Broccoli, brussel sprouts, cabbage, cauliflower	Broadleaf and grass weeds. Apply after crop emergence (2- to 4- leaf stage) or after transplanting (1 to 3 days) and prior to weed emergence. Direct the spray to the base of the plant to limit contact to the foliage. PHI 60 days. PHI 7 days for cabbage and head & stem brassica.
Sethoxydim 0.28	(Poast) 1.5 EC 1.5 pt.	1	Broccoli (including Chinese and raab), Brussels sprouts, cabbage (bok choy, Chinese mustard, napa), cauliflower, collards, kale, kohlrabi, mustard/rape greens	Annual and perennial weeds. Include a crop oil concentrate or methylated seed oil in spray solution. Maximum rate of 3.0 pt./A per season. PHI 30 days.

Table 6.7. Insecticides labeled for management of pests of cole crops.

Labels change frequently. Be sure to read a current product label before applying any chemical. Also refer to Table 19.1 for biopesticide and other alternative products labeled for disease management.

Insect or mite pest	MOA Code ¹	Trade Name (Active Ingredient) *Restricted	Rate (Product/acre)	REI (hours)	Days to Harvest	Remarks ²
Aphids	1B	*Dibrom 8 EC (naled)	1 pt	48	1	Apply no more than 1 pt per acre in Florida. Do not apply more than 5 pt per acre per season. Broccoli, cabbage, cauliflower, Brussels sprouts, kale and collards.
	1B	Dimethoate 4 EC (dimethoate)	0.5-1 pt – broccoli, cauliflower; 0.5 pt – kale, mustard greens, turnip	48	7 – broccoli, cauliflower; 14 – kale, mustard greens, turnip	Highly toxic to bees. For broccoli, cauliflower, kale, turnip greens and roots, and mustard greens only.
	1B	*Lorsban Advanced (chlorpyrifos) and other generic products	Preplant, at plant, post plant soil application: See label. foliar: 1-2 pt	24, 72 for cauliflower	Preplant: 30 foliar: 21	See label for crop-specific instructions; Pre or post-plant soil application for root aphids only. Foliar: Do not make more than 3 applications of products containing chlorpyrifos.
	1B	Malathion 5EC, 8F (malathion)	5EC: 1-2 pt, 1.6 pt for collards, kale, mustard greens; 8F: 1.25 pt, 1 for collards, kale, mustard greens	48, 12 for collards, kale, and mustard greens	2 for head and stem Brassica except cabbage, 7 for greens and cabbage	see label for limitations on number of applications per season--varies by crop.
	1B	*MSR Spray Concentrate (oxydemeton-methyl)	1.5-2 pt	7 days	7	Broccoli, broccoflower, broccolini, cabbage, cauliflower - See label for restrictions.
	3A	*Ambush 25W3 (and generics)	3.2-6.4 oz 3.2-12.8 oz – cabbage and Chinese cabbage only	12	1	Do not apply more than 51.2 oz/acre per season. Head and stem Brassica crops only.
	3A	*Brigade 2 EC (bifenthrin)	2.1-6.4 fl oz	12	7	Do not apply more than 0.4 lb ai/acre for leafy or 0.5 lb ai/acre for head and stem.
	3A	*Mustang (zeta-cypermethrin)	2.4-4.3 fl oz	12	1	Do not make applications less than 7 days apart. Diamondback moth populations in Florida have been found to be resistant to pyrethroids.
	3A	Pyganic 5.0 (pyrethrins)	4.5-18 oz	12	0	Harmful to bees. Can be used in greenhouses. OMRI-listed. ²
	4A	Actara (thiamethoxam)	1.5-5.5 oz	12	0 -head and stem 7 - leafy	Foliar application. Do not use if other 4A insecticide has been applied.
	4A	Admire Pro (imidacloprid) (see appropriate labels for other brands)	soil: 4.4-10.5 fl oz, foliar: 1.3 fl oz	12	soil: 21, foliar: 7	Most effective as a soil application. Do not apply more than 10.5 fl oz per acre per crop season as a soil application or 6.5 fl oz as foliar applications. Do not apply to both soil and foliage.
	4A	Assail 30SG (acetamiprid)	2.0-4.0 oz—head and stem cole crops, 2.0-5.3 oz—leafy cole crops and turnip greens	12	7-head and stem, 3-leafy cole crops and turnip greens	Susceptibility may vary with aphid species. Do not apply more than 5 times per season for head and stem cole crops or 4 times per season for leafy cole crops, or apply more often than every 7 days. Turnip roots cannot be used for food/feed.
	4A	Belay Insecticide; 50 WDG (clothianidin)	Insecticide: soil: 9-12 fl oz, foliar: 3-4 fl oz; 50 WDG: soil: 4.8-6.4 oz, foliar: 1.6-2.1 oz	12	Insecticide: soil: apply at planting, foliar: 7; 50 WDG: 7	Insecticide: soil: Do not apply more than 6.4 oz per acre per season. See label for application instructions. foliar: Do not apply more than 6.4 oz per acre per season. Do not use an adjuvant. Toxic to bees. 50 WDG: Includes turnip greens. Do not apply more than 0.2 lb ai/acre regardless of application method (or a total of 12 fl oz of this formulation).
	4A	Platinum, Platinum 75SG (thiamethoxam)	Platinum: 5.0-11 fl oz; Platinum 75SG: 1.66-3.67 oz	12	30	Soil application.
	4A	Venom Insecticide Scorpion 35 SL insecticide (dinotefuran)	Soil and foliar rates different; Check label	12	foliar: 1 soil: 21	Use one application method, not both (soil or foliar). For head and stem Brassica only. Foliar: Do not apply more than 0.268 lb ai per acre per season.
	4D	Sivanto Prime (flupyradifurone)	7-14 fl oz	4	1	Soil or foliar application. Maximum per crop season: 28 fl oz/acre. Maximum crop seasons per year: 3.
	4A, 28	Durivo (thiamethoxam, chlorantraniliprole)	10-13 fl oz	12	30	Soil application. May be applied via one of several different applications methods. One application per season within 28 days of plant emergence or transplanting.

Table 6.7. Insecticides labeled for management of pests of cole crops. (continued)

Labels change frequently. Be sure to read a current product label before applying any chemical.
Also refer to Table 19.1 for biopesticide and other alternative products labeled for disease management.

Insect or mite pest	MOA Code ¹	Trade Name (Active Ingredient) *Restricted	Rate (Product/acre)	REI (hours)	Days to Harvest	Remarks ²
	3A, 28	*Besiege (lambda-cyhalothrin and chlorantraniliprole)	5-9 fl oz	24	3	Highly toxic to bees exposed to direct treatment or residues on blooming crops. Head and stem Brassica only.
	4A, 28	Voliam Flexi (thiamethoxam and chlorantraniliprole)	4-7 oz	12	head and stem – 3, leafy Brassica greens - 7	Foliar application. Highly toxic to bees exposed to direct treatment or residues on blooming crops.
	9B	Fulfill (pymetrozine)	2.75 oz	12	7	Apply when aphids first appear. Maximum of 2 applications per crop.
	23	Movento (spirotetramat)	4-5 fl oz	24	1	Limited to 10 oz/acre per season. Only use a spreading-penetrating adjuvant known to be safe for the target crop.
	28	Exirel (cyazypyr)	13.5-20.5 fl oz	12	1	Do not apply more than 0.4 lb ai/acre of cyazypyr or cyantraniliprole containing products per crop whether applications are made to foliage or soil. See label for diamondback moth resistance management.
	28	Verimark (cyazypyr)	6.75-13.5 fl oz	4	N/A: applied at planting	See label for diamondback moth resistance management.
	29	Beleaf 50 SG (flonicamid)	2.0-2.8 oz	12	0	Do not apply more than 8.4 oz/acre per season. Begin applications before pests reach damaging levels.
	–	Mycotrol ESO (<i>Beauveria bassiana</i> strain GHA)	0.25-1 quart per acre. Apply in sufficient water to cover foliage, typically 5-100 gallons per acre.	4	0	May be used in greenhouses. Contact dealer for recommendations if an adjuvant must be used. Compatible as a tank mix with some fungicides.
	-	BotaniGard ES (<i>Beauveria bassiana</i> strain GHA)	0.25-1 quart per acre. Apply in sufficient water to cover foliage, typically 5-100 gallons per acre.	4	0	May be used in greenhouses. Contact dealer for recommendations if an adjuvant must be used. Compatible as a tank mix with some fungicides.
	–	Grandevo (<i>Chromobacterium subtsugae</i> strain PRAA4-1)	1.0-3.0 lb	4	0	Can be used in organic production. OMRI-listed ²
	–	M-Pede 49% EC (soap, insecticidal)	1-2 % V/V	12	0	OMRI-listed ² .
	–	Suffoil-X (mineral oil)	1-2% v/v	4	0	OMRI-listed ² .
	–	Saf-T-Side, others (Oil, insecticidal)	1-2 gal/100 gal	4	up to day of harvest	Saf-T-Side is OMRI-listed ² .
	–	Azatin XL (azadirachtin)	5-21 fl oz	4	0	Antifeedant, repellent, insect growth regulator.
	–	Molt-X (azadirachtin)	10 fl oz	4	0	OMRI-listed ² . Antifeedant, repellent, insect growth regulator.
	–	Trilogy (extract of neem oil)	0.5-2% V/V	4	0	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. OMRI-listed ² .
Caterpillars (including diamondback moth, cabbage looper, imported cabbageworm, corn earworm, cross-striped cabbageworm, cabbage webworm, armyworms)	1A	*Lannate LV; *SP (methomyl)	LV: 1.5-3.0 pt SP: 0.5-1 lb	48	Cabbage – 1, broccoli and cauliflower – 3, others –10	Do not make more than 10 applications per crop (8 for collards, kale, mustard and turnip greens). For use on broccoli, cabbage, cauliflower, Chinese cabbage, fresh market collards, kale, mustard and turnip greens.
	1A	Sevin 80S; XLR Plus, 4F (carbaryl)	80S: 0.625-2.5 lb; XLR, 4F: 0.5-2 qt	12	3 or 14, depending on specific crop	Apply no more than 7.5 lb/acre of 80S or 6 qt of 4F or XLR Plus per crop. See label for specific crops.
	1B	*Diazinon AG-500, *50 W (diazinon)	AG500 preplant: 1-4 qt 50W: 2-8 lb	96	preplant	Root maggot, cutworms only. Broccoli, cabbage, cauliflower, collard, kale, mustard greens. See label for depth to incorporate.
	1B	*Dibrom 8 EC (naled)	1 pt	48	1	Apply no more than 1 pt per acre in Florida. Do not apply more than 5 pt per acre per season. Broccoli, cabbage, cauliflower, Brussels sprouts, kale and collards.

Table 6.7. Insecticides labeled for management of pests of cole crops. (continued)

Labels change frequently. Be sure to read a current product label before applying any chemical.
Also refer to Table 19.1 for biopesticide and other alternative products labeled for disease management.

Insect or mite pest	MOA Code ¹	Trade Name (Active Ingredient) *Restricted	Rate (Product/acre)	REI (hours)	Days to Harvest	Remarks ²
	1B	*Lorsban Advanced (chlorpyrifos)	Preplant, at plant, post plant soil application: See label. foliar: 1-2 pt	24, 72 for cauliflower	Preplant: 30 foliar: 21	Preplant for root maggot, cutworms and symphylans only. See label for crop-specific instructions; Foliar: Do not make more than 3 applications of products containing chlorpyrifos. Will not control organophosphate-resistant diamondback moth.
	1B	Malathion 5EC, 8F (malathion)	5EC: 1-2 pt, 1.6 pt for collards, kale, mustard greens; 8F: 1.25 pt, 1 for collards, kale, mustard greens	48, 12 for collards, kale, and mustard greens	2 for head and stem Brassica except cabbage, 7 for greens and cabbage	see label for limitations on number of applications per season--varies by crop.
	3A	*Ambush 25W (permethrin)	3.2-6.4 oz, 3.2-12.8 oz – cabbage and Chinese cabbage only	12	1	Do not apply more than 51.2 oz/acre per season. Head and stem Brassica crops only.
	3A	*Asana XL (0.66 EC) (esfenvalerate)	2.9-9.6 fl oz – head and stem Brassicas, 5.8-9.6 oz –collards, 9.6 – mustard greens	12	3-head and stem; 7-collards, mustard greens	Do not apply more than 0.4 lb ai/acre per season for head and stem Brassica or 0.2 lb ai/acre per season for collards and mustard greens.
	3A	*Baythroid XL (beta-cyfluthrin)	0.8-3.2 fl oz	12	0	Maximum per crop season: 12.8 fl oz/A.
	3A	*Brigade 2 EC (bifenthrin)	2.1-6.4 fl oz	12	7	Do not apply more than 0.4 lb ai/acre for leafy or 0.5 lb ai/acre for head and stem.
	3A	*Capture LFR (bifenthrin)	3.4-8.5 fl oz	12	at planting	For mixing directly with liquid fertilizer to control soil insect pests.
	3A	*Danitol (fenpropathrin)	10.67-16 fl oz	24	7	Do not apply more than 42.67 fl oz per acre per season. Head and stem Brassica only.
	3A	*Declare Insecticide (gamma-cyhalothrin)	0.77-1.54 fl oz	24	1	First and second instars only. Head and stem Brassica only. Do not apply more than 12.3 fl oz per acre per season.
	3A	*Mustang (zeta-cypermethrin)	2.4-4.3 fl oz	12	1	Do not make applications less than 7 days apart. Diamondback moth populations in Florida have been found to be resistant to pyrethroids.
	3A	Pyganic 5.0 (pyrethrins)	4.5-18 oz	12	0	Harmful to bees. Can be used in greenhouses. OMRI-listed. ²
	3A	*Warrior II (lambda-cyhalothrin)	0.96-1.92 fl oz	24	1	Do not apply more than 0.24 lb ai/acre or 15.36 fl oz of product/acre per season. 1 st and 2 nd instar only. For head and stem Brassica only.
	4A, 28	Durivo (thiamethoxam, chlorantraniliprole)	10-13 fl oz	12	30	May be applied via one of several different soil applications methods. One application per season within 28 days of plant emergence or transplanting.
	4A, 28	Voliam Flexi (thiamethoxam and chlorantraniliprole)	4-7 oz	12	head and stem – 3, leafy Brassica greens - 7	Highly toxic to bees exposed to direct treatment or residues on blooming crops.
	5	Radiant SC (spinetoram)	5-10 fl oz	4	1	Do not apply to seedlings grown for transplant. Do not make more than two consecutive applications of Group 5 insecticides. Recommended to reserve for thrips where they are a problem.
	6	*Proclaim (emamectin benzoate)	2.4-4.8 oz	12	7 - head and stem; 14 - leafy	Do not make more than 2 sequential applications without rotating to another product with a different mode of action. Do not apply by aircraft. Not for turnips grown for roots.
	11A	DiPel DF and other products (<i>Bacillus thuringiensis</i> subspecies <i>kurstaki</i>)	0.5-2.0 lb	4	0	Treat when larvae are young. See label for rates for specific pests. Good coverage is essential. OMRI-listed ² . Can be used in greenhouses.
	11A	Xentari DF and other products (<i>Bacillus thuringiensis</i> subspecies <i>aizawai</i>)	0.5-2.0 lb	4	0	Treat when larvae are young. Thorough coverage is essential. May be used in the greenhouse. Can be used in organic production.

Table 6.7. Insecticides labeled for management of pests of cole crops. (continued)

Labels change frequently. Be sure to read a current product label before applying any chemical.
Also refer to Table 19.1 for biopesticide and other alternative products labeled for disease management.

Insect or mite pest	MOA Code ¹	Trade Name (Active Ingredient) <i>*Restricted</i>	Rate (Product/acre)	REI (hours)	Days to Harvest	Remarks ²
	15	Rimon 0.83 EC (novaluron)	6-12 fl oz	12	7	No more than 3 applications or 24 fl oz per acre per season. No more than 2 applications for thrips or whiteflies. Head and stem Brassica only.
	18	Intrepid 2F (methoxyfenozide)	4-10 fl oz, depending on pest.	4	1	Do not apply more than 64 oz per acre per season.
	22	Avaunt 30 WG (indoxacarb)	2.5-3.5 oz	12	3	Do not apply more than 14 oz per acre per crop. Add a wetting agent to improve coverage. Do not use in greenhouse or in crops grown for transplant.
	22	Avaunt eVo (indoxacarb)	2.5-3.5 oz/A	12	3	
	28	Coragen (rynaxypyr)	3.5-7.5 fl oz	4	3	For best results, use an adjuvant when using as a foliar spray. Can be applied to soil at planting or by drip chemigation. See label for diamondback moth resistance management.
	28	Exirel (cyazypyr)	13.5-20.5 fl oz	12	1	Do not apply more than 0.4 lb ai/acre of cyazypyr or cyantraniliprole containing products per crop whether applications are made to foliage or soil. See label for diamondback moth resistance management.
	–	Checkmate DBM-F (pheromone)	3.1-6.2 fl oz	0	0	For mating disruption of diamondback moth. Does not affect larvae and eggs already on plants. Do not exceed 23 fl oz per acre per year.
	–	Grandevo (Chromobacterium subsugae strain PRAA4-1)	1.0-3.0 lb	4	0	Can be used in organic production. OMRI-listed ²
	–	Molt-X (azadirachtin)	8 fl oz	4	0	OMRI-listed ² . Antifeedant, repellent, insect growth regulator.
	–	Aza-Direct (azadirachtin)	1-2 pt, up to 3.5 pt, if needed	4	0	Antifeedant, repellent, insect growth regulator. OMRI-listed ² .
Fire Ants	–	Prokil Cryolite (cryolite)	8-16 lb	12	7	For broccoli, Brussels sprouts, and cauliflower only. Do not apply more than 96 lb per season or more often than every 7 days.
	3A	Pyganic 5.0 (pyrethrins)	4.5-18 oz	12	0	Harmful to bees. Can be used in greenhouses. OMRI-listed. ²
	7A	Extinguish ((S)-methoprene)	1.0-1.5 lb	4	0	Slow-acting IGR (insect growth regulator). Best applied early spring and fall where crop will be grown. Colonies will be reduced after three weeks and eliminated after 8 to 10 weeks. May be applied by ground equipment or aerially.
Flea beetles	7C	Esteem Ant Bait (pyriproxyfen)	1.5-2.0 lb	12	1	Apply when ants are actively foraging. Do not exceed 0.134 lb ai per acre per season
	1A	Sevin 80S; XLR Plus, 4F (carbaryl)	80S: 0.625-2.5 lb; XLR, 4F: 0.5-2 qt	12	3 or 14, depending on specific crop.	Apply no more than 7.5 lb/acre of 80S or 6 qt of 4F or XLR Plus per crop. See label for specific crops.
	1B	*Lorsban Advanced (chlorpyrifos)	Preplant, at plant, post plant soil application: See label. foliar: 1-2 pt	24, 72 for cauliflower	Preplant: 30 foliar: 21	See label for crop-specific instructions; Foliar: Do not make more than 3 applications of products containing chlorpyrifos.
	1B	Malathion 5EC, 8F (malathion)	5EC: 1-2 pt, 1.6 pt for collards, kale, mustard greens; 8F: 1.25 pt, 1 for collards, kale, mustard greens	48, 12 for collards, kale, and mustard greens	2 for head and stem Brassica except cabbage, 7 for greens and cabbage	see label for limitations on number of applications per season--varies by crop.
	3A	*Asana XL (0.66 EC) (esfenvalerate)	2.9-9.6 fl oz – head and stem Brassicas, 5.8-9.6 oz –collards, 9.6 – mustard greens	12	3-head and stem; 7-collards, mustard greens	Do not apply more than 0.4 lb ai/acre per season for head and stem <i>Brassica</i> or 0.2 lb ai/acre per season for collards and mustard greens.
	3A	*Baythroid XL (beta-cyfluthrin)	0.8-3.2 fl oz	12	0	Maximum per crop season: 12.8 fl oz/A.
	3A	*Brigade 2 EC (bifenthrin)	2.1-6.4 fl oz	12	7	Do not apply more than 0.4 lb ai/acre for leafy or 0.5 lb ai/acre for head and stem.

Table 6.7. Insecticides labeled for management of pests of cole crops. (continued)

Labels change frequently. Be sure to read a current product label before applying any chemical.
Also refer to Table 19.1 for biopesticide and other alternative products labeled for disease management.

Insect or mite pest	MOA Code ¹	Trade Name (Active Ingredient) *Restricted	Rate (Product/acre)	REI (hours)	Days to Harvest	Remarks ²
	3A	*Declare Insecticide (gamma-cyhalothrin)	0.77-1.54 fl oz	24	1	First and second instars only. Head and stem Brassica only. Do not apply more than 12.3 fl oz per acre per season.
	3A	*Mustang (zeta-cypermethrin)	2.4-4.3 fl oz	12	1	Do not make applications less than 7 days apart. Diamondback moth populations in Florida have been found to be resistant to pyrethroids.
	3A	Pyganic 5.0 (pyrethrins)	4.5-18 oz	12	0	Harmful to bees. Can be used in greenhouses. OMRI-listed. ²
	3A	*Warrior II and generics (lambda-cyhalothrin)	0.96-1.92 fl oz	24	1	Do not apply more than 0.24 lb ai/acre or 15.36 fl oz of product/acre per season. (1)1st and 2nd instar only. For head and stem Brassica only.
	4A	Actara (thiamethoxam)	1.5-5.5 oz	12	0 -head and stem 7 - leafy	Do not use if other 4A insecticide has been applied.
	4A	Belay Insecticide; 50 WDG (clothianidin)	Insecticide: soil: 9-12 fl oz, foliar: 3-4 fl oz; 50 WDG: soil: 4.8-6.4 oz, foliar: 1.6-2.1 oz	12	Insecticide: soil: apply at planting, foliar: 7; 50 WDG: 7	Insecticide: soil: Do not apply more than 6.4 oz per acre per season. See label for application instructions. foliar: Do not apply more than 6.4 oz per acre per season. Do not use an adjuvant. Toxic to bees. 50 WDG: Includes turnip greens. Do not apply more than 0.2 lb ai/acre regardless of application method (or a total of 12 fl oz of this formulation).
	4A	Platinum; Platinum 75SG (thiamethoxam)	5.0-11 fl oz; 75G: 1.66-3.67 oz	12	30	Soil application.
	4A	Venom and Scorpion Insecticide (dinotefuran)	Soil and foliar rates different; Check label	12	foliar: 1 soil: 21	Use one application method, not both (soil or foliar). For head and stem Brassica only. Foliar: Do not apply more than 0.268 lb ai per acre per season.
	4A, 28	Durivo (thiamethoxam, chlorantraniliprole)	10-13 fl oz	12	30	May be applied via one of several different soil applications methods. One application per season within 28 days of plant emergence or transplanting.
	3A, 28	*Besiege (lambda-cyhalothrin and chlorantraniliprole)	5-9 fl oz	24	3	Highly toxic to bees exposed to direct treatment or residues on blooming crops. Head and stem Brassica only.
	4A, 28	Voliam Flexi (thiamethoxam and chlorantraniliprole)	4-7 oz	12	head and stem - 3, leafy Brassica greens - 7	Highly toxic to bees exposed to direct treatment or residues on blooming crops.
	15	Rimon 0.83 EC (novaluron)	6-12 fl oz	12	7	No more than 3 applications or 24 fl oz per acre per season. No more than 2 applications for thrips or whiteflies. Head and stem Brassica only.
	28	Exirel (cyazypyr)	13.5-20.5 fl oz	12	1	Do not apply more than 0.4 lb ai/acre of cyazypyr or cyantraniliprole containing products per crop whether applications are made to foliage or soil. See label for diamondback moth resistance management.
	28	Verimark (cyazypyr)	5-13.5 fl oz	4	N/A: applied at planting	See label for diamondback moth resistance management.
	-	Grandevo (Chromobacterium subtsugae strain PRAA4-1)	1.0-3.0 lb	4	0	Can be used in organic production. OMRI-listed ² . Leaf beetle larvae: newly hatched to second instar
Grasshoppers	-	Azatin XL (azadirachtin)	5-21 fl oz	4	0	Antifeedant, repellent, insect growth regulator.
	-	Prokil Cryolite (cryolite)	8-16 lb	12	7	For broccoli, Brussels sprouts, and cauliflower only. Do not apply more than 96 lb per season or more often than every 7 days.
	3A	*Asana XL (0.66 EC) (esfenvalerate)	2.9-9.6 fl oz – head and stem Brassicas, 5.8-9.6 oz –collards, 9.6 – mustard greens	12	3-head and stem; 7-collards, mustard greens	Do not apply more than 0.4 lb ai/acre per season for head and stem Brassica or 0.2 lb ai/acre per season for collards and mustard greens.

Table 6.7. Insecticides labeled for management of pests of cole crops. (continued)

Labels change frequently. Be sure to read a current product label before applying any chemical.
Also refer to Table 19.1 for biopesticide and other alternative products labeled for disease management.

Insect or mite pest	MOA Code ¹	Trade Name (Active Ingredient) *Restricted	Rate (Product/acre)	REI (hours)	Days to Harvest	Remarks ²
	3A	*Mustang (zeta-cypermethrin)	2.4-4.3 fl oz	12	1	Do not make applications less than 7 days apart. Diamondback moth populations in Florida have been found to be resistant to pyrethroids.
	3A, 28	*Besiege (lambda-cyhalothrin and chlorantraniliprole)	5-9 fl oz	24	3	Highly toxic to bees exposed to direct treatment or residues on blooming crops. Head and stem Brassica only.
Harlequin bug, stink bug, plant bugs	4A	Venom Insecticide (dinotefuran)	foliar: 1-4 oz soil: 5-6 oz	12	foliar: 1 soil: 21	Use one application method, not both (soil or foliar). For head and stem Brassica only. Foliar: Do not apply more than 0.268 lb ai per acre per season.
	15	*Dimilin 2L (diflubenzuron)	2-4 fl oz	12	7	Not effective against adult stage. No more than 4 applications per season. May be applied only to turnip varieties that do not produce a harvestable root.
	1A	Sevin 80S; XLR Plus, 4F (carbaryl)	80S: 0.625-2.5 lb; XLR, 4F: 0.5-2 qt	12	3 or 14, depending on specific crop	Apply no more than 7.5 lb/acre of 80S or 6 qt of 4F or XLR Plus per crop. See label for specific crops.
	3A	*Baythroid XL (beta-cyfluthrin)	0.8-3.2 fl oz	12	0	Maximum per crop season: 12.8 fl oz/A.
	3A	*Brigade 2 EC (bifenthrin)	2.1-6.4 fl oz	12	7	Do not apply more than 0.4 lb ai/acre for leafy or 0.5 lb ai/acre for head and stem.
	3A	*Danitol (fenpropathrin)	10.67-16 fl oz	24	7	Do not apply more than 42.67 fl oz per acre per season. Head and stem Brassica only.
	3A	*Declare Insecticide (gamma-cyhalothrin)	0.77-1.54 fl oz	24	1	⁽¹⁾ First and second instars only. Head and stem Brassica only. Do not apply more than 12.3 fl oz per acre per season.
	3A	*Mustang (zeta-cypermethrin)	2.4-4.3 fl oz	12	1	Do not make applications less than 7 days apart. Diamondback moth populations in Florida have been found to be resistant to pyrethroids.
	3A	Pyganic 5.0 (pyrethrins)	4.5-18 oz	12	0	Harmful to bees. Can be used in greenhouses. OMRI-listed. ²
	3A	*Warrior II (lambda-cyhalothrin)	0.96-1.92 fl oz	24	1	Do not apply more than 0.24 lb ai/acre or 15.36 fl oz of product/acre per season. ⁽¹⁾ 1 st and 2 nd instar only. For head and stem Brassica only.
	3A, 28	*Besiege (lambda-cyhalothrin and chlorantraniliprole)	5-9 fl oz	24	3	Highly toxic to bees exposed to direct treatment or residues on blooming crops. Head and stem Brassica only.
	4A	Assail 30SG (acetamiprid)	2.0-4.0 oz—head and stem cole crops, 2.0-5.3 oz—leafy cole crops and turnip greens	12	7-head and stem, 3-leafy cole crops and turnip greens	Begin applications for whiteflies when first adults are noticed. Do not apply more than 5 times per season for head and stem cole crops or 4 times per season for leafy cole crops, or apply more often than every 7 days. Turnip roots cannot be used for food/feed.
	4A	Belay Insecticide; 50 WDG (clothianidin)	Insecticide: soil: 9-12 fl oz, foliar: 3-4 fl oz; 50 WDG: soil: 4.8-6.4 oz, foliar: 1.6-2.1 oz	12	Insecticide: soil: apply at planting, foliar: 7; 50 WDG: 7	Insecticide: soil: Do not apply more than 6.4 oz per acre per season. See label for application instructions. foliar: Do not apply more than 6.4 oz per acre per season. Do not use an adjuvant. Toxic to bees. 50 WDG: Includes turnip greens. Do not apply more than 0.2 lb ai/acre regardless of application method (or a total of 12 fl oz of this formulation).
4A	Scorpion 35SL Insecticide (dinotefuran)	foliar: 2-7 fl oz, soil: 9-10.5 fl oz	12	foliar: 1 soil: 21	Head and stem Brassica only. Do not use more than 10.5 fl oz when applying to foliage or 21 fl oz when applying to soil. Use only one application method.	
Leafminers	4A	Venom Insecticide (dinotefuran)	foliar: 1-4 oz soil: 5-6 oz	12	foliar: 1 soil: 21	Use one application method, not both (soil or foliar). For head and stem Brassica only. Foliar: Do not apply more than 0.268 lb ai per acre per season.
	15	Rimon 0.83 EC (novaluron)	6-12 fl oz	12	7	No more than 3 applications or 24 fl oz per acre per season. No more than 2 applications for thrips or whiteflies. Head and stem Brassica only.

Table 6.7. Insecticides labeled for management of pests of cole crops. (continued)

Labels change frequently. Be sure to read a current product label before applying any chemical. Also refer to Table 19.1 for biopesticide and other alternative products labeled for disease management.

Insect or mite pest	MOA Code ¹	Trade Name (Active Ingredient) *Restricted	Rate (Product/acre)	REI (hours)	Days to Harvest	Remarks ²
	4A	Belay Insecticide; 50 WDG (clothianidin)	Insecticide: soil: 9-12 fl oz, foliar: 3-4 fl oz; 50 WDG: soil: 4.8-6.4 oz, foliar: 1.6-2.1 oz	12	Insecticide: soil: apply at planting, foliar: 7; 50 WDG: 7	Insecticide: soil: Do not apply more than 6.4 oz per acre per season. See label for application instructions. foliar: Do not apply more than 6.4 oz per acre per season. Do not use an adjuvant. Toxic to bees. 50 WDG: Includes turnip greens. Do not apply more than 0.2 lb ai/acre regardless of application method (or a total of 12 fl oz of this formulation).
	4A	Scorpion 35SL Insecticide (dinotefuran)	foliar: 2-7 fl oz, soil: 9-10.5 fl oz	12	foliar: 1 soil: 21	Head and stem Brassica only. Do not use more than 10.5 fl oz when applying to foliage or 21 fl oz when applying to soil. Use only one application method.
	4A	Venom Insecticide (dinotefuran)	foliar: 1-4 oz soil: 5-6 oz	12	foliar: 1 soil: 21	Use one application method, not both (soil or foliar). For head and stem Brassica only. Foliar: Do not apply more than 0.268 lb ai/acre per season.
	5	Radiant SC (spinetoram)	5-10 fl oz	4	1	Do not apply to seedlings grown for transplant. Do not make more than two consecutive applications of Group 5 insecticides.
	6	*Proclaim (emamectin benzoate)	2.4-4.8 oz	12	7 - head and stem; 14 - leafy	Do not make more than 2 sequential applications without rotating to another product with a different mode of action. Do not apply by aircraft. Not for turnips grown for roots.
	15	Rimon 0.83 EC (novaluron)	6-12 fl oz	12	7	No more than 3 applications or 24 fl oz per acre per season. No more than 2 applications for thrips or whiteflies. Head and stem Brassica only.
	17	Trigard (cyromazine)	2.66 oz	12	7	Limited to 6 applications. Includes turnip greens, not grown for roots.
Mites	28	Exirel (cyazapyr)	13.5-20.5 fl oz	12	1	Do not apply more than 0.4 lb ai/acre of cyazapyr or cyantraniliprole containing products per crop whether applications are made to foliage or soil. See label for diamondback moth resistance management.
	28	Verimark (cyazapyr)	6.75-13.5 fl oz	4	N/A: applied at planting	See label for diamondback moth resistance management.
	-	Aza-Direct (azadirachtin)	1-2 pt, up to 3.5 pt, if needed	4	0	Antifeedant, repellent, insect growth regulator. OMRI-listed ² .
	-	Azatin XL (azadirachtin)	5-21 fl oz	4	0	Antifeedant, repellent, insect growth regulator.
Whitefly	-	Suffoil-X (mineral oil)	1-2% v/v	4	0	OMRI-listed ² .
	-	Neemix 4.5 (azadirachtin)	4-16 fl oz	12	0	IGR and feeding repellent. Greenhouse and field. OMRI-listed ² .
	-	Saf-T-Side, others (Oil, insecticidal)	1-2 gal/100 gal	4	up to day of harvest	Saf-T-Side is OMRI-listed ² .
	4A	Actara (thiamethoxam)	1.5-5.5 oz	12	0 -head and stem 7 - leafy	Do not use if other 4A insecticide has been applied.
	4A	Admire Pro (imidacloprid) (see appropriate labels for other brands)	4.4-10.5 fl oz for soil application, 1.3 fl oz for foliar	12	foliar: 7 soil: 21	Do not apply more than 10.5 fl oz per acre per crop season as a soil application or 6.5 fl oz as foliar applications. Do not apply to both soil and foliage.
	4A	Assail 30SG (acetamiprid)	2.0-4.0 oz—head and stem cole crops, 2.0-5.3 oz—leafy cole crops and turnip greens	12	7-head and stem, 3-leafy cole crops and turnip greens	Begin applications for whiteflies when first adults are noticed. Do not apply more than 5 times per season for head and stem cole crops or 4 times per season for leafy cole crops, or apply more often than every 7 days. Turnip roots cannot be used for food/feed.
	4A	Belay Insecticide; 50 WDG (clothianidin)	Insecticide: soil: 9-12 fl oz, foliar: 3-4 fl oz; 50 WDG: soil: 4.8-6.4 oz, foliar: 1.6-2.1 oz	12	Insecticide: soil: apply at planting, foliar: 7; 50 WDG: 7	Insecticide: soil: Do not apply more than 6.4 oz per acre per season. See label for application instructions. foliar: Do not apply more than 6.4 oz per acre per season. Do not use an adjuvant. Toxic to bees. 50 WDG: Includes turnip greens. Do not apply more than 0.2 lb ai/acre regardless of application method (or a total of 12 fl oz of this formulation).

Table 6.7. Insecticides labeled for management of pests of cole crops. (continued)

Labels change frequently. Be sure to read a current product label before applying any chemical.
Also refer to Table 19.1 for biopesticide and other alternative products labeled for disease management.

Insect or mite pest	MOA Code ¹	Trade Name (Active Ingredient) *Restricted	Rate (Product/acre)	REI (hours)	Days to Harvest	Remarks ²
	4A	Platinum 75SG (thiamethoxam)	5.0-11 fl oz; 75G : 1.66-3.67 oz	12	30	Soil application.
	4A	Scorpion 35SL Insecticide (dinotefuran)	foliar: 2-7 fl oz, soil: 9-10.5 fl oz	12	foliar: 1 soil: 21	Head and stem Brassica only. Do not use more than 10.5 fl oz when applying to foliage or 21 fl oz when applying to soil. Use only one application method.
	4A	Venom Insecticide (dinotefuran)	foliar: 1-4 oz soil: 5-6 oz	12	foliar: 1 soil: 21	Use one application method, not both (soil or foliar). For head and stem Brassica only. Foliar: Do not apply more than 0.268 lb ai/acre per season.
	4A, 28	Durivo (thiamethoxam, chlorantraniliprole)	10-13 fl oz	12	30	May be applied via one of several different soil applications methods. One application per season within 28 days of plant emergence or transplanting.
	4A, 28	Voliam Flexi (thiamethoxam and chlorantraniliprole)	4-7 oz	12	head and stem – 3, leafy Brassica greens - 7	Highly toxic to bees exposed to direct treatment or residues on blooming crops.
	4D	Sivanto Prime (flupyradifurone)	7-14 fl oz	4	1	Maximum per crop season: 28 fl oz/acre. Maximum crop seasons per year: 3.
	7C	Knack (pyriproxyfen)	8-10 fl oz	12	7	Immatures only. Apply when nymphs first appear. Limited to 2 applications per season.
	9B	Fulfill (pymetrozine)	2.75 oz	12	7	Apply when aphids and whiteflies first appear. Provides suppression of whiteflies. Maximum of 2 applications per crop.
	15	Rimon 0.83 EC (novaluron)	6-12 fl oz	12	7	No more than 3 applications or 24 fl oz per acre per season. No more than 2 applications for thrips or whiteflies. Head and stem Brassica only.
	16	Courier 40SC (buprofezin)	9.0-13.6 fl oz	12	1	Immatures only. Do not make more than 2 applications per crop cycle or 4 applications per year.
	23	Movement (spirotetramat)	4-5 fl oz	24	1	Limited to 10 oz/acre per season. Only use a spreading-penetrating adjuvant known to be safe for the target crop.
	23	Oberon 2 SC (spiromesifen)	7.0-8.5 fl oz	12	7	Maximum amount per crop: 25.5 fl oz/acre. No more than 3 applications. Not for turnip greens.
	28	Exirel (cyazypyr)	13.5-20.5 fl oz	12	1	Do not apply more than 0.4 lb ai/acre of cyazypyr or cyantraniliprole containing products per crop whether applications are made to foliage or soil. See label for diamondback moth resistance management.
	28	Verimark (cyazypyr)	6.75-13.5 fl oz	4	N/A: applied at planting	See label for diamondback moth resistance management.
		Bealeaf 50 SG (flonicamid)	2.8 oz/A	12	0	Suppression only
	-	Aza-Direct (azadirachtin)	1-2 pt, up to 3.5 pt, if needed	4	0	Antifeedant, repellent, insect growth regulator. OMRI-listed ² .
	-	Molt-X (azadirachtin)	10 fl oz	4	0	OMRI-listed ² . Antifeedant, repellent, insect growth regulator.
	-	Azatin XL (azadirachtin)	5-21 fl oz	4	0	Antifeedant, repellent, insect growth regulator.
	-	BotaniGard ES (<i>Beauveria bassiana</i> strain GHA)	0.25-1 quart per acre. Apply in sufficient water to cover foliage, typically 5-100 gallons per acre.	4	0	May be used in greenhouses. Contact dealer for recommendations if an adjuvant must be used. Compatible as a tank mix with some fungicides.
	-	Grandevo (<i>Chromobacterium subtsugae</i> strain PRAA4-1)	1.0-3.0 lb	4	0	Can be used in organic production. OMRI-listed ² . Leaf beetle larvae: newly hatched to second instar
	-	M-Pede 49% EC (soap, insecticidal)	1-2 % V/V	12	0	OMRI-listed ² .

Table 6.7. Insecticides labeled for management of pests of cole crops. (continued)

Labels change frequently. Be sure to read a current product label before applying any chemical. Also refer to Table 19.1 for biopesticide and other alternative products labeled for disease management.

Insect or mite pest	MOA Code ¹	Trade Name (Active Ingredient) *Restricted	Rate (Product/acre)	REI (hours)	Days to Harvest	Remarks ²
Wireworms	-	Suffoil-X (mineral oil)	1-2% v/v	4	0	OMRI-listed ² .
	-	Saf-T-Side, others (Oil, insecticidal)	1-2 gal/100 gal	4	up to day of harvest	Saf-T-Side is OMRI-listed ² .
	-	Neemix 4.5 (azadirachtin)	4-16 fl oz	12	0	IGR and feeding repellent. Greenhouse and field. OMRI-listed ² .
	-	Requiem EC (extract of <i>Chenopodium ambrosioides</i>)	2-4 qt	4	0	Apply before pests reach damaging levels.
	-	Trilogy (extract of neem oil)	0.5-2% V/V	4	0	Apply morning or evening to reduce potential for leaf burn. Toxic to bees exposed to direct treatment. OMRI-listed ² .
	1B	*Diazinon AG-500, *50 W (diazinon)	AG500 preplant: 1-4 qt 50W: 2-8 lb	96	preplant	Broccoli, cabbage, cauliflower, collard, kale, mustard greens. See label for depth to incorporate.
	1B	Lorsban 75WG (chlorpyrifos)	Foliar: 0.67-1.33 lb Preplant soil: 2.66 lb for cauliflower, 3.00 lb for all others At plant or post planting: 0.8-2.15 oz/1000 feet of row. Specific rate depends on the crop.	24, 72 for cauliflower	21; pre or at planting	Do not make more than 3 applications of products containing chlorpyrifos. Will not control organophosphate-resistant diamondback moth. Preplant: Incorporate preplant applications 2- 4 inches deep.
	3A	*Capture LFR (bifenthrin)	3.4-8.5 fl oz	12	at planting	For mixing directly with liquid fertilizer to control soil insect pests.

¹ Mode of Action (MOA) codes for plant pest insecticides from the Insecticide Resistance Action Committee (IRAC) Mode of Action Classification v. 8.2, March 2017. Number codes (1 through 29) are used to distinguish the main insecticide mode of action groups, with additional letters for certain sub-groups within each main group. All insecticides within the same group (with same number) indicate same active ingredient or similar mode of action. This information must be considered for the insecticide resistance management decisions. - = unknown, or a mode of action that has not been classified yet

² Information provided in this table applies only to Florida. Be sure to read a current product label before applying any product. The use of brand names and any mention or listing of commercial products or services in the publication does not imply endorsement by the University of Florida Cooperative Extension Service nor discrimination against similar products or services not mentioned. OMRI listed: Listed by the Organic Materials Review Institute for use in organic production.

* Restricted use insecticide.

Table 6.8. Cole crop fungicides ordered by disease and FRAC group according to mode of action.

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Labels change frequently. Be sure to read a current product label before applying any chemical. Refer to Table 19.2 for biopesticide and other alternative products labeled for disease management.							
COLE CROPS							
Head and Stem Crops: Broccoli, Brussels Sprouts, Cauliflower, Chinese Broccoli and Chinese Cabbage;							
Leafy Crops: Collard, Kale, Mustard and Turnip; and Watercress							
Alternaria leaf spot (<i>Alternaria</i> spp.)	M1	(copper compounds) Many brands available: AmeriCop 40 DF, Badge SC, Badge X2, Basic Copper 53, Champ DP Dry Prill, Champ Formula 2 FL, Champ WG, Champion++, Copper-Count-N, Cueva, Cuprofix Ultra 40 Disperss, Cuproxat, Kentan DF, Kocide 2000, Kocide 3000, Kocide DF, Kop-Hydroxide, MasterCop, Nordox, Nordox 75WG, Nu-Cop 3L, Nu-Cop 50 WP, Nu-Cop 50DF, Nu-Cop HB, Nu-Cop 30 HB, Nu-Cop XLR, Previsto, Kop-Hydroxide	SEE INDIVIDUAL LABELS		1	Varies by product from 4 hr to 2 days	Mancozeb or maneb enhances bactericidal effect of fix copper compounds. Some reddening on older Broccoli leaves at higher rates and flecking on wrapper leaves of Cabbage may occur.

Table 6.8. Cole crop fungicides ordered by disease and FRAC group according to mode of action. (continued)

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Labels change frequently. Be sure to read a current product label before applying any chemical. Refer to Table 19.2 for biopesticide and other alternative products labeled for disease management.							
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo ZN, Choloronil 720, Chlorothalonil 720SC, Echo 720, Echo 90 DF, Echo Zn, Equus 500 ZN, Equus 720 SST, Equus DF, Initiate 720, Initiate ZN, Praiz	SEE INDIVIDUAL LABELS		7	1 - 2	See individual labels for crop subgrouping.
	2	Iprodione 4L AG Rovral 4F Enclosure 4 Nevado 4F (iprodione)	1pt	4 pt	10	-	Only labeled for Chinese mustard. Limit is 4 appl for mustard.
	3	Monsoon Orius 3.6F TebuStar 3.6L Tebuzol 3.6F Toledo 3.6F (tebuconazole)	4 fl oz	16 fl oz	7	0.5	Not labeled for watercress or head and stem cole crops. Apply prior to infection when environmental conditions are favorable.
	3	Procure 480 SC (triflumizole)	8 fl oz	18 fl oz	1	0.5	Not labeled for watercress or head and stem cole crops. Apply prior to infection and repeat sprays at a 14 day interval.
	4 & M5	Ridomil Gold Bravo Ridomil Gold Bravo SC (mefenoxam + chlorothalonil)	1.5 lb	See label	7	2	Not labeled for leafy cole crops or watercress. Limit is 4 applications per crop.
	7	Endura (boscalid)	9 oz	18 oz	0 (head and stem) 14 (leafy)	0.5	Not labeled for watercress; Limit is 2 appl/crop.
	7	Fontelis (penthiopyrad)	30 fl oz	72 fl oz	0	0.5	No more than 2 sequential applications.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	80 fl oz	7	0.5	Begin applications prior to disease development, and continue on a 7 – 10 day interval. Make no more than 2 sequential applications before rotating to another effective fungicide with a different mode of action.
	9 & 12	Switch 62.5WG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	No more than 2 sequential appl. before rotating to a different mode of action for at least 2 appl; 30 day plant back for off label crops.
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0 (head and stem) 3 (leafy)	4 hr	No more than 2 sequential appl/stem and head crop.
	11	Reason 500 SC (fenamidone)	8.2 fl oz	24.6 fl oz	2	0.5	Do not make more than 1 sequential application.
	11	Quadris Equation SC Satori (azoxystrobin)	15.5 fl oz	92.3 fl oz	0	4 hr	No more than 2 sequential appl. Different seasonal application limits for head and stem, and leaf green brassica subgroups.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	56 fl oz	1	0.5	No more than 1 sequential appl. Limit of 4 applications per season.
	11 & 3	Quilt (azoxystrobin + propiconazole)	14 fl oz	42 fl oz	7	0.5	
	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8.2 fl oz	24.6 fl oz	3	0.5	No more than 2 sequential applications. No more the 3 applications in a season.
	29	Omega 500F (fluazinam)	15.25 fl oz	See label	See Label	0.5	The REI is 2 days for workers conducting handset irrigation activities.
	U15 & M5	Orondis Opti (oxathiapiprolin + chlorothalonil)	40 fl oz	160 fl oz	7	0.5	Limit is no more than 2 sequential appl. Max of 4 applications per year.

Table 6.8. Cole crop fungicides ordered by disease and FRAC group according to mode of action. (continued)

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Labels change frequently. Be sure to read a current product label before applying any chemical. Refer to Table 19.2 for biopesticide and other alternative products labeled for disease management.							
Alternaria blight (<i>Alternaria</i> spp.)	7	Endura (boscalid)	9 oz	18 oz	0 (head and stem) 14 (leafy)	0.5	Not labeled for watercress; Limit is 2 appl/crop.
	9 & 12	Switch 62.5WG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	Can be applied as a preplant and surface application. Do not use in greenhouse crops or field-grown vegetable bedding plants.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	56 fl oz	1	0.5	No more than 1 sequential appl.
Anthraxnose (<i>Colletotrichum</i> spp.)	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	80 fl oz	7	0.5	Begin applications prior to disease development, and continue on a 7 – 10 day interval. Make no more than 2 sequential applications before rotating to another effective fungicide with a different mode of action. Do not exceed 80 fl oz per season.
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0 (head and stem) 3 (leafy)	4 hr	No more than 2 sequential appl/stem and head crop.
	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8.2 fl oz	24.6 fl oz	3	0.5	No more than 2 sequential applications. No more the 3 applications in a season.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	56 fl oz	1	0.5	No more than 1 sequential appl.
	11 & 3	Quilt (azoxystrobin + propiconazole)	14 fl oz	42 fl oz	7	0.5	
Black Leg (<i>Leptosphaeria maculans</i>)	2	Iprodione 4L AG Rovral 4F Enclosure 4 Nevado 4F (iprodione)	2 pt	4 pt	0	-	Only labeled for broccoli. Limit is 2 appl for broccoli.
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0 (head and stem)	4 hr	No more than 2 sequential appl/stem and head crop.
	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8.2 fl oz	24.6 fl oz	3	12 hr	No more than 2 sequential applications. No more the 3 applications in a season. Do not apply to turnip greens or roots.
Black Rot (<i>Xanthomonas campestris</i>)	M1	(copper compounds) Many brands available.	SEE INDIVIDUAL LABELS		1	Varies by product from 4 hr to 2 days	Mancozeb or maneb enhances bactericidal effect of fix copper compounds.
	P	Actigard 50 WG (acibenzolar-S-methyl)	1 oz	4 oz	7	0.5	Apply preventively; limit is 4 appl/crop on a 7-day schedule. Suppression only.
Cercospora Leaf Spot (<i>Cercospora brassicicola</i>)	3	Monsoon Orius 3.6F TebuStar 3.6L Tebuzol 3.6F Toledo 3.6F (tebuconazole)	4 fl oz	16 fl oz	7	0.5	Not labeled for watercress or head and stem cole crops. Apply prior to infection when environmental conditions are favorable.
	3	Rhyme (flutriafol)	7 fl oz		7	0.5	Use of silicone or oil based additives may result in negative crop response. In situations where an adjuvant is necessary; use of a nonionic surfactant is recommended
	3	Tilt (propiconazole)	4 fl oz	12 fl oz	7	0.5	
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	80 fl oz	7	0.5	Begin applications prior to disease development, and continue on a 7 – 10 day interval. Make no more than 2 sequential applications before rotating to another effective fungicide with a different mode of action.
	9 & 12	Switch 62.5WG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	Can be applied as a preplant and surface application. Do not use in greenhouse crops or field-grown vegetable bedding plants. Suppression only.

Table 6.8. Cole crop fungicides ordered by disease and FRAC group according to mode of action. (continued)

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Labels change frequently. Be sure to read a current product label before applying any chemical. Refer to Table 19.2 for biopesticide and other alternative products labeled for disease management.							
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0 (head and stem) 3 (leafy)	4 hr	No more than 2 sequential appl/stem and head crop.
	11	Reason 500SC (fenamidone)	8.2 oz	24.6 oz	2	0.5	Limits are no more than 1 sequential appl. Suppression only.
	11	Quadris Equation SC Satori (azoxystrobin)	15.5 fl oz	46 fl oz	0	4 hr	Labeled for leaf greens brassica. No more than 2 sequential appl.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	56 fl oz	1	0.5	No more than 1 sequential appl.
	11 & 3	Topguard EQ (azoxystrobin + flutriafol)	8 fl oz		7	0.5	Use of silicone or oil-based additives may result in negative crop response. In situations where an adjuvant is necessary; use of a nonionic surfactant is recommended
	11 & 3	Quilt (azoxystrobin + propiconazole)	14 fl oz	42 fl oz	7	0.5	
	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8.2 fl oz	24.6 fl oz	3	12 hr	No more than 2 sequential applications. No more the 3 applications in a season.
Club root (<i>Plasmodiophora brassicae</i>)	21	Ranman (cyazofamid)	SEE LABEL		-	0.5	Applied as a transplant soil drench.
	29	Omega 500F (fluazinam)	2.6 pt soil appl.; 6.45 fl oz/ 100 gal trans-plant drench	3.85 pt	20 (leafy); 50 (head and stem)	2	Not labeled for watercress. Treated turnip roots are not fit for human or livestock consumption.
Downy Mildew (<i>Perenospora parasitica</i>)	M1	(copper compounds) Many brands available: AmeriCop 40 DF, Badge SC, Badge X2, Basic Copper 53, Champ DP Dry Prill, Champ Formula 2 FL, Champ WG, Champion++, Copper-Count-N, Cueva, Cuprox Ultra 40 Disperss, Cuproxat, Kentan DF, Kocide 2000, Kocide 3000, Kocide DF, Kop-Hydroxide, MasterCop, Nordox, Nordox 75WG, Nu-Cop 3L, Nu-Cop 50 WP, Nu-Cop 50DF, Nu-Cop HB, Nu-Cop 30 HB, Nu-Cop XLR, Previsto, Kop-Hydroxide	SEE INDIVIDUAL LABELS		1	Varies by product from 4 hr to 2 days	Mancozeb or maneb enhances bactericidal effect of fix copper compounds.
	M3	(mancozeb) Many brands available: Dithane F45 Rainshield, Dithane M45, Fortuna 75WDG, Koverall, Manzate Max, Manzate Pro-Stick, Penncozeb 75DF, Penncozeb 80WP, Protect DF, Roper DF Rainshield	SEE INDIVIDUAL LABELS		10	1	Not labeled for collards, mustard, turnip or watercress. See labels for restrictions and details.
	M5	(chlorothalonil) Many brands available: Bravo Ultrex, Bravo Weather Stik, Bravo ZN, Choloronil 720, Chlorothalonil 720SC, Echo 720, Echo 90 DF, Echo Zn, Equus 500 ZN, Equus 720 SST, Equus DF, Initiate 720, Initiate ZN, Praiz	SEE INDIVIDUAL LABELS		7	2	Not labeled for leafy cole crops or watercress.
	4	Ridomil Gold SL (mefenoxam)	0.25 pt foliar	1 pt (foliar)	7	2	Not labeled for watercress; Use only in a tank mix with another effective fungicide (non FRAC code 4).

Table 6.8. Cole crop fungicides ordered by disease and FRAC group according to mode of action. (continued)

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Labels change frequently. Be sure to read a current product label before applying any chemical. Refer to Table 19.2 for biopesticide and other alternative products labeled for disease management.							
	4 & M5	Ridomil Gold Bravo, Ridomil Gold Bravo SC (mefenoxam + chlorothalonil)	1.5 lb	See label	7	2	Not labeled for leafy cole crops or watercress. Limit is 4 applications per crop.
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0 (head and stem) 3 (leafy)	4 hr	No more than 2 sequential appl/stem and head crop.
	11	Quadris Equation SC Satori (azoxystrobin)	15.5 fl oz	92.3	0	4 hr	Labeled for head and stem brassicas. No more than 2 sequential appl.
	11	Reason 500SC (fenamidone)	8.2 oz	24.6 oz	2	0.5	Limits are no more than 1 sequential appl.
	21	Ranman (Cyazofamid)	2.75 fl oz	39.5 fl oz	0	0.5	This product can be applied as a transplant soil drench. Do not make more than six appl.
	21	Actigard 50 WG (acibenzolar-S-methyl)	1 oz	4 oz	7	0.5	Apply preventively; limit is 4 appl/crop on a 7-day schedule. Suppression only.
	29	Omega 500F (fluazinam)	15.25 fl oz	See label	See Label	0.5	The REI is 2 days for workers conducting handset irrigation activities.
	33	Aliette (aluminum tris)	5 lbs	--	3	--	Do not exceed 7 applications per season.
	40	Acrobat (dimethomorph)	6.4 oz	32 oz	0	0.5	Not labeled for head and stem cole crops. Only 5 appl. per season. See supplemental label for restrictions and details.
	40	Forum (dimethomorph)	6 oz	30 oz	0	0.5	Not labeled for turnip or watercress. Only 5 appl. per season.
	40	Revus (mandipropamid)	8 fl oz	32 fl oz	1	0.5	Not labeled for turnip or watercress. Limit is no more than 2 sequential appl. or 4 total appl.
	43	Presidio (fluopicolide)	4 fl oz	16 fl oz	2	0.5	Not labeled for watercress. Limit is no more than 2 sequential appl. or 4 total appl. per season.
	45 & 40	Zapro (ametoctradin + dimthomorph)	14 fl oz	42 fl oz	0	0.5	Limit is no more than 2 sequential appl.
	U15 & M5	Orondis Opti (oxathiapiprolin + chlorothalonil)	40 fl oz	160 fl oz	7	0.5	Limit is no more than 2 sequential appl. Max of 4 applications per year.
	U15 & 40	Orondis Ultra (oxathiapiprolin + mandipropamid)	8 fl oz	32 fl oz	1	4 hr	Limit is no more than 2 sequential appl. Max of 4 applications per year.
Fusarium soilborne diseases <i>Fusarium</i> spp.	12	Maxim 4FS (fludioxonil)	0.08 to 0.16 fl oz/ 100 lb. of seed	See label	-	0.5	Seed treatment only; Not labeled for turnip or watercress.
Gray mold <i>(Botrytis cinerea)</i>	7	Endura (boscalid)	9 oz	18 oz	0 (head and stem) 14 (leafy)	0.5	Not labeled for watercress; Limit is 2 appl/crop.
	7	Fontelis (penthiopyrad)	30 fl oz	72 fl oz	0	0.5	No more than 2 sequential applications.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	80 fl oz	7	0.5	Begin applications prior to disease development. No more than 2 sequential applications before rotating to another effective fungicide with a different mode of action.
Powdery Mildew <i>(Erysiphe polygoni)</i>	M2	(sulfur) Many brands available: Cosavet DF, Cosavet DF Edge, Crusade DF, Kumulus DF, Kumulus DF, Micro Sulf, Microfine Sulfure, Microthiol Disperss, Suffa, Sulfur 90W, Thiolux	SEE INDIVIDUAL LABELS		0	-	Products are available for most cole crops; See labels for restrictions and details.

Table 6.8. Cole crop fungicides ordered by disease and FRAC group according to mode of action. (continued)

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Labels change frequently. Be sure to read a current product label before applying any chemical. Refer to Table 19.2 for biopesticide and other alternative products labeled for disease management.							
	3	Monsoon Orius 3.6F TebuStar 3.6L Tebuzol 3.6F Toledo 3.6F (tebuconazole)	4 fl oz	16 fl oz	7	0.5	Not labeled for watercress or head and stem cole crops. Apply prior to infection when environmental conditions are favorable.
	3	Procure 480 SC (triflumizole)	8 fl oz	18 fl oz	0 (leafy)	0.5	Not labeled for watercress or head and stem brassica. See label for restrictions and details.
	3	Tilt (propiconazole)	4 fl oz	12 fl oz	7	0.5	
	3	Rhyme (flutriafol)	7 fl oz		7	0.5	Use of silicone or oil based additives may result in negative crop response. In situations where an adjuvant is necessary; use of a nonionic surfactant is recommended
	7	Endura (boscalid)	9 oz	18 oz	0 (head and stem) 14 (leafy)	0.5	Limit is 2 appl/crop. Suppression Only.
	7	Fontelis (penthiopyrad)	30 fl oz	72 fl oz	0	0.5	No more than 2 sequential applications.
	9 & 12	Switch 62.5WG (cyprodinil + fludioxonil)	14 oz	56 oz	7	0.5	No more than 2 sequential appl. before rotating to a different mode of action for at least 2 appl; 30 day plant back for off label crops.
	9 & 3	Inspire Super (cyprodinil + difenoconazole)	20 fl oz	80 fl oz	7	0.5	Begin applications prior to disease development, and continue on a 7 – 10 day interval. Make no more than 2 sequential applications before rotating to another effective fungicide with a different mode of action.
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0 (head and stem) 3 (leafy)	4 hr	No more than 2 sequential appl/stem and head crop.
	11 & 3	Quadris Top (azoxystrobin + difenoconazole)	14 fl oz	56 fl oz	1	0.5	No more than 1 sequential appl.
	11 & 3	Topguard EQ (azoxystrobin + flutriafol)	8 fl oz		7	0.5	Use of silicone or oil-based additives may result in negative crop response. In situations where an adjuvant is necessary; use of a nonionic surfactant is recommended
	11 & 3	Quilt (azoxystrobin + propiconazole)	14 fl oz	42 fl oz	7	0.5	
	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8.2 fl oz	24.6 fl oz	3	12 hr	No more than 2 sequential applications. No more the 3 applications in a season.
Pythium & Phytophthora diseases (soil)	4	Ridomil Gold SL (mefenoxam)	2 pt (soil)	2 pt (soil)	7	2	Not labeled for watercress; Use only in a tank mix with another effective fungicide (non FRAC code 4).
	4	Apron XL (mefenoxam)	SEE LABEL		-	2	Seed treatment only; Not labeled for watercress. See label for details.
	4	Ultra Flourish (mefenoxam)	4 pt	4 pt	-	2	Soil applied as a preplant treatment or following transplanting.
Pythium Damping-off Pythium spp.	4	Allegiance-FL (Metalaxyl)	SEE LABEL		-	2	Seed treatment only. Primarily for commercial seed treatment.
	4	MetaStar 2E AG (Metalaxyl)	SEE LABEL		-	2	Can be applied as a preplant and surface application. Do not use in greenhouse crops or field-grown vegetable bedding plants.
	43	Presidio (fluopicolide)	4 fl oz	16 fl oz	2	-	Not labeled for watercress. Limit is no more than 2 sequential appl. or 4 total appl. per season.

Table 6.8. Cole crop fungicides ordered by disease and FRAC group according to mode of action. (continued)

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Labels change frequently. Be sure to read a current product label before applying any chemical. Refer to Table 19.2 for biopesticide and other alternative products labeled for disease management.							
<i>Phytophthora</i> spp.	4 & 11	Uniform (mefenoxam + azoxystrobin)	0.34 fl oz/100 ft of row	1.0 lb a.i.	-	-	Only one application per season.
	4	MetaStar 2E AG (Metalaxyl)	SEE LABEL		-	2	Can be applied as a preplant and surface application. Do not use in greenhouse crops or field-grown vegetable bedding plants.
	43	Presidio (fluopicolide)	4 fl oz	16 fl oz	2	-	Not labeled for watercress. Limit is no more than 2 sequential appl. or 4 total appl. per season.
Rhizoctonia rot and blight (<i>Rhizoctonia solani</i>)	7	Endura (boscalid)	9 oz	18 oz	0 (head and stem) 14 (leafy)	0.5	Limit is 2 appl/crop. Suppression Only.
	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	See Label	4 hr	No more than 2 sequential appl/stem and head crop. Labeled only for suppression in leaf greens.
	11	Quadris Equation SC Satori (azoxystrobin)	0.40 to 0.80 fl oz/100 row feet	46 fl oz	0	4 hr	Labeled only for the soilborne control on leaf green brassicas. See label for details on soilborne applications. Dynasty seed treatment is also available, check label for more information.
	12	Maxim 4FS (fludioxonil)	0.08 to 0.16 fl oz/ 100 lb. of seed		-	0.5	Seed treatment only; Not labeled for turnip or watercress.
	14	Blocker 4F Terraclor 400 Terraclor 75WP Terraclor FL (PCNB)	See label	30 lb a.i.	-	0.5	Not labeled for leafy cole crops or watercress.
	4 & 11	Uniform (mefenoxam + azoxystrobin)	0.34 fl oz/ 100 ft of row	1.0 lb a.i.	-	-	Only one application per season.
	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8.2 fl oz	24.6 fl oz	3	12 hr	No more than 2 sequential applications. No more the 3 applications in a season.
	Ring Spot (<i>Mycosphaerella brassicicola</i>)	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0	4 hr
11 & 3		Quilt (azoxystrobin + propiconazole)	14 fl oz	42 fl oz	7	0.5	
11 & 7		Priaxor (pyraclostrobin + fluxapyroxad)	8.2 fl oz	24.6 fl oz	3	12 hr	No more than 2 sequential applications. No more the 3 applications in a season.
Sclerotinia rot (<i>Sclerotinia</i> spp.)	7	Endura (boscalid)	9 oz	18 oz	0 (head and stem) 14 (leafy)	0.5	Not labeled for watercress; Limit is 2 appl/crop.
	7	Fontelis (penthiopyrad)	30 fl oz	72 fl oz	0	0.5	No more than 2 sequential applications.
White rust (<i>Albugo candida</i>)	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0 (head and stem) 3 (leafy)	4 hr	No more than 2 sequential appl.
	11	Quadris Equation SC Satori (azoxystrobin)	15.5 fl oz	46 fl oz	0	4 hr	Not labeled for watercress; No more than 1 sequential appl.
	11	Reason 500SC (fenamidone)	8.2 oz	24.6 oz	2	0.5	Limits are no more than 1 sequential appl.

Table 6.8. Cole crop fungicides ordered by disease and FRAC group according to mode of action. (continued)

Pertinent Diseases or Pathogens	Fungicide Group ¹	Chemical (active ingredients)	Max. Rate/Acre		Min. Days to		Remarks ²
			Applic.	Season	Harvest	Reentry	
Labels change frequently. Be sure to read a current product label before applying any chemical. Refer to Table 19.2 for biopesticide and other alternative products labeled for disease management.							
	11 & 3	Topguard EQ (azoxystrobin + flutriafol)	8 fl oz		7	0.5	Use of silicone or oil-based additives may result in negative crop response. In situations where an adjuvant is necessary; use of a nonionic surfactant is recommended
	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8.2 fl oz	24.6 fl oz	3	12 hr	No more than 2 sequential applications. No more the 3 applications in a season.
White leaf spot (<i>Pseudocercospora capsellae</i>)	11	Cabrio EG (pyraclostrobin)	16 oz	64 oz	0	4 hr	Not labeled for collards, kale, mustard or watercress; No more than 2 sequential appl/stem and head crop.
	11 & 7	Priaxor (pyraclostrobin + fluxapyroxad)	8.2 fl oz	24.6 fl oz	3	12 hr	No more than 2 sequential applications. No more the 3 applications in a season.

¹ FRAC code (fungicide group): Number (1 through 46) and letters (U and P) are used to distinguish the fungicide mode of action groups. All fungicides within the same group (with same number or letter) indicate same active ingredient or similar mode of action. This information must be considered for the fungicide resistance management decisions. U = unknown, or a mode of action that has not been classified yet and is typically associated with another number; P = host plant defense inducers. Source: FRAC Code List 2018; <http://www.frac.info/> (FRAC = Fungicide Resistance Action Committee).

² Information provided in this table applies only to Florida. Be sure to read a current product label before applying any chemical. The use of brand names and any mention or listing of commercial products or services in the publication does not imply endorsement by the University of Florida Cooperative Extension Service nor discrimination against similar products or services not mentioned.

Table 6.9. Non-fumigant nematicides for crucifer / cole crops in Florida. (continued)

Product	Application Directions
Mocap 15G (a.i. ethoprop)	Apply 13 pounds per acre (36 inch row spacing) or 0.9 pounds per 1,000 linear feet of row in a band of 15 inches wide on the row at-planting. Mix with the top 2 to 4 inches of soil with mechanical equipment right after application. If broadcast, apply 34 lbs/acre from 1 week before planting to at planting time and mix with 2-4 inches of soil. DO NOT use as a seed furrow treatment or allow granules to contact the seed. Only 1 application per season
Nimitz (a.i. fluensulfone)	All applications must be incorporated either physically or via drip or overhead irrigation. Make preplant applications at a rate of 3.5 to 7 pints, (56.0 to 80.0 fl. oz.) per acre, a minimum of thirty days before planting. Do not plant any unlisted crops into treated land for 365 days after application of the product. Do not apply more than one application per crop, and no more than 112 fl. oz. of product per acre, per year (365 days). Provides control only for nematodes. Growers applying Nimitz must consult the product label to observe the plant-back (recropping) intervals for a variety of leafy vegetables and brassica crops, onions, bananas, sugarcane, and other crops.
Velum (a.i. fluopyram)	Apply max 6.84 fl oz/acre using only Chemigation into root-zone through low-pressure drip, trickle, micro-sprinkler or equivalent equipment. Observe minimum 5-day interval between soil applications. Do not apply more than 13.7 fl oz of Velum (0.446 lbs Fluopyram) per acre per year, regardless of formulation (Velum and/or Luna) or method of application (soil or foliar). For soil application, to limit the potential for development of disease resistance to this chemical class, the first foliar fungicide application after Velum should be a product from a different FRAC group.

Mocap is an insecticide/nematicide; Velum is a fungicide/nematicide; Nimitz is a true nematicide. Unlike fumigants, these products are not volatile and will move through the soil via water; depending on the water solubility, these products will have different recommendations as far as how to best apply them (see specific label recommendations); when nematode pressure is high, they may not be as consistently effective against root nematodes as the fumigants.

Table 6.10. Fumigant nematicides for crucifer / cole crops in Florida.

Nematicide	Broadcast Application ¹		In the Row Applications
	Gallons or Lbs Per acre	Fl oz /1000 ft / chisel spaced 12" apart	
Telone II ^{2,3}	9 to 12 gal	26 to 35	For any row spacing, application rates given may be concentrated in the row, but shall never exceed the labeled maximum for broadcast applications. Consult the product label for additional detail.
Telone C-17 ^{2,3}	10.8 to 17.1 gal	31.8 to 50.2	For any row spacing, application rates given may be concentrated in the row, but shall never exceed the labeled maximum for broadcast applications. Consult the product label for additional detail.
Telone C-35 ^{2,3}	13 to 20.5 gal	38 to 60	For any row spacing, application rates given may be concentrated in the row, but shall never exceed labeled maximum for broadcast applications. Consult the product label for additional detail.
Pic-Clor 60	19 to 31.5	57 to 90	For any row spacing, application rates should never exceed the labeled maximum for broadcast applications. Consult the product label for additional detail.
Vapam HL	75 gal	-	For drip or in-row chisel fumigation, consult product label for proportionately reduced overall rates, drip concentration and flow modifying directions and procedures.
KPam HL	60 gal	-	For drip or in-row chisel fumigation, consult product label for proportionately reduced overall rates, drip concentration and flow modifying directions.
Allyl isothiocyanate (AITC) Dominus	40 gal	-	For drip or in-row fumigation and crop termination, consult product label for proportionately reduced overall rates, drip concentration and flow modifying directions

¹ Gallons /acre and Fl oz / 1000 feet provided only for mineral soils. Higher rates may be possible for heavier textured (loam, silt, clay) or highly organic soils.

² All of the fumigants mentioned are for retail sale and use only by state certified applicators or persons under their direct supervision. New supplemental labeling for the Telone products must be in the hands of the user at the time of application. See new product label details for additional use restrictions based on soil characteristics, buffer zones, requirements for Personal Protective Equipment (PPE), mandatory good agricultural practices (GAP's), product and applicator training certification, and other rate modifying recommendations.

³ Higher application rates are possible in the presence of cyst-forming nematodes.

Rates are believed to be correct for products named, and similar products of other brand names, when applied to mineral soils. Higher rates are required for muck (organic) soils. However, the **grower** has the final responsibility to see that each product is used legally; **read the label** of the product to be sure that you are using it properly.