

# 5. Cucumbers

Products registered for greenhouse cucumber insect and mite pests are listed in Table 5–1.

Products registered for greenhouse cucumber diseases are listed in Table 5–2.

**Table 5–1.** Products registered for greenhouse cucumber insect and mite pests

For more information on pesticide application, visit [www.sprayers101.com](http://www.sprayers101.com) — search keywords “greenhouse” or “airblast 101.”

<b>LEGEND:</b> PHI = pre-harvest interval (in days)      NS = no information was provided on the product label      REI = re-entry interval * = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.					
IRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>APHIDS</b>					
1B	dichlorvos	DDVP 20% EC	6 mL/1 L water	7	Spray foliage to the point of run-off (approximately 5 L/100 m <sup>2</sup> ). Thoroughly ventilate premises before re-entering on the day following treatment. <b>REI: 24 hr</b>
	naled	Dibrom	9.6 mL/100 m <sup>3</sup>	2	Vapour treatment. Do not exceed 3 applications per crop cycle (including one postharvest). Minimum interval between applications is 7 days. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. <b>REI: 48 hr (must be fully ventilated before re-entry)</b>
4A	imidacloprid	Intercept 60 WP	16 g/80 L water/ 1,000 mature plants	1	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Do not exceed 1 application per season. Applications should be made when infestation pressure surpasses threshold and beneficials are not able to maintain pest populations below damage thresholds. May harm pollinators and certain beneficial insects. <b>REI: NS</b>
4D	flupyradifurone	Altus	<b>Foliar:</b> 500–750 mL/ha <b>Drench:</b> 750–1,000 mL/ha (7.5–10 mL/100 m <sup>2</sup> )	1	Thorough, uniform coverage of the crop is required for optimum control. Use the higher rate for higher pest infestation levels. Minimum application volume is 500 L per hectare.  Foliar: Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off.  Drench: Application to soil or soilless media should be made with sufficient water to ensure incorporation into the root zone. Follow with moderate irrigation. Irrigate carefully within the next 10 days to avoid loss of active ingredient due to leaching.  Minimum interval between applications is 7 days. Do not exceed 2,000 mL per hectare per crop cycle. May cause some leaf yellowing and/or mottling. <b>REI: 12 hr</b>

<sup>1</sup> See Appendix F for IRAC group definitions.

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<b>APHIDS (cont'd)</b>					
9B	pymetrozine	Endeavor 50 WG	100–200 g (50–100 g a.i.) in a minimum of 1,000 L water/ha	3	<b>Green peach aphid (<i>Myzus persicae</i>), melon aphid (<i>Aphis gossypii</i>)</b> Do not exceed 2 applications per crop cycle or 3 applications per year in greenhouses with multiple crop cycles. Apply as a foliar spray. Minimum interval between applications is 7 days. On hard-to-wet plants, label recommends adding a non-ionic or organosilicone-based surfactant to improve coverage. <b>REI: 12 hr</b>
23	spirotetramat	Kontos	30–42 mL/100 L water <b>Maximum use rate per single application:</b> 300 mL/ha (72 g a.i./ha)	3	Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712–1,000 L per hectare (42–30 mL concentration). Use the higher concentration for higher pest infestation levels. Repeat application every 7–14 days. Do not exceed 900 mL per hectare (216 g a.i./ha) per crop cycle. Do not exceed 3 applications per crop cycle. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. <b>REI: 12 hr</b>
29	flonicamid	Beleaf 50 SG	<b>Foliar:</b> 0.3 g/L water <b>Drip:</b> 12.5 mg/plant	0	Apply before populations reach economic thresholds or as populations begin to increase, but before damaging populations become established. Minimum interval between applications is 7 days. Do not exceed 2 applications per crop cycle (no more than 1 application per crop cycle may be foliar).  Foliar application method: Apply sufficient volume to ensure good coverage, up to 1,000 L/ha. The maximum volume should be used when plant foliage is dense. Do not exceed 1 foliar application per crop cycle.  Drip application method: Apply through drip (trickle) irrigation systems or drench by hand using sufficient water volume to ensure delivery of the product to the roots. Do not apply this product through any other type of irrigation system.  <b>REI: 12 hr</b>

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IRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>APHIDS (cont'd)</b>					
UNF	<i>Beauveria bassiana</i> strain ANT-03	Bio-Ceres G WB*	2–4 g/L water	0	Reduces pest numbers. Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L per hectare of spray volume will typically be required. This product is most effective when used early, before high insect populations develop. Repeat application within 7 days. This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
		Bio-Ceres G WP*			
	<i>Beauveria bassiana</i> strain GHA	BotaniGard 22WP	250–500 g/400 L	0	Foliar application method: Spray to wet but not to the point of run-off. Repeat application every 5–10 days. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores.  Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including <i>Aphidius colemani</i> , <i>Amblyseius swirskii</i> , <i>Encarsia formosa</i> and <i>Eretmocerus eremicus</i> . Do not release <i>Orius insidiosus</i> in the presence of bee-vectored BotaniGard 22WP. See label for more details. <b>REI: Foliar: 4 hr; Bee-vectored: 0</b>
<i>Beauveria bassiana</i> PPRI 5339	Velifer	450–900 mL/1,000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. <b>REI: 4 hr</b>	

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<b>APHIDS (cont'd)</b>						
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. <b>REI: NS</b>	
	mineral oil	Purespray Green Spray Oil 13E*	10 L/ 1,000 L water (1% solution)/ha	NS	Deters feeding. Apply when pest first appears. Repeat application every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. <b>REI: 12 hr</b>	
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	1 part concentrate: 50 parts water	0	Spray early in the morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. <b>REI: NS</b>
		Neudosan Commercial*				
		Opal Insecticidal Soap*				
Opal2 Insecticidal Soap*						
Safer's Insecticidal Soap Concentrate*	Insects must be sprayed directly to achieve proper control. Repeat applications as required. <b>REI: NS</b>					
<b>BANANA MOTH (<i>Opogona sacchari</i>)</b>						
11A	<i>Bacillus thuringiensis</i> subsp. <i>kurstaki</i> strain EVB113-19	Bioprotec 3P DF*	0.8 kg/1,000 L water	0	Foliar application. Make application just prior to egg hatch. Apply the product such that it flows along the stem, coating it well. Thorough coverage of foliage and stems is necessary (minimum of 300 L water/ha). Repeat application every 7 days as needed. <b>REI: NS</b>	
		Bioprotec CAF*	1.6 L/1,000 L water			
<b>BEE T ARMYWORM (<i>Spodoptera exigua</i>)</b>						
11A	<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i> strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	Treat when larvae are young (early instars), before the crop is damaged. Use sufficient spray volume to ensure thorough coverage, but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. <b>REI: Re-enter into treated areas only after the spray has dried.</b>	

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<b>IRAC Group<sup>1</sup></b>	<b>Common Name/ Active Ingredient</b>	<b>Trade Name/ Formulation</b>	<b>Rate</b>	<b>PHI</b>	<b>Remarks</b>
<b>CORN EARWORM (tomato fruitworm) (<i>Helicoverpa (=Heliothis) zea</i>)</b>					
11A	<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i> strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	Treat when larvae are young (early instars), before the crop is damaged. Use sufficient spray volume to ensure thorough coverage, but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
<b>DUPONCHELIA FOVEALIS</b>					
11A	<i>Bacillus thuringiensis</i> subsp. <i>kurstaki</i> strain ABTS-351	DiPel 2X DF*	625 g/1,000 L	0	Make applications when egg hatch is essentially complete, when larvae are small, but before crop damage occurs. Apply the product such that it flows along the stem, coating it well. Thorough coverage of foliage and stem is necessary. <b>REI: NS</b>
	<i>Bacillus thuringiensis</i> subsp. <i>kurstaki</i> strain EVB113-19	Bioprotec 3P DF* Bioprotec CAF*	0.8 kg/1,000 L water 1.6 L/1,000 L water	0	Foliar application. Make application when egg hatch is essentially complete, but before crop damage occurs. Apply the product such that it flows along the stem, coating it well, and into the top layer of the soil around the base of the plant. Thorough coverage of foliage and stems is necessary. Repeat application every 7 days as needed. <b>REI: NS</b>
<b>EARWIGS</b>					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap* Safer's Insecticidal Soap Concentrate*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. <b>REI: NS</b>
<b>EUROPEAN CORN BORER (<i>Ostrinia nubilalis</i>)</b>					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not apply by a fogger or mister. <b>REI: 12 hr</b>
	spinosad	Entrust 80 WG*	30 g/1,000 L water	2	Maximum application volume that can be used is 2,000 L per hectare. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. <b>REI: 12 hr</b>
		Entrust SC*	100 mL/1,000 L water		
Success	50 mL/1,000 L water				

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<b>FUNGUS GNATS</b>					
11A	<i>Bacillus thuringiensis</i> subsp. <i>israelensis</i> , serotype H-14, strain AM 65-52	VectoBac 600L	<b>Light to moderate infestation:</b> 2–4 L/1,000 L water <b>Heavy infestation:</b> 4–8 L/1,000 L water	NS	Apply weekly as a soil drench or when pest monitoring indicates the need. This product is a larvicide and will not control adult gnats. <b>REI: NS</b>
<b>LEAFHOPPERS</b>					
4D	flupyradifurone	Altus	<b>Foliar:</b> 500–750 mL/ha <b>Drench:</b> 750–1,000 mL/ha (7.5–10 mL/100 m <sup>2</sup> )	1	Thorough, uniform coverage of the crop is required for optimum control. Use the higher rate for higher pest infestation levels. Minimum application volume is 500 L per hectare. Foliar: Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Drench: Application to soil or soilless media should be made with sufficient water to ensure incorporation into the root zone. Follow with moderate irrigation. Irrigate carefully within the next 10 days to avoid loss of active ingredient due to leaching. Minimum interval between applications is 7 days. Do not exceed 2,000 mL per hectare per crop cycle. May cause some leaf yellowing and/or mottling. <b>REI: 12 hr</b>
<b>LEAFMINERS</b>					
6	abamectin	Avid 1.9% EC	30 mL/100 L water	3	<b>Liriomyza spp.</b> Application should be made preferably in 2,000–4,000 L water/ha. Do not exceed 1,200 mL or apply less than 600 mL product per hectare per application. Use in sufficient water to obtain uniform coverage. Make no more than 5 applications per crop cycle. Do not exceed 6,000 mL product per hectare per crop cycle. Do not apply through any type of irrigation system. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
<b>LEAFROLLERS</b>					
1B	naled	Dibrom	9.6 mL/100 m <sup>3</sup>	2	Vapour treatment. Do not exceed 3 applications per crop cycle (including 1 postharvest). Minimum interval between applications is 7 days. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. <b>REI: 48 hr (must be fully ventilated before re-entry)</b>

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<b>LOOPERS</b>					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	<b>Cabbage looper (<i>Trichoplusia ni</i>)</b> Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not apply by a fogger or mister. <b>REI: 12 hr</b>
	spinosad	Entrust 80 WG*	72 g/1,000 L water	2	<b>Cabbage looper (<i>Trichoplusia ni</i>)</b> Maximum application volume that can be used is 1,000 L per hectare. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. <b>REI: 12 hr</b>
		Entrust SC*	240 mL/1,000 L water		
		Success	120 mL/1,000L water		
11A	<i>Bacillus thuringiensis</i> subsp. <i>kurstaki</i> strain ABTS-351	DiPel 2X DF*	75–150 g/250 L	0	<b>Alfalfa looper (<i>Autographa californica</i>), Cabbage looper (<i>Trichoplusia ni</i>), Chrysodeixis spp.</b> Apply at egg hatch to target young larvae (early instars). For best control, thorough coverage is required. Under heavy population pressure, or for larger larvae, shorten the spray interval or use a rate at the higher end of the range. Repeat application every 3–14 days. <b>REI: NS</b>
		Foray 48BA	0.6–1.8 L/ 500–1,000 L water/ha (60–180 mL/1,000 m <sup>2</sup> )	NS	<b>Cabbage looper (<i>Trichoplusia ni</i>)</b> Apply using a high volume spray. Repeat application every 10 days when loopers first appear. Larvae should be treated when they are newly hatched. <b>REI: NS</b>
	<i>Bacillus thuringiensis</i> subsp. <i>kurstaki</i> strain EVB113-19	Bioprotec 3P DF*	0.92 kg/1,000 L water	0	<b>Cabbage looper (<i>Trichoplusia ni</i>)</b> Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. <b>REI: NS</b>
	<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i> strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	<b>Cabbage looper (<i>Trichoplusia ni</i>), tomato looper (<i>Chrysodeixis chalcites</i>)</b> Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
28	chlorantraniliprole	Coragen	125 mL/1,000 L	1	<b>Cabbage looper (<i>Trichoplusia ni</i>)</b> Begin applications when treatment thresholds have been reached. Thorough coverage is required to obtain optimum control. Repeat applications if monitoring indicates it is necessary. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not exceed a total of 750 mL product per hectare per crop cycle. The maximum finished spray volume is 2,000 L/ha. <b>REI: 12 hr</b>

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<b>LOOPERS (cont'd)</b>					
28	cyantraniliprole	Exirel	250 mL/ha	0	<b>Cabbage looper (<i>Trichoplusia ni</i>)</b> Thorough coverage is required to obtain optimum control. Select a spray volume appropriate for the size of plants and density of foliage. Do not apply in irrigation water. Use of mist blowers, thermal foggers, ultra-low volume (ULV) and electrostatic sprayers is not permitted. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and certain beneficial insects. <b>REI: 12 hr</b>
NC	<i>Autographa californica</i> <i>Nucleopolyhedrovirus</i> FV11	Loopex*	50–200 mL/400 L water	0	<b>Cabbage looper (<i>Trichoplusia ni</i>)</b> Application timing should target small larvae and be applied using high-volume spray systems (minimum 400 L/ha). Uniform spray deposit coverage of the foliage is essential for optimum control. Repeat applications every 7–14 days as needed. <b>REI: Re-enter into treated areas only after mists have settled.</b>
<b>LYGUS BUGS (TARNISHED PLANT BUG)</b>					
15	novaluron	Rimon	835 mL/ha	1	For control of nymphs of Lygus bugs including <i>Lygus lineolaris</i> . Apply when the majority of the population is at egg hatch to the second instar. Apply in a maximum spray volume of 935 L water per hectare. Use higher spray volumes when foliage canopy is dense and pest pressure is high. Repeat application every 7–10 days as needed. Do not exceed 3 applications per crop cycle. Toxic to certain beneficial insects (e.g. predatory mites, parasitoid wasps) and may be toxic to bee colonies exposed to direct treatment, drift, or residues on flowering crops or weeds. <b>REI: 12 hr</b>
29	flonicamid	Beleaf 50 SG	<b>Foliar:</b> 0.3 g/L water <b>Drip:</b> 12.5 mg/plant	0	Apply before populations reach economic thresholds or as populations begin to increase, but before damaging populations become established. Minimum interval between applications is 7 days. Do not exceed 2 applications per crop cycle (no more than 1 application per crop cycle may be foliar).  Foliar application method: Apply sufficient volume to ensure good coverage, up to 1,000 L per hectare. The maximum volume should only be used when plant foliage is dense. Do not exceed 1 foliar application per crop cycle.  Drip application method: Apply through drip (trickle) irrigation systems or drench by hand using sufficient water volume to ensure delivery of the product to the roots. Do not apply this product through any other type of irrigation system.  <b>REI: 12 hr</b>

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<b>MEALYBUGS</b>					
1B	naled	Dibrom	9.6 mL/100 m <sup>3</sup>	2	Vapour treatment. Do not exceed 3 applications per crop cycle (including one postharvest). Minimum interval between applications is 7 days. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. <b>REI: 48 hr (must be fully ventilated before re-entry)</b>
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. <b>REI: NS</b>
	potassium salts of fatty acids	Opal2 Insecticidal Soap Safer's Insecticidal Soap Concentrate	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as required. <b>REI: NS</b>
<b>MITES</b>					
1B	naled	Dibrom	9.6 mL/100 m <sup>3</sup>	2	<b>Two-spotted spider mite (<i>Tetranychus urticae</i>)</b> Vapour treatment. Do not exceed 3 applications per crop cycle (including one postharvest). Minimum interval between applications is 7 days. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. <b>REI: 48 hr (must be fully ventilated before re-entry)</b>
6	abamectin	Avid 1.9% EC	30 mL/100 L water	3	<b>Two-spotted spider mite (<i>Tetranychus urticae</i>)</b> Application should be made preferably in 2,000–4,000 L water per hectare. Do not apply more than 1,200 mL or less than 600 mL product per hectare per application. Use in sufficient water to obtain uniform coverage. Do not exceed 5 applications per crop cycle. Apply no more than 6,000 mL product per hectare per crop cycle. Do not apply through any type of irrigation system. <b>REI: Re-enter into treated areas only after residues have dried.</b>
12B	fenbutatin oxide	Vendex 50W	50 g/100 L water	3	<b>Two-spotted spider mite (<i>Tetranychus urticae</i>)</b> Begin applications when mites appear and repeat as necessary to maintain control. Thorough coverage of all foliage, especially the under-surface of leaves, is essential. The addition of a suitable spreader-sticker will usually result in better mite control. Not highly injurious to beneficial mites and is non-toxic to honeybees. <b>REI: 12 hr; 48 hr for high foliar-contact activities.</b>
		Vendex 50WP			

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IRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>MITES (cont'd)</b>					
13	chlorfenapyr	Pylon	20–30 mL/100 L water	0	<b>Two-spotted spider mite (<i>Tetranychus urticae</i>), Broad mite (<i>Polyphagotarsonemus latus</i>)</b> Do not exceed 1 application per crop cycle. Do not apply using a spray volume greater than 1,000 L per hectare. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. Do not use on tomato varieties with a diameter of less than 2.5 cm when mature. This product is toxic to bees and certain beneficial insects. <b>REI: 12 hr</b>
20B	acequinocyl	Shuttle 15 SC	0.21–0.46 L/500 L water (0.07–0.15 g a.i./L of solution)	1	<b>Two-spotted spider mite (<i>Tetranychus urticae</i>)</b> Apply as a full coverage spray to the foliage. Thorough coverage is essential for effective control. Actual spray volume will vary, depending on the size of the plants being sprayed. Application should be made as soon as the mite population reaches economic infestation levels. Apply the higher concentration for heavy pest infestations. Minimum interval between applications is 21 days. Do not exceed 2 applications per crop cycle (0.69 kg a.i./ha). <b>REI: 12 hr</b>
20D	bifenazate	Floramite SC	125 mL (30 g a.i.)/ 400 L water	1	<b>Two-spotted spider mite (<i>Tetranychus urticae</i>)</b> Apply as a full coverage spray to the foliage to obtain uniform coverage. Actual spray volume will vary depending on the size of the plants being treated. Application should be made as soon as mites appear and will provide residual control for up to 28 days. Do not exceed 2 applications per crop cycle. After 1 application of this product rotate to products of an alternate chemical class. This product is primarily active on the motile stages of mites. It is not effective against rust mites, broad mites and flat mites. <b>REI: 12 hr</b>
21A	pyridaben	Dyno-Mite WP SanMite WP	284 g/1,000 L water/ha	2	<b>Two-spotted spider mite (<i>Tetranychus urticae</i>)</b> Do not exceed 2 applications per crop cycle. Minimum interval between applications is 28 days. Do not apply this product through any type of irrigation system. Do not apply as a fog. <b>REI: 12 hr</b>
	fenpyroximate	FujiMite		7	<b>Two-spotted spider mite (<i>Tetranychus urticae</i>)</b> Apply when pests are in immature stages or when populations reach economic thresholds. Apply in a minimum spray volume of 1,000 L per hectare to ensure thorough coverage of the foliage. Do not exceed 1 application per crop cycle. Toxic to certain beneficial insects. <b>REI: 12 hr</b>
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	<b>Two-spotted spider mite (<i>Tetranychus urticae</i>)</b> Under high pest population pressure, repeat application every 10–14 days as needed. Do not exceed 2 applications per crop cycle. Avoid applying during the warmest part of the day. Mite juvenile stages are often more susceptible than adults. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. <b>REI: 12 hr</b>

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IRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks	
<b>MITES (cont'd)</b>						
UNF	<i>Beauveria bassiana</i> PPRI 5339	Velifer	450–900 mL/1,000 L water	0	<b>Two-spotted spider mite (<i>Tetranychus urticae</i>)</b> Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3-10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. <b>REI: 4 hr</b>	
	<i>Metarhizium anisopliae</i> strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Repeat application every 5–10 days as needed. Spray to wet all foliage, but not to the point of run-off. Do not apply through a thermal pulse fogger. <b>REI: Re-enter into treated areas only after the spray has dried.</b>	
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of mite presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Mites, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. <b>REI: NS</b>	
	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	For suppression. Apply when pest first appears. Repeat applications every 7–14-days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. <b>REI: 12 hr</b>	
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	1 part concentrate: 50 parts water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. <b>REI: NS</b>
		Neudosan Commercial*				
		Opal Insecticidal Soap*				
Opal2 Insecticidal Soap*						
Safer's Insecticidal Soap Concentrate*						
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap*	5 L/100 L water	1	<b>Two-spotted spider mite (<i>Tetranychus urticae</i>)</b> Spray all plant parts once weekly for 2–3 weeks, and thereafter as required. If possible, foliage should be misted daily with water until mite control is achieved. <b>REI: NS</b>	

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<b>IRAC Group<sup>1</sup></b>	<b>Common Name/ Active Ingredient</b>	<b>Trade Name/ Formulation</b>	<b>Rate</b>	<b>PHI</b>	<b>Remarks</b>
<b>PSYLLIDS</b>					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap Safer's Insecticidal Soap Concentrate*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. <b>REI: NS</b>
<b>SCALE</b>					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. <b>REI: NS</b>
<b>THRIPS</b>					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	<b>Western flower thrips (<i>Frankliniella occidentalis</i>)</b> For suppression. Use the higher rate when insect populations are high and/or insects are large. Apply when western flower thrips first appear. Do not exceed 3 applications per crop cycle, with a minimum of 7 days between applications. Do not apply by a fogger or mister. <b>REI: 12 hr</b>
	spinosad	Entrust 80 WG*	30 g/1,000 L water	2	<b>Western flower thrips (<i>Frankliniella occidentalis</i>)</b> For suppression. Maximum application volume that can be used is 2,000 L per hectare. Apply when western flower thrips first appears. Do not apply by a fogger or mister. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. <b>REI: 12 hr</b>
		Entrust SC*	100 mL/1,000 L water		
		Success	50 mL/1,000 L water		
28	cyantranilprole	Exirel	500–1,000 mL/ha	0	For suppression. Thorough coverage is required to obtain optimum control. Use the higher listed rate and higher spray volumes for large plants or dense foliage. If thrips populations are above thresholds, use a registered knockdown product before application. Do not apply in irrigation water. Use of mist blowers, thermal foggers, ultra-low volume (ULV) and electrostatic sprayers is not permitted. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and certain beneficial insects. <b>REI: 12 hr</b>
29	flonicamid	Beleaf 50 SG	<b>Foliar:</b> 0.3 g/L water <b>Drip:</b> 12.5 mg/plant	0	Minimum interval between applications is 7 days. Do not exceed 2 applications per crop cycle (no more than 1 application per crop cycle may be foliar). Foliar application method: Apply sufficient volume to ensure good coverage, up to 1,000 L per hectare. The maximum volume should be used when plant foliage is dense. Do not apply more than 1 foliar application per crop cycle. Drip application method: Apply through drip (trickle) irrigation systems or drench by hand using sufficient water volume to ensure delivery of the product to the roots. Do not apply this product through any other type of irrigation system. <b>REI: 12 hr</b>

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<b>THRIPS (cont'd)</b>					
UNF	<i>Beauveria bassiana</i> strain ANT-03	Bio-Ceres G WB*	2–4 g/L water	0	Reduces pest numbers. Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L per hectare of spray volume will typically be required. This product is most effective when used before high insect populations develop. Repeat application every 3–5 days as needed. This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
		Bio-Ceres G WP*			
	<i>Beauveria bassiana</i> strain GHA	BotaniGard 22WP	500–1,000 g/400 L	0	Foliar application method: Spray to wet but not to the point of run-off. Repeat application every 5–10 days. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores.  Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including <i>Aphidius colemani</i> , <i>Amblyseius swirskii</i> , <i>Encarsia formosa</i> , and <i>Eretmocerus eremicus</i> . Do not release <i>Orius insidiosus</i> in the presence of bee-vectored BotaniGard 22WP. See label for more details. <b>REI: Foliar: 4 hr; Bee-vectored: 0</b>
	<i>Beauveria bassiana</i> PPRI 5339	Velifer	450–900 mL/1,000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3–10 days Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. <b>REI: 4 hr</b>
	<i>Metarhizium anisopliae</i> strain F52	Met52 EC	<b>Foliar:</b> 0.5–5 L/1,000 L  <b>Drench:</b> 108 mL/10 L	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. The need for and timing of re-application should be determined by monitoring. Repeat application in 5–10 days as needed. Spray to wet all foliage but not to the point of run-off. Do not apply through a thermal pulse fogger.  Drench application method: May reduce pest numbers. Drench application should be thoroughly watered-in without causing water to come out of the bottom of the pots/grow bags. Depending on the growing media type and moisture, this will be around 250 mL/4-L pot or grow bag. Re-apply as required. The need for and timing of re-application should be determined by monitoring. Do not apply via drip irrigation. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
NC	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	For suppression. Apply when pest first appears. Repeat application every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. <b>REI: 12 hr</b>

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<b>TOMATO HORNWORM (<i>Manduca quinquemaculata</i>)</b>					
11A	<i>Bacillus thuringiensis</i> subsp. <i>kurstaki</i> strain EVB113-19	Bioprotec 3P DF*	0.46–0.92 kg/ 1,000 L water	0	Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. <b>REI: NS</b>
<b>WHITEFLIES</b>					
1B	dichlorvos	DDVP 20% EC	6 mL/1 L water	7	Spray foliage to the point of run-off (approximately 5 L/100 m <sup>2</sup> ). Thoroughly ventilate premises before re-entering on the day following treatment. <b>REI: 24 hr</b>
	naled	Dibrom	9.6 mL/100 m <sup>3</sup>	2	Vapour treatment. Do not exceed 3 applications per crop cycle (including one postharvest). Minimum interval between applications is 7 days. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. <b>REI: 48 hr (must be fully ventilated before re-entry)</b>
3A	permethrin	Ambush 50 EC	20 mL/100 L water	1	<b>Greenhouse whitefly (<i>Trialeurodes vaporariorum</i>)</b> Apply to cover all foliage thoroughly. Repeat application as necessary to maintain control. <b>REI: NS</b>
		Pounce 384 EC	260 mL/1,000 L water	1	<b>Greenhouse whitefly (<i>Trialeurodes vaporariorum</i>)</b> Apply to cover all foliage thoroughly. Repeat application as necessary to maintain control. <b>REI: Re-enter into treated areas only after the spray deposit has dried.</b>
4A	imidacloprid	Intercept 60 WP	16 g/80 L water/ 1,000 mature plants	1	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Do not exceed 1 application per season. May harm pollinators and certain beneficial insects. <b>REI: NS</b>
4D	flupyradifurone	Altus	<b>Foliar:</b> 750–1,000 mL/ha <b>Drench:</b> 1,500–2,000 mL/ha (15–20 mL/100 m <sup>2</sup> )	1	Thorough, uniform coverage of the crop is required for optimum control. Use the higher rate for higher pest infestation levels. Minimum application volume is 500 L per hectare. <b>Foliar:</b> Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. <b>Drench:</b> Application to soil or soilless media should be made with sufficient water to ensure incorporation into the root zone. Follow with moderate irrigation. Irrigate carefully within the next 10 days to avoid loss of active ingredient due to leaching. Minimum interval between applications is 7 days. Do not exceed 2,000 mL per hectare per crop cycle. May cause some leaf yellowing and/or mottling. <b>REI: 12 hr</b>

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<b>IRAC Group<sup>1</sup></b>	<b>Common Name/ Active Ingredient</b>	<b>Trade Name/ Formulation</b>	<b>Rate</b>	<b>PHI</b>	<b>Remarks</b>
<b>WHITEFLIES (cont'd)</b>					
7C	pyriproxyfen	Distance	45 mL/100 L water	3	<b>Greenhouse whitefly (<i>Trialeurodes vaporariorum</i>), silverleaf whitefly (<i>Bemisia tabaci</i> B biotype) and sweet potato whitefly (<i>Bemisia tabaci</i>)</b> Apply as a foliar spray mixture uniformly to all plant surfaces and to the point of run-off. Make first application when adult insects begin to appear. Repeat application after 14–28 days. Use longer interval when plants are not growing rapidly. Do not exceed 2 applications per crop cycle. If the cropping cycle is less than 6 months, do not apply more than 2 applications per 6 months. <b>REI: 12 hr</b>
16	buprofezin	Talus	36–43 g/100 L	2	Apply when adults first appear. Use the higher application rate when pest pressure is high. Minimum interval between applications is 21 days. Do not exceed 2 applications per crop cycle.  When using 36 g/100 L, apply no more than 870 L spray solution/ha. When using 43 g/100 L, apply no more than 730 L of spray solution/ha. <b>REI: 48 hr</b>
21A	fenpyroximate	FujiMite	2.5 L/ha	7	For suppression. Apply when pests are in immature stages or when populations reach economic thresholds. Apply in a minimum spray volume of 1,000 L per hectare to ensure thorough coverage of the foliage. Do not exceed 1 application per crop cycle. Toxic to certain beneficial insects. <b>REI: 12 hr</b>
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	<b>Greenhouse whitefly (<i>Trialeurodes vaporariorum</i>), silverleaf whitefly (<i>Bemisia tabaci</i> B biotype) and sweet potato whitefly (<i>Bemisia tabaci</i>)</b> Under high pest population pressure, repeat application every 10–14 days as needed. Do not exceed 2 applications per crop cycle. Avoid applying during the warmest part of the day. Effective against nymphs and has some effect on the pupal stage. Will not reduce adult whitefly populations. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. <b>REI: 12 hr</b>
	spirotriamat	Kontos	30–42 mL/100 L water <b>Maximum use rate per single application:</b> 300 mL/ha (72 g a.i./ha)	3	Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712 L per hectare (42 mL concentration) to 1,000 L per hectare (30 mL concentration). Use the higher concentration for higher pest infestation levels. Minimum interval between applications 7–14 days. Maximum product allowed per crop cycle is 900 mL per hectare (216 g a.i./ha). Do not exceed 3 applications per crop cycle. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. <b>REI: 12 hr</b>

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<b>WHITEFLIES (cont'd)</b>					
28	cyantraniliprole	Exirel	750–1,000 mL/ha	0	For suppression. Thorough coverage is required to obtain optimum control. Use the higher listed rate and higher spray volumes for large plants or dense foliage. If thrips populations are above thresholds, use a registered knockdown product before application. Do not apply in irrigation water. Use of mist blowers, thermal foggers, ultra-low volume (ULV) and electrostatic sprayers is not permitted. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and certain beneficial insects. <b>REI: 12 hr</b>
29	flonicamid	Beleaf 50 SG	<b>Foliar:</b> 0.3 g/L water <b>Drip:</b> 12.5 mg/plant	0	Suppression only for foliar application. Apply before populations reach economic thresholds or as populations begin to increase, but before damaging populations become established. Minimum interval between applications is 7 days. Do not apply more than 2 applications per crop cycle (no more than 1 application per crop cycle may be foliar). <b>Foliar:</b> Apply sufficient volume to ensure good coverage, up to 1,000 L per hectare. The maximum volume should be used when plant foliage is dense. Do not apply more than 1 foliar application per crop cycle. <b>Drip:</b> Apply through drip (trickle) irrigation systems or drench by hand using sufficient water volume to ensure delivery of the product to the roots. Do not apply this product through any other type of irrigation system. <b>REI: 12 hr</b>

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<b>WHITEFLIES (cont'd)</b>					
UNF	<i>Beauveria bassiana</i> strain ANT-03	Bio-Ceres G WB*	2–4 g/L water	0	Reduces pest numbers. Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L of spray volume will typically be required for 1 ha. This product is most effective when used early, before high insect populations develop. Repeat application every 7 days. In the case of a pest outbreak, repeat application every 3–5 days. This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
		Bio-Ceres G WP*			
	<i>Beauveria bassiana</i> strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet but not to the point of run-off. Repeat application every 5–10 days. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores.  Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including <i>Aphidius colemani</i> , <i>Amblyseius swirskii</i> , <i>Encarsia formosa</i> , and <i>Eretmocerus eremicus</i> . Do not release <i>Orius insidiosus</i> in the presence of bee-vectored BotaniGard 22WP. See label for more details. <b>REI: Foliar: 4 hr; Bee-vectored: 0</b>
	<i>Beauveria bassiana</i> PPRI 5339	Velifer	450–900 mL/1,000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. <b>REI: 4 hr</b>
	<i>Metarhizium anisopliae</i> strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. Repeat application every 5–10 days. Spray to wet all foliage but not to the point of run-off. Do not apply through a thermal pulse fogger. <b>REI: Re-enter into treated areas only after the spray has dried.</b>

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<b>WHITEFLIES (cont'd)</b>					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. <b>REI: NS</b>
	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	Deters feeding. Apply when pest first appears. Repeat application every 7–14-days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. <b>REI: 12 hr</b>
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	0	Spray early in morning, evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. <b>REI: NS</b>
		Neudosan Commercial*			
		Opal Insecticidal Soap*			
	Opal2 Insecticidal Soap*	1 part concentrate: 100 parts water	0	Insects must be sprayed directly to achieve proper control. Spray all plant surfaces thoroughly at 2-week intervals. <b>REI: NS</b>	
	Safer's Insecticidal Soap Concentrate*				
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap*	5 L/100 L water	1	Spray all plant surfaces as required by pest pressure at 2-week intervals. <b>REI: NS</b>

<sup>1</sup> See Appendix F for IRAC group definitions.

**Table 5–2.** Products registered for greenhouse cucumber diseases

For more information on pesticide application, visit [www.sprayers101.com](http://www.sprayers101.com) — search keywords “greenhouse” or “airblast 101.”

FRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>ALTERNARIA LEAF BLIGHT (<i>Alternaria cucumerina</i>)</b>					
M1	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L water/ha	1	Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. <b>REI: 4 hr</b>
<b>ANTHRACNOSE (<i>Colletotrichum orbiculare</i>)</b>					
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	463–926 mL/ha (25-50 g a.i./ha)	0	Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as a preventative application when conditions favour disease development. Repeat application every 7–10 days as needed. Do not exceed 150 g a.i. per hectare per year. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
M1	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L water/ha	1	Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. <b>REI: 4 hr</b>
<b>ANGULAR LEAF SPOT (<i>Pseudomonas syringae</i> pv. <i>orbiculare</i>)</b>					
M1	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L water/ha	1	Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. <b>REI: 4 hr</b>
<b>BACTERIAL WILT (<i>Erwinia tracheiphila</i>)</b>					
M1	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L water/ha	1	Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. <b>REI: 4 hr</b>
NC	hydrogen peroxide and peroxyacetic acid	OxiDate* OxiDate 2.0*	100 mL/10 L water (1.0% v/v)	0	For suppression. Begin applications preventatively, at the first sign of disease, or when conditions are favourable for disease development. Repeat application ever 7 days. Under severe disease conditions, repeat application every 5 days. Do not exceed 8 applications. <b>REI: 4 hr</b>
<b>CERCOSPORA LEAF SPOT (<i>Cercospora citrullina</i>)</b>					
44	<i>Bacillus subtilis</i> strain QST 713	Cease* Rhapsody ASO*	1–2 L/100 L water	0	For suppression. Begin applications soon after emergence or transplant when environmental conditions and plant stage are conducive to rapid disease development. Repeat applications every 7–10 days as needed. Thorough coverage is essential. <b>REI: NS</b>

<sup>1</sup> See Appendix G for FRAC group definitions.

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FRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>DOWNY MILDEW (<i>Pseudoperonospora cubensis</i>)</b>					
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	463–926 mL/ha (25–50 g a.i./ha)	0	For suppression. Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as a preventative application when conditions favour disease development. Repeat application every 5–8 days as needed to maintain suppression. Do not exceed 150 g a.i. per hectare per year. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
21	cyazofamid	Torrent 400SC	0.15–0.2 L/400–2,000 L water/ha	1	For late downy mildew control, repeat applications every 7–10 days beginning with initial flowering or when disease conditions are favourable for disease development. Use a higher rate and shorter interval under moderate to heavy disease pressure. Label recommends tank-mixing with a non-ionic or organosilicone surfactant at the lowest label rate for water volumes below 600 L per hectare. At water volumes above 600 L per hectare, a surfactant is not needed. Do not exceed 4 applications per crop cycle. <b>REI: 12 hr</b>
28	propamocarb hydrochloride	Previcur N	1.5 L/ha	2	For suppression. Apply foliar treatment when plants begin to vine or when conditions first become favourable for disease development, but before infection. Do not exceed 1 application per crop cycle. <b>REI: 12 hr</b>
40	mandipropamid	Revus	400 mL/ha with 1.5 L/ha of Previcur N	2	For suppression. Apply as a resistance management tool as a foliar application when plants begin to vine or when conditions are favourable for disease development. Do not exceed 1 application per crop cycle. Do not apply by chemigation. <b>REI: 12 hr</b>
44	<i>Bacillus subtilis</i> strain QST 713	Cease* Rhapsody ASO*	1–2 L/100 L water	0	For suppression. Begin applications soon after emergence or transplant when environmental conditions and plant stage are conducive to rapid disease development. Repeat application every 7–10 days as needed. Thorough coverage is essential. <b>REI: NS</b>
46	tea tree oil	Timorex Gold*	2–8 L/400–800 L water/ha	2	For suppression. Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. Do not apply through any type of irrigation system. Good coverage and wetting of foliage is required. For preventative treatments, apply at 7–14-day intervals, depending on disease level. Use shorter application intervals under conditions that promote rapid disease development. Do not apply with captan or sulphur, which could cause phytotoxicity. <b>REI: 24 hr</b>
49	oxathiapiprolin	Orondis Orondis Ultra B Zorvec Enicade	0.0875–0.35 L/ha	0	Foliar application only. Begin applications prior to disease development. Repeat applications every 5–14 days. Use the higher rate and shorter interval when disease pressure is high or for susceptible varieties. Do not exceed 4 applications per crop cycle per year. Where multiple crop cycles are produced in the same year do not exceed 6 foliar applications or 1.4 L per hectare per year. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. <b>REI: 12 hr</b>
40 + 45	ametoctradin + dimethomorph	Zampro	0.8–1 L/2,000 L water/ha	0	For suppression. Begin applications prior to disease development. Repeat applications every 5–7 days. Use the higher rate and shorter interval when disease pressure is high. Do not exceed 3 applications per crop cycle. <b>REI: NS</b>

<sup>1</sup> See Appendix G for FRAC group definitions.

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FRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>DOWNY MILDEW (<i>Pseudoperonospora cubensis</i>) (cont'd)</b>					
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	Repeat applications every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. <b>REI: 4 hr</b>
P 05	<i>Reynoutria sachalinensis</i> extract	Regalia Maxx*	2.5 mL/L water (0.25% v/v)	0	For suppression. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat application every 7–10 days as needed. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not to the point of runoff. Do not apply in a spray volume of more than 1,500 L per hectare. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
P 07	mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	2.9–5.8 L/ha in a minimum of 225 L water/ha	0	For suppression. Begin applications when conditions favour disease development. Repeat applications every 7–14 days. Use the higher rate and shorter application interval when disease pressure is high. Do not exceed 7 applications per year. <b>REI: Allow entry only after thorough ventilation and spray mist has cleared and the treated surface has dried.</b>
	mono- and di-potassium salts of phosphorous acid	Confine Extra	3–5 L/ha in a minimum of 100 L water	1	For suppression. Do not exceed 6 foliar applications per growing season. Begin applications when conditions are favourable for disease. <b>REI: Allow entry only after thorough ventilation and spray mist has cleared and the treated surface has dried.</b>
		Rampart	3–5 L/ha	0	For suppression. Begin applications after plants become established. Repeat applications every 2–4 weeks. Use the higher rate and shorter application interval when disease pressure is high. The suggested water volume is 1,000 L per hectare when cucumber plants are medium sized. <b>REI: 4 hr. After REI, re-entry into treated areas is only permitted after thorough ventilation, spray mist has cleared and the treated surface has dried.</b>
NC	citric and lactic acid	Cyclone*	8% dilution in water solution	0	For suppression. Apply prior to, or at the early stages of disease development. Apply as foliar spray until runoff. Repeat application every 7–10 days. Can leave white hydrosoluble residues on treated crop. Label recommends using a surfactant to achieve better coverage of leaves and better efficacy. <b>REI: 4 hr</b>
	garlic powder	Influence WP*	6.9 kg/1,000 L water/ha	0	May inhibit symptoms when used in conjunction with integrated pest management strategies. Spray the foliage and substrate surface. Ensure thorough coverage. Repeat application every 7–14 days. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
	hydrogen peroxide and peroxyacetic acid	OxiDate*	100 mL/10 L water (1.0% v/v)	0	For partial suppression. Begin applications preventatively, at the first sign of disease, or when conditions are favourable for disease development. Repeat application every 7 days. Under severe disease conditions, repeat application every 5 days. Do not exceed 8 applications. <b>REI: 4 hr</b>
OxiDate 2.0*					

<sup>1</sup> See Appendix G for FRAC group definitions.

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FRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>GREY MOULD (BOTRYTIS BLIGHT, STEM CANKER) (<i>Botrytis cinerea</i>)</b>					
2	iprodione	Rovral WP	100 g/100 L water/ha	2	Spray to run-off ensuring good coverage of the plants, particularly stem nodes, immediately following any pruning. Begin application at the first sign of disease. <b>REI: 12 hr</b>
		Rovral WDG	100 g/100 L water		
7	fluopyram	Luna Privilege	500 mL/ha	0	Begin fungicide applications preventatively. Use sufficient water volume and spray pressure to provide thorough and uniform coverage. Do not exceed 2 applications per crop cycle. Minimum application interval is 6 weeks. Do not apply under low light conditions as crop injury may occur.  Suggested spray volumes by crop height: 1.1 m: 1,000 L/ha 2.1 m: 2,500 L/ha <b>REI: 12 hr</b>
	penthiopyrad	Fontelis	1–1.5 L/ha	1	Begin applications prior to disease development. Repeat application every 7–14 days. Use higher rate and shorter interval when disease pressure is high. Do not exceed 4.9 L per hectare per season. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. <b>REI: 12 hr</b>
9	pyrimethanil	Scala SC	2 L/ha	1	Apply at first sign of disease. Spray volumes will vary depending on crop canopy height. Use appropriate spray volume to ensure thorough coverage of leaf canopy and stems. Use a minimum of 485 L per hectare for smaller plants, increasing to 1,000–2,500 L per hectare for larger plants. Repeat application every 7–14 days as needed. Do not exceed 2 applications per growing season. Do not apply more than 1 application before alternating with a fungicide with a different mode of action. Ventilate for at least 2 hr after application. Proper ventilation after spraying is essential to avoid brown or necrotic spots that can be caused by the vapour activity of Scala SC. <b>REI: 24 hr</b>
17	fenhexamid	Decree 50 WDG	<b>Small plants:</b> 1.5 kg/ha (0.75 kg a.i./ha)	1	Apply in a spray volume of approximately 500 L (small plants) to 1,500 L (large/mature plants). Begin applications when conditions favour disease development. Repeat application after 7 days if conditions continue to favour disease. Do not exceed 2 applications per crop cycle. Do not exceed 3 kg per hectare per season. <b>REI: 4 hr</b>
BM 02	<i>Gliocladium catenulatum</i> strain J1446	Prestop*	0.5% aqueous suspension (25 g/5 L water)	NS	For suppression. Apply as a foliar spray treatment to plant stems and leaves. Spray to wet but not to the point of run-off. Most effective when applied preventatively, before disease starts. Repeat application every 3–4 weeks, with shorter intervals used under conditions of moderate to high disease pressure. <b>REI: 4 hr</b>
	<i>Trichoderma harzianum</i> Rifai strain KRL-AG2	RootShield HC*	3.75–7.5 g/L water	NS	For suppression. Use a volume of spray solution to thoroughly cover foliage. Spray to wet but not to the point of run-off. Use higher rates when conditions favour disease development or high disease pressure is anticipated. <b>REI: 4 hr</b>
M 03	ferbam	Ferbam 76 WDG	2 kg/1,000 L water	1	Repeat application every week. Causes severe injury to seedless English cucumbers. <b>REI: Re-enter into treated areas only after the spray has dried.</b>

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<b>LEGEND:</b> PHI = pre-harvest interval (in days)      NS = no information was provided on the product label      REI = re-entry interval					
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<b>GUMMY STEM BLIGHT (<i>Didymella bryoniae</i>)</b>					
2	iprodione	Rovral WP Rovral WDG	100 g/100 L water	2	Apply label rate using 1,000–2,000 L water per hectare. Spray to run-off ensuring good coverage of the plants, particularly stem nodes, immediately following any pruning. Begin application at the first sign of disease. <b>REI: 12 hr</b>
3	myclobutanil	Nova WSP	340 g/ha	2	Do not exceed 1 application per crop cycle. Apply when disease first appears. <b>REI: 12 hr</b>
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	463–926 mL/ha (25-50 g a.i./ha)	0	For suppression. Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as a preventative application when conditions favour disease development. Repeat application every 7–14 days as needed to maintain suppression. Do not exceed 150 g a.i. per hectare per year. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
44	<i>Bacillus subtilis</i> strain QST 713	Cease* Rhapsody ASO*	1–2 L/100 L water	0	For suppression. Begin applications soon after emergence or transplant when environmental conditions and plant stage are conducive to rapid disease development. Repeat application every 7–10 days as needed. Thorough coverage is essential. <b>REI: NS</b>
7 + 11	boscalid + pyraclostrobin	Pristine WG	1.3 kg in a minimum of 250 L water/ha	0	For suppression. Apply when conditions favour disease development. Do not apply this product using any type of foggers or misters. Do not exceed 1 application per crop cycle. Do not use on plants that will be transplanted. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
BM 02	<i>Gliocladium catenulatum</i> strain J1446	Prestop*	1% aqueous suspension (50 g/5 L water)	NS	For suppression. Apply as a foliar spray treatment to plant stems and leaves. Spray to wet but not to the point of run-off. Most effective when applied preventively, before disease starts. Repeat applications every 3–4 weeks, with shorter intervals used under conditions of moderate to high disease pressure. <b>REI: 4 hr</b>
<b>PHYTOPHTHORA BLIGHT (<i>Phytophthora foliar blight</i>)</b>					
49	oxathiapiprolin	Orondis Orondis Ultra B Zorvec Enicade	0.175–0.35 L/ha	0	<b><i>Phytophthora capsici</i></b> Foliar application only. Begin applications prior to disease development. Repeat applications every 5–14 days. Use the higher rate and shorter interval when disease pressure is high. Do not exceed 4 applications per crop cycle per year. Where multiple crop cycles are produced in the same year do not exceed 6 foliar applications or 1.4 L per hectare per year. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. <b>REI: 12 hr</b>

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<b>PHYTOPHTHORA BLIGHT (<i>Phytophthora</i> foliar blight) (cont'd)</b>					
P 07	mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	2.9–5.8 L/ha in a minimum of 225 L water/ha	0	<b><i>Phytophthora capsici</i></b> For suppression. Begin applications when conditions favour disease development. Repeat applications every 7–14 days. Use the higher rate and shorter application interval when disease pressure is high. Do not exceed 7 applications per year. <b>REI: Allow entry only after thorough ventilation and spray mist has cleared and the treated surface has dried.</b>
	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–6 L/ha in a minimum of 100 L water	1	<b><i>Phytophthora capsici</i>, <i>P. nicotianae</i></b> For suppression. Do not exceed 6 foliar applications per growing season. Begin applications when conditions are favourable for disease. <b>REI: Allow entry only after thorough ventilation, spray mist has cleared and the treated surface has dried.</b>
		Rampart	<b>Foliar:</b> 3–8 L/1,000 L water/ha <b>Drench:</b> 5–7 L in a minimum of 1,000 L water	0	<b><i>Phytophthora capsici</i></b> For suppression. Use the higher rate and shorter application interval when disease pressure is high.  Foliar: Apply lower rate every 2–4 weeks after plants become established. Drench: Apply with normal irrigation schedule. <b>REI: 4 hr. After REI, re-entry into treated areas is only permitted after thorough ventilation, spray mist has cleared and the treated surface has dried.</b>
<b>POWDERY MILDEW</b>					
3	myclobutanil	Nova WSP	340 g/ha	2	Do not exceed 1 application per crop cycle. Apply when disease first appears. <b>REI: 12 hr</b>
7	fluopyram	Luna Privilege	100 mL/ha	0	<b><i>Erysiphe cichoracearum</i> (= <i>Golovinomyces cichoracearum</i>), <i>Sphaerotheca fuliginea</i> (= <i>Podosphaera xanthii</i>)</b> Begin fungicide applications preventatively. Use sufficient water volume and spray pressure to provide thorough and uniform coverage. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 6 weeks. Do not apply under low light conditions as crop injury may occur.  Suggested spray volumes by crop height: 1.1 m: 1,000 L/ha 2.1 m: 2,500 L/ha <b>REI: 12 hr</b>
	penthiopyrad	Fontelis	1.25 L/ha	1	<b><i>Erysiphe cichoracearum</i> (= <i>Golovinomyces cichoracearum</i>), <i>Sphaerotheca fuliginea</i> (= <i>Podosphaera xanthii</i>)</b> Begin applications prior to disease development. Repeat application every 7–14 days. Use higher rate and shorter interval when disease pressure is high. Do not exceed 4.9 L per hectare per season. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. <b>REI: 12 hr</b>

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FRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>POWDERY MILDEW (cont'd)</b>					
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	463–926 mL/ha (25–50 g a.i./ha)	0	Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as a preventative application when conditions favour disease development. Repeat application every 7–14 days as needed to maintain control. When disease is present, suppression is provided. Do not apply more than 150 g a.i. per hectare per year. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
44	<i>Bacillus amyloliquefaciens</i> strain D747	Double Nickel 55 *	<b>Foliar:</b> 1–2.5 kg/ha <b>Low disease pressure:</b> 0.5–1 kg/ha	0	<b><i>Erysiphe cichoracearum</i> (=Golovinomyces cichoracearum), <i>Sphaerotheca fuliginea</i> (=Podosphaera xanthii)</b> For suppression. Apply from fruit formation to end of maturity. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. <b>REI: Do not re-enter until sprays have dried.</b>
		Double Nickel LC*	<b>Foliar:</b> 5–12.5 L/ha <b>Low disease pressure:</b> 2.5–5 L/ha		
46	tea tree oil	Cease*	1–2 L/100 L water	0	<b><i>Erysiphe</i> spp., <i>Sphaerotheca</i> spp.</b> For suppression. Begin applications soon after emergence or transplant when environmental conditions and plant stage are conducive to rapid disease development. Repeat application every 7–10 days. Thorough coverage is essential. <b>REI: NS</b>
		Rhapsody ASO*			
46	tea tree oil	Timorex Gold*	2–8 L in 400–800 L water/ha	2	<b><i>Erysiphe cichoracearum</i> (=Golovinomyces cichoracearum), <i>Sphaerotheca fuliginea</i> (=Podosphaera xanthii)</b> Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. Do not apply through any type of irrigation system. Good coverage and wetting of foliage is required. For preventive treatments, repeat application every 7–14 days as needed. Use shorter application intervals under conditions that promote rapid disease development. Do not apply with captan or sulphur, which could cause phytotoxicity. <b>REI: 24 hr</b>
7 + 11	boscalid + pyraclostrobin	Pristine WG	1.3 kg in a minimum of 250 L water/ha	0	<b><i>Sphaerotheca fuliginea</i> (=Podosphaera xanthii)</b> For suppression. Apply when conditions favour disease development. Do not apply this product using any type of foggers or misters. Do not exceed 1 application per crop cycle. Do not use on plants that will be transplanted. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
9 + 12	cyprodinil + fludioxonil	Palladium WG	775 g/200–3,000 L water/ha	1	<b><i>Sphaerotheca fuliginea</i> (=Podosphaera xanthii)</b> For suppression. Do not exceed 3 applications per crop cycle. First application should be made when disease first appears. Repeat application after 7–10 days. Make no more than 2 sequential applications before alternating with a treatment with another mode of action. <b>REI: 24 hr</b>

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<b>POWDERY MILDEW (cont'd)</b>					
BM 02	<i>Streptomyces lydicus</i> strain WYEC 108	Actinovate SP	420 g/470–800 L water/ha	NS	<b><i>Sphaerotheca fuliginea</i> (=Podosphaera xanthii)</b> For suppression. Make the first application when conditions are conducive to disease development. Repeat application every 7–14 days. Use the shorter application interval under high disease pressure. Spray to wet but not the point of run-off. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	<b><i>Erysiphe cichoracearum</i> (=Golovinomyces cichoracearum), <i>Sphaerotheca fuliginea</i> (=Podosphaera xanthii)</b> Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. <b>REI: 4 hr</b>
M 02	sulphur	Cosavet DF Edge	0.12 kg/100 L water	1	<b><i>Sphaerotheca fuliginea</i> (=Podosphaera xanthii)</b> Use sufficient volume to provide thorough coverage. Repeat applications every 5 days as needed. Do not exceed 8 applications per year. <b>REI: 24 hr</b>
		Kumulus DF*	120 g/100 L water	1	Repeat application every 5 days as needed. Do not exceed 8 applications per season. Do not apply if temperature is above 27°C (in shade) and high humidity prevails or is expected within 3 days after the treatment. Do not apply under intense sunshine. <b>REI: 24 hr</b>
		Microscopic Sulphur WP*	105 g/100 L water	1	Apply at weekly intervals as needed. Do not make more than 8 applications per season. Do not apply if high temperatures (above 25°C) and high humidity prevail or are expected during the 3 days following application. <b>REI: 24 hr</b>
P 05	<i>Reynoutria sachalinensis</i> extract	Regalia Maxx*	1.25–2.5 mL/L water (0.125%–0.25% v/v)	0	<b><i>Erysiphe cichoracearum</i> (=Golovinomyces cichoracearum), <i>Sphaerotheca fuliginea</i> (=Podosphaera xanthii)</b> For suppression. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat application every 7–10 days. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not exceed a spray volume of 1,500 L per hectare. <b>REI: Re-enter into treated areas only after the spray has dried.</b>

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FRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>POWDERY MILDEW (cont'd)</b>					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Begin applications when conditions are favourable for disease development or when disease first appears. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. <b>REI: NS</b>
	citric and lactic acid	Cyclone*	1.2% dilution in water solution	0	<b>Erysiphe cichoracearum (=Golovinomyces cichoracearum), Sphaerotheca fuliginea (=Podosphaera xanthii)</b> For suppression. Apply prior to, or at the early stages of disease development. Apply as foliar spray in sufficient spray volume to ensure thorough coverage. Repeat application every 7–10 days. Can leave white hydrosoluble residues on treated crop. Label recommends using a surfactant to achieve better coverage of leaves and better efficacy. <b>REI: 4 hr</b>
	garlic powder	Influence LC*	1.8% with high volume sprayer  <b>Tank mix:</b> 0.45% with Cyclone at 0.3% without surfactant	0	<b>Sphaerotheca fuliginea (=Podosphaera xanthii)</b> For suppression. Apply preventively or at first signs of disease. Repeat application every 7–10 days. Ensure thorough coverage of foliage. Do not exceed 18 L per hectare. Do not use with ultra low volume sprayers. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
		Influence WP*	6.9 kg/1,000 L water/ha	0	<b>Sphaerotheca fuliginea (=Podosphaera xanthii)</b> For suppression. Spray the foliage and substrate surface. Ensure thorough coverage. Repeat application every 7–14 days. <b>REI: Re-enter into treated areas only after the spray has dried.</b>
	mineral oil	Purespray Green Spray Oil 13E*	10 L/ 1,000 L water (1% solution)/ha	NS	<b>Sphaerotheca fuliginea (=Podosphaera xanthii)</b> For suppression. Apply when conditions are favourable for disease development and/or when first symptoms appear. Repeat application every 7–14 days. For effective control thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. <b>REI: 12 hr</b>
	potassium bicarbonate	MilStop*	5.6 kg/2,000 L water/ha	0	<b>Sphaerotheca fuliginea (=Podosphaera xanthii)</b> Start application at first sign of disease. Uniform and complete coverage of the foliage is essential for the most effective results. Number of applications will depend on disease pressure. Repeat application every 7 days. Do not exceed 10 applications per season. Do not apply through any type of irrigation system. <b>REI: 4 hr</b>
	potassium bicarbonate	Sirocco	5.6 kg/ha	0	<b>Sphaerotheca fuliginea (=Podosphaera xanthii, P. fusca)</b> Begin applications at the first sign of disease or when conditions are conducive to disease development. Label recommended spray volume is 1,000–2,000 L per hectare. Repeat application every 7 days. Do not exceed 10 applications per year. <b>REI: 4 hr</b>
<b>SEPTORIA LEAF SPOT</b>					
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	<b>Septoria cucurbitacearum</b> Repeat application every 5–10-days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. <b>REI: 4 hr</b>

<sup>1</sup> See Appendix G for FRAC group definitions.

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FRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>ROOT DISEASES</b>					
<b>ROOT ROTS (DAMPING OFF)</b>					
21	cyazofamid	Torrent 400SC	30 mL/100 L water	60	<b>Pythium spp.</b> Apply as a soil drench to thoroughly wet the growing medium immediately after seeding. Do not exceed 1 application. Do not use any surfactant. <b>REI: 12 hr</b>
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant.	2	<b>Pythium spp.</b> Do not mix with other products. Prevent intense sunlight after application. Do not exceed 4 applications per crop cycle. Do not exceed 2 applications per crop cycle to seeding beds or seedlings. Do not exceed 2 applications per crop cycle after-transplanting. The higher rate should be used for second and third application. <b>REI: 12 hr</b>
44	<i>Bacillus subtilis</i> strain MBI 600	Serifel*	50 g/12.5 L water/ 21.9 m <sup>3</sup> growing media	NS	<b>Fusarium spp., Pythium spp., Rhizoctonia solani</b> For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m <sup>3</sup> of plant-growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. <b>REI: NS</b>
BM 02	<i>Gliocladium catenulatum</i> strain J1446	Prestop*	0.5% aqueous suspension (25 g/5 L water) See <b>Remarks.</b>	NS	<b>Pythium spp., Rhizoctonia solani</b> For suppression. Apply as a growing medium treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or else make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat application every 3–6 weeks, with shorter intervals used under conditions of moderate to high disease pressure. <b>REI: 4 hr</b>  <b>Rates</b> <b>Growing media:</b> 125–250 mL suspension/10 L growing media <b>Soil drench:</b> 20 L suspension/m <sup>2</sup> growing media
	<i>Trichoderma harzianum</i> Rifai strain KRL-AG2 and <i>Trichoderma virens</i> strain G-41	BW240 WP	30–60 g/100 L water/ m <sup>2</sup> of soil/ potting mixture surface	0	<b>Fusarium spp., Phytophthora spp., Pythium spp., Rhizoctonia spp.</b> For suppression. Apply immediately after sowing seed or planting. Repeat application after 8–10 weeks if the disease is expected. Do not use overhead boom chemigation for second application or after the four-leaf stage. Use a higher rate and shorter interval when disease pressure is high. <b>REI: 4 hr</b>
	<i>Streptomyces lydicus</i> strain WYEC 108	Actinovate SP	See <b>Remarks.</b>	NS	<b>Pythium spp.</b> For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat application every 7–14 days. <b>REI: Re-enter into treated areas only after the spray has dried.</b>  <b>Rates</b> <b>Seed treatment:</b> 7.5–42 g/300 mL water/kg of seed <b>Hydroponic systems:</b> 420–840 g/ha <b>Soil drench:</b> 42–84 g/100 L water/m <sup>3</sup> of growing media

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FRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>ROOT ROTS (DAMPING OFF) (cont'd)</b>					
BM 02 (cont'd)	<i>Streptomyces</i> strain K61	Mycostop WP*	See <b>Remarks.</b>	NS	<b><i>Fusarium spp.</i>, <i>Pythium spp.</i></b> For suppression. Apply immediately after transplanting. Repeat applications every 3–6 weeks. For seedling production, apply first spray after emergence using lower rate. <b>REI: NS</b>  <b>Rates</b> <b>Rockwool:</b> 5–10 mg/plant (for spraying and drenching, use 10–20 mL/plant of 0.05% suspension) <b>Beds:</b> 5–10 g/100 m <sup>2</sup> (for spraying and drenching, use 0.1–0.2 L/m <sup>2</sup> of 0.05% suspension)
	<i>Trichoderma harzianum</i> Rifai strain T-22	Trianum G*	See <b>Remarks.</b>	NS	<b><i>Pythium ultimum</i></b> For suppression. For the best results, begin use from propagation onwards, before occurrence of disease. Mix evenly in growing medium before filling seed trays at propagation and transplanting. <b>REI: NS</b>  <b>Rates</b> <b>Before filling seed trays or containers:</b> 750 g/m <sup>3</sup> <b>Subsequent applications at transplanting or repotting:</b> 375 g/m <sup>3</sup> <b>Crops on substrate, when transplanting:</b> 1 g per planting hole
		Trianum P*	See <b>Remarks.</b>	NS	<b><i>Pythium ultimum</i></b> For suppression.  Sowing application method: For the best results, begin use from propagation onwards, before occurrence of disease.  Transplanting high crop density: Use a water volume equivalent to 10% of the substrate volume or 2–5 L/m <sup>2</sup> .  Low crop density: Use a water volume equivalent to 10% of the substrate volume or 100 L/1,000 plants. <b>REI: NS</b>  <b>Rates</b> <b>Sowing:</b> 1.5 g/m <sup>2</sup> of cultivated area, suspended in 2.5–5 L water <b>Transplanting high crop density:</b> 3 g/m <sup>2</sup> of cultivated area (1.5 g/m <sup>2</sup> if plants have been treated previously) <b>Transplanting low crop density:</b> 30 g/1,000 plants (15 g/1,000 plants if plants have been treated previously)
NC	garlic powder	Influence WP*	10–20 kg/ 1,000 L water/300 m <sup>2</sup>	0	<b><i>Pythium spp.</i>, <i>Rhizoctonia solani</i></b> For partial suppression. Apply as a drench to the substrate surface at seeding. Use the higher rate under high disease pressure or when conditions are conducive to disease development. <b>REI: Re-enter into treated areas only after the spray has dried.</b>

<sup>1</sup> See Appendix G for FRAC group definitions.

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FRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>LEGEND:</b> PHI = pre-harvest interval (in days)      NS = no information was provided on the product label      REI = re-entry interval * = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.					
<b>ROOT ROTTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT)</b>					
4	metalaxyl-M	Ridomil Gold 480 EC Ridomil Gold 480 SL	250 mL of solution (0.75–1.25 mL/ 10 L water) to base of each plant	21	<b>Pythium spp.</b> Do not exceed 1 application per crop cycle, immediately after transplanting as a drench to the growing media at the base of each plant. Do not use in the propagation house. Do not apply to cucumbers intended for transplant out to fields. Do not apply to cucumbers grown in soil. <b>REI: 12 hr</b>
12	fludioxonil	Medallion	300 mL/1,000 L water	1	<b>Fusarium oxysporum f. sp. radicis-cucumerinum</b> For suppression. Use as drench application of 250 mL solution per plant. Apply to seedling crop prior to transplanting. Do not exceed 1 application per crop cycle. Do not apply to the foliage. <b>REI: 12 hr</b>
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant.	2	<b>Pythium spp.</b> Do not mix with other products. Prevent intense sunlight after application. Do not exceed 4 applications per crop cycle. Do not exceed 2 seeding/seedling applications per crop cycle. Do not exceed 2 after-transplanting applications per crop cycle. The higher rate should be used for second and third application. <b>REI: 12 hr</b>
44	<i>Bacillus subtilis</i> strain MBI 600	Serifel*	50 g/12.5 L water/ 21.9 m <sup>3</sup> growing media	NS	<b>Fusarium spp., Pythium spp., Rhizoctonia solani</b> For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m <sup>3</sup> of plant-growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. <b>REI: NS</b>
BM 02	<i>Gliocladium catenulatum</i> strain J1446	Prestop*	0.5% aqueous suspension (25 g/5 L water) to 1% aqueous suspension (50 g/5 L water) See <b>Remarks.</b>	NS	<b>Fusarium oxysporum; Pythium spp.</b> For suppression. Apply as a growing media treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or else make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat applications every 3–6 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. <b>REI: 4 hr</b>  <b>Rates</b> <b>Growing media:</b> 125–250 mL of suspension/10 L growing media <b>Soil drench:</b> 20 L suspension/10 m <sup>2</sup> growing media
	<i>Streptomyces lydicus</i> strain WYEC 108	Actinovate SP	See <b>Remarks.</b>	NS	<b>Pythium spp.</b> For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat application every 7–14 days. <b>REI: Re-enter into treated areas only after the spray has dried.</b>  <b>Rates</b> <b>Seed treatment:</b> 7.5–42 g/300 mL water/kg of seed <b>Hydroponic systems:</b> 420–840 g/ha <b>Soil drench:</b> 42–84 g/100 L water/m <sup>3</sup> of growing media

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FRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>ROOT ROTTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT) (cont'd)</b>					
BM 02 (cont'd)	<i>Streptomyces</i> strain K61	Mycostop WP*	See <b>Remarks.</b>	NS	<b>Fusarium spp.</b> For suppression. Apply immediately after transplanting. Repeat applications every 3–6 weeks. For seedling production, apply first spray after emergence using lower rate. <b>REI: NS</b>  <b>Rates</b> <b>Rockwool:</b> 5–10 mg/plant (for spraying and drenching, use 10–20 mL/plant of 0.05% suspension) <b>Beds:</b> 5–10 g/100 m <sup>2</sup> (for spraying and drenching, use 0.1–0.2 L/m <sup>2</sup> of 0.05% suspension)
	<i>Trichoderma harzianum</i> Rifai strain KRL-AG2	RootShield Granules*	600–750 g/m <sup>3</sup> (loose) planting mix or soil	NS	<b>Fusarium spp., Pythium spp., Rhizoctonia spp.</b> For suppression. For best results, thoroughly incorporate granules during mix preparation or pot filling, or incorporate into planting beds by raking or tilling. <b>REI: 4 hr</b>
		Bora HC*	<b>Drench:</b> 55–110 g/m <sup>3</sup>	NS	<b>Fusarium spp., Pythium spp., Rhizoctonia spp.</b> For suppression. Can be applied through low-pressure watering nozzles such as fan nozzles or other watering systems. <b>REI: 4 hr</b>
		Bora WP*			
		RootShield HC*			
RootShield WP*					
<i>Trichoderma harzianum</i> Rifai strain T-22	Trianium G*	See <b>Remarks.</b>	NS	<b>Pythium aphanidermatum</b> For suppression. For the best results, begin use from propagation onwards, before occurrence of disease. Mix evenly in growing medium before filling seed trays at propagation and transplanting. <b>REI: NS</b>  <b>Rates</b> <b>Before filling seed trays or containers:</b> 750 g/m <sup>3</sup> <b>Subsequent applications at transplanting or repotting:</b> 375 g/m <sup>3</sup> <b>Crops on substrate, when transplanting:</b> 1 g/planting hole	

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FRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT) (cont'd)</b>					
P 07	mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	2.9–5.8 L/ha in a minimum of 225 L water/ha	0	<b>Phytophthora spp., Pythium spp.</b> For suppression. Begin applications when conditions favour disease development. Repeat applications every 7–14 days. Use the higher rate and shorter application interval when disease pressure is high. Do not exceed 7 applications per year. <b>REI: Allow entry only after thorough ventilation, the spray mist has cleared and the treated surface has dried.</b>
	mono- and di-potassium salts of phosphorous acid	Confine Extra	3–6 L/ha in a minimum of 100 L water	1	<b>Pythium spp.</b> For suppression. Do not exceed 6 drench applications per growing season. Begin applications when conditions are favourable for disease. <b>REI: Allow entry only after thorough ventilation, the spray mist has cleared and the treated surface has dried.</b>
		Rampart	<b>Foliar:</b> 3–8 L/1,000 L water/ha <b>Drench:</b> 5–7 L in a minimum of 1,000 L water	0	<b>Phytophthora spp., Pythium spp.</b> For suppression. Use the higher rate and shorter application interval when disease pressure is high. Foliar: Apply lower rate every 2–4 weeks after plants become established. Drench: Apply with normal Irrigation schedule. <b>REI: 4 hr. After REI, re-entry into treated areas is only permitted after thorough ventilation, spray mist has cleared and the treated surface has dried.</b>
NC	garlic powder	Influence WP*	10–20 kg/ 1,000 L water/300 m <sup>2</sup>	0	<b>Pythium spp., Rhizoctonia solani</b> For partial suppression. Apply as a drench to the substrate surface at seeding. Use the higher rate under high disease pressure or when conditions are conducive to disease development. <b>REI: Re-enter into treated areas only after the spray has dried.</b>

<sup>1</sup> See Appendix G for FRAC group definitions.