

# 7. Lettuce

Products registered for greenhouse lettuce insect and mite pests are listed in Table 7–1.

Products registered for greenhouse lettuce diseases are listed in Table 7–2.

**Table 7–1.** Products registered for greenhouse lettuce insect and mite pests

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

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IRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>APHIDS</b>					
1B	malathion	Fyfanon 50% EC	1.5–2.75 L/ha	leaf: 21 head: 7	Do not exceed 2 applications per year. Minimum interval between applications is 10 days. <b>REI: 12 hr</b>
		Malathion 85 E	735–1,345 mL/ha	7	Do not exceed 2 applications per year. Minimum interval between applications is 10 days. The product is more effective if the temperature is 20°C or more or when temperatures will reach or exceed this minimum. <b>REI: 12 hr</b>
4A	imidacloprid	Intercept 60 WP	<b>Transplant tray plug drench:</b> 4.1 g/1,000 seedling plants	28	<b>Green peach aphid (<i>Myzus persicae</i>), lettuce aphid (<i>Nasonovia ribis-nigri</i>), melon aphid (<i>Aphis gossypii</i>)</b> 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 crop cycle. Apply product at least 10 days prior to transplanting. Do not use less than 15 L solution/100 m <sup>2</sup> of seedling trays. 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.  <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 2000 mL/ha per crop cycle. <b>REI: 12 hr</b>
23	spirotetramat	Kontos	43–60 mL/100 L water Maximum of 72 g a.i./ha/ application	7	Rate selected for use should depend on infestation level of those pests. Minimum interval between applications is 7 days. Re-apply only when monitoring indicates it is necessary. Do not exceed 900 mL (216 g a.i.) per hectare 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>

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

**Table 7–1.** Products registered for greenhouse lettuce insect and mite pestsFor more information on pesticide application, visit [www.sprayers101.com](http://www.sprayers101.com) — search keywords “greenhouse” or “airblast 101.”

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IRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>APHIDS (cont'd)</b>					
NC	<i>Beauveria bassiana</i> strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet but avoid run-off. Repeat application every 5–10 days as needed. High populations may require 2–5-day intervals. 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>
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	Kopa Insecticidal Soap*	8 L/400 L 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	1 part concentrate: 50 parts water	Insects must be sprayed directly to achieve proper control. Repeat applications as required. <b>REI: NS</b>			

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**Table 7-1.** Products registered for greenhouse lettuce insect and mite pestsFor more information on pesticide application, visit [www.sprayers101.com](http://www.sprayers101.com) — search keywords “greenhouse” or “airblast 101.”

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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>ARMYWORMS</b>					
1B	malathion	Malathion 85 E	735–1,345 mL/ha	7	Do not exceed 2 applications per year. Minimum interval between applications is 10 days. <b>REI: 12 hr</b>
11A	<i>Bacillus thuringiensis</i> subsp. <i>aizawai</i> strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	<b>Beet armyworm (<i>Spodoptera exigua</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 treated areas only after spray is dried.</b>
<b>CORN EARWORM (TOMATO FRUITWORM) (<i>Helicoverpa (=Heliiothis) 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 every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. <b>REI: Re-enter treated areas only after spray is dried.</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. <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. <b>REI: 12 hr</b>

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**Table 7–1.** Products registered for greenhouse lettuce insect and mite pestsFor more information on pesticide application, visit [www.sprayers101.com](http://www.sprayers101.com) — search keywords “greenhouse” or “airblast 101.”

IRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>LOOPERS</b>					
3A	lambda-cyhalothrin	Matador 120 EC	83 mL/ha	3	<b>Cabbage looper (<i>Trichoplusia ni</i>)</b> Apply when insects or damage first appear. For best results, apply against early developmental stages of the pest. Do not exceed 2 applications per year. Apply in sufficient water to ensure adequate coverage. For best results, apply during the early morning before temperatures rise and during the evening, past the heat of the day. <b>REI: 24 hr</b>
		Warrior	83 mL/ha	3	<b>Cabbage looper (<i>Trichoplusia ni</i>)</b> Apply when insects or damage first appear. For best results, apply against early developmental stages of the pest. Do not exceed 2 applications per year. Repeat application every 7 days. Apply in sufficient water to ensure adequate coverage. For best results, apply during the early morning before temperatures rise and during the evening, past the heat of the day. <b>REI: 24 hr</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>
		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 500 L/ha. 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*		
Success	120 mL/1,000 L water				
11A	<i>Bacillus thuringiensis</i> subsp. <i>kurstaki</i> strain ABTS-351	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 after loopers first appear. In general, 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 needed 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 treated areas only after spray is 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>LOOPERS (cont'd)</b>					
18	tebufenozide	Confirm 240F	0.6 L/ha	14	<b>Cabbage looper (<i>Trichoplusia ni</i>)</b> Apply on early instars. Apply in sufficient water to ensure thorough coverage. Begin applications when first signs of feeding damage appear. Repeat application every 10–14 days if needed. Do not exceed 2 applications per crop cycle. Effective against larval Lepidoptera, however, it is essentially non-toxic to adult bees and does not adversely affect beneficial insects such as predatory mites, beetles, wasps and spiders. <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 treated areas only after spray is dried.</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>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>
17	cyromazine	Citation 75WP	75 g (1 water soluble bag)/ 570 L water	14	<b>Bradysia sp.</b> Apply to the foliage and moist surfaces where the insects breed and feed. Apply sufficient amount of mixture for thorough coverage. Do not exceed 1,010 L spray solution per hectare. Minimum interval between applications is 7 days. Do not exceed 4 applications per growing season. Do not apply through any type of irrigation equipment. May adversely affect some species of predatory mites and leafminer parasitoids. <b>REI: 12 hr</b>

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<b>MEALYBUGS</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*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as needed. <b>REI: NS</b>
Safer's Insecticidal Soap Concentrate*					
<b>MITES</b>					
1B	malathion	Fyfanon 50% EC	1.5–2.75 L/ha	leaf: 21 head: 7	Do not exceed 2 applications per year. Minimum interval between applications is 10 days. <b>REI: 12 hr</b>
		Malathion 85 E	735–1,345 mL/ha	7	Do not exceed 2 applications per year. Minimum interval between applications is 10 days. <b>REI: 12 hr</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 spray has dried.</b>

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<b>MITES (cont'd)</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>
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L 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*	1 part concentrate: 50 parts water	<b>Two-spotted spider mite (<i>Tetranychus urticae</i>)</b> Insects must be sprayed directly to achieve proper control. Repeat application every week for 2–3 weeks. <b>REI: NS</b>			
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> Repeat application every week 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>
<b>PSYLLIDS</b>					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. <b>REI: NS</b>
		Safer's Insecticidal Soap Concentrate*			
<b>SCALES</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>

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<b>THRIPS</b>					
1B	malathion	Fyfanon 50% EC	1.5–2.75 L/ha	leaf: 21 head: 7	Do not exceed 2 applications per year. Minimum interval between applications is 10 days. <b>REI: 12 hr</b>
		Malathion 85 E	735–1,345 mL/ha	7	
UNF	<i>Beauveria bassiana</i> strain GHA	BotaniGard 22WP	500–1,000 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	<b>Foliar:</b> 0.5–5 L/1,000 L water <b>Drench:</b> 108 mL/10 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.  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 spray has dried.</b>
<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>

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<b>WHITEFLIES</b>					
1B	malathion	Fyfanon 50% EC	1.5–2.75 L/ha	leaf: 21 head: 7	Do not exceed 2 applications per year. Minimum interval between applications is 10 days. <b>REI: 12 hr</b>
		Malathion 85 E	735–1,345 mL/ha	7	<b>Greenhouse whitefly (<i>Trialeurodes vaporariorum</i>)</b> Do not exceed 2 applications per year. Minimum interval between applications is 10 days. <b>REI: 12 hr</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.  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. <b>REI: 12 hr</b>
4A	imidacloprid	Intercept 60 WP	<b>Transplant tray plug drench:</b> 4.1 g/1,000 seedling plants	28	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 crop cycle. Apply product at least 10 days prior to transplanting. Do not use less than 15 L solution/100 m <sup>2</sup> of seedling trays. May harm pollinators and certain beneficial insects. <b>REI: NS</b>
UNF	<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>

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

**Table 7–1.** Products registered for greenhouse lettuce insect and mite pestsFor more information on pesticide application, visit [www.sprayers101.com](http://www.sprayers101.com) — search keywords “greenhouse” or “airblast 101.”

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IRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>WHITEFLIES (cont'd)</b>					
UNF (cont'd)	<i>Beauveria bassiana</i> PPRI 5339	Velifer	450–900 mL/1000 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. 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 spray has dried.</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	Kopa Insecticidal Soap*	8 L/400 L 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*	1 part concentrate: 100 parts water		Insects must be sprayed directly to achieve proper control. Spray all plant surfaces thoroughly at 2-week intervals. <b>REI: NS</b>	
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 7-2.** Products registered for greenhouse lettuce diseasesFor more information on pesticide application, visit [www.sprayers101.com](http://www.sprayers101.com) — search keywords “greenhouse” or “airblast 101.”

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FRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>BLUE MOULD (<i>Peronospora effusa</i>)</b>					
40	mandipropamid	Micora	400–600 mL/ha (100–150 g a.i./ha)	7	Begin applications prior to disease development. Repeat applications every 7–10 days. Use of a non-ionic adjuvant (0.25% v/v) is recommended on the label. Do not exceed 4 applications per crop cycle.
		Revus	400–600 mL/ha (100–150 g a.i./ha)	7	Applications should begin prior to disease development. Do not exceed 4 applications per season. <b>REI: 12 hr</b>
<b>BOTTOM ROT (<i>Rhizoctonia solani</i>)</b>					
44	<i>Bacillus subtilis</i> var. <i>amyloliquefaciens</i> strain FZB24	Taegro WP*	190 g/935.4 L water/ha	0	For suppression. Applications should be made to the plant base and soil/growing medium surface to protect the contact between the soil/growing medium and leaf tissue as the lettuce develops. Repeat application every 7 days when conditions are conducive to disease development. Water in solution immediately after application. <b>REI: 0 hr</b>
<b>DOWNY MILDEW (<i>Bremia lactucae</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. 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 spray has dried.</b>
40	mandipropamid	Micora	400–600 mL/ha (100–150 g a.i./ha)	7	Begin applications prior to disease development. Repeat applications every 7–10 days. Use of a non-ionic adjuvant (0.25% v/v) is recommended on the label. Do not exceed 4 applications per crop cycle.
		Revus	400–600 mL/ha (100–150 g a.i./ha)	7	Applications should begin prior to disease development. Do not exceed 4 applications per season. <b>REI: 12 hr</b>
44	<i>Bacillus amyloliquefaciens</i> strain D747	Double Nickel 55*	1–2.5 kg/ha	0	For suppression. Begin applications preventively when conditions are favourable for onset of disease. Repeat application every 7–10 days for as long as conditions favour disease development. <b>REI: Re-enter into treated areas only after spray has dried.</b>
		Double Nickel LC*	5–12.5 L/ha		
	<i>Bacillus subtilis</i> strain QST 713	Cease* Rhapsody ASO*	1–2 L/100 L water	0	For suppression. Begin application soon after emergence or transplant and when conditions are conducive to disease development. Repeat application every 7 days as needed. <b>REI: NS</b>
40 + 45	ametoctradin + dimethomorph	Zampro	0.8–1 L/1,000 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.

**Table 7–2.** Products registered for greenhouse lettuce diseasesFor more information on pesticide application, visit [www.sprayers101.com](http://www.sprayers101.com) — search keywords “greenhouse” or “airblast 101.”

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FRAC Group <sup>1</sup>	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
<b>DOWNY MILDEW (<i>Bremia lactucae</i>) (cont'd)</b>					
P 07	mono- and di-potassium salts of phosphorous acid	Confine Extra	3–7 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, spray mist has cleared and the treated surface has dried.</b>
		Rampart	3–8 L/1,000 L water/ha	0	<b>Pythium spp.</b> For suppression. Apply lower rate every 2–4 weeks after plants become established. <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>
	mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	2.9–5.8 L/ha in a minimum of 225 L water/ha	0	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, spray mist has cleared and the treated surface has dried.</b>
NC	hydrogen peroxide and peroxyacetic acid	OxiDate*	100 mL/10 L water (1.0% v/v)	0	For suppression. Begin applications preventatively or at the first sign of disease and/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*			
<b>GREY MOULD (BOTRYTIS BLIGHT) (<i>Botrytis cinerea</i>)</b>					
2	iprodione	Rovral WP	1 kg/2,000 L water/ha	14	Use a high-volume sprayer. Do not exceed 1 application per year at the 3-leaf stage. <b>REI: 12 hr</b>
		Rovral WDG			
7	fluopyram	Luna Privilege	500 mL/ha	7	First application can be made one week after transplanting at the earliest crop stage BBCH 12 (2nd leaf developed) and can be repeated once before the latest crop stage BBCH 49 (final head size for harvest is reached). 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: 1.2 m - 1000 L/ha 2.7 m - 1000–1500 L/ha  Drench: Do not apply prior to flowering on the 9th truss or before March 1st. Apply as part of a normal irrigation cycle, late in the day on last watering. Avoid applications when conditions favour rapid growth.  <b>REI: 12 hr</b>
17	fenhexamid	Decree 50 WDG	1.5 kg/ha (0.75 kg a.i./ha)	3	Begin application when conditions favour disease development. Repeat application after 7 days if conditions continue to favour disease. Do not exceed 2 applications per crop cycle. <b>Do not exceed 3 kg per hectare per season. 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>GREY MOULD (BOTRYTIS BLIGHT) (<i>Botrytis cinerea</i>) (cont'd)</b>					
44	<i>Bacillus subtilis</i> strain QST 713	Cease*	1–2 L/100 L water	0	For suppression. Begin applications soon after emergence or transplant. Repeat application every 7–10 days as needed. When environmental conditions are conducive to rapid disease development, use in a rotational program with other registered fungicides. Thorough coverage is essential. <b>REI: NS</b>
		Rhapsody ASO*			
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 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>
	<i>Trichoderma harzianum</i> Rifai strain KRL-AG2	RootShield HC*	10 g/L water	NS	For suppression. Use a quantity of spray solution to thoroughly cover foliage. Spray to wet but not to the point of run-off. Repeat applications every 7–14 days. <b>REI: NS</b>
M 03	ferbam	Ferbam 76 WDG	2 kg/1,000 L water	NS	Spray seedlings before first transplanting. Repeat application after 10 days. <b>REI: NS</b>
NC	<i>Aureobasidium pullulans</i> DSM 14940 and DSM 14941	Botector*	1 kg/ha in 500–2,000 L water	0	Apply preventatively soon after emergence or transplant if climatic conditions are favourable for infection or at first sign of disease onset. Repeat application every 7 days as needed. <b>REI: 4 hr</b>
<b>POWDERY MILDEW</b>					
44	<i>Bacillus subtilis</i> strain QST 713	Cease*	1–2 L/100 L water	0	<b>Erysiphe cichoracearum</b> For suppression. Begin applications when conditions are conducive to disease development. Repeat application every 7–10 days as needed. Apply sufficient water to ensure complete coverage of entire plant. <b>REI: NS</b>
		Rhapsody ASO*			
7 + 11	boscalid + pyraclostrobin	Pristine WG	1.3–1.6 kg in a minimum of 250 L water/ha	0	<b>Erysiphe cichoracearum</b> For suppression. Begin application prior to disease development. Will provide suppression for a period of 10–14 days depending on disease pressure. 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: 24 hr</b>
9 + 12	cyprodinil + fludioxonil	Palladium WG	775 g/ 200–3,000 L water/ha	1	<b>Erysiphe cichoracearum</b> Begin applications prior to or at the onset of disease. Repeat application every 7–10 days if conditions remain favourable for disease development. Make no more than 2 sequential applications before alternating with a treatment with another mode of action. The third application can be made if conditions remain favourable for disease development. Do not exceed 3 applications per crop cycle. <b>REI: 12 hr</b>

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

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<b>POWDERY MILDEW (cont'd)</b>					
NC	potassium bicarbonate	MilStop*	2.8–5.6 kg/1,000 L water/ha	0	<b>Golovinomyces</b> For suppression. 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 7–14 days. Do not exceed 10 applications per season. Do not apply through any type of irrigation system. <b>REI: 4 hr</b>
	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>SCLEROTINIA ROT (SCLEROTINIA DROP, LETTUCE DROP)</b>					
2	iprodione	Rovral WP Rovral WDG	1 kg/2,000 L water/ha	14	Use a high-volume sprayer. Do not exceed 1 application per year at the 3-leaf stage. <b>Toxic to certain beneficial insects. REI: 12 hr</b>
44	<i>Bacillus amyloliquefaciens</i> strain D747	Double Nickel 55* Double Nickel LC*	<b>Foliar:</b> 1–2.5 kg/ha <b>Low disease pressure:</b> 0.2–1 kg/ha	0	<b>Sclerotinia minor, Sclerotinia sclerotiorum</b> For suppression. Apply from planting to formation of the head of lettuce. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. <b>REI: Re-enter into treated areas only after spray has dried.</b>
	<i>Bacillus subtilis</i> strain QST 713	Cease* Rhapsody ASO*	1–2 L/100 L water	0	<b>Sclerotinia minor, Sclerotinia sclerotiorum</b> For suppression. Head and leaf drop: Apply as a directed spray with multiple nozzles to each seed line in sufficient water to ensure thorough coverage of lower plant leaves and surrounding soil surface within 7 days of thinning or transplanting. Repeat application every 10–14 days if conditions for disease development persist. Use high rate and lower applications intervals under conditions of moderate to high disease pressure. <b>REI: NS</b>

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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 ROTTS (DAMPING OFF)</b>					
4	Metalaxyl-M and S-isomer	Subdue Maxx	1.5–2.5 mL/10 L water	21	<b>Pythium aphanidermatum</b> Apply as a soil drench after the cotyledons have fully expanded to the 2nd true leaf stage and at least one day before transplanting. Do not exceed one application per crop cycle. Apply 50–200 mL of solution per m <sup>2</sup> at the base of seedlings. Irrigate within 1–2 days to ensure product reaches the root zone. Use the higher rate under conditions of high disease pressures, or when there is a history of high disease pressure. Do not apply to the foliage. <b>REI: 12 hr</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 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 treated areas only after 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

<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 ROTTS (DAMPING OFF) (cont'd)</b>					
BM 02	<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><i>Fusarium spp.</i>, <i>Phytophthora spp.</i>, <i>Pythium spp.</i>, <i>Rhizoctonia spp.</i></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>Trichoderma harzianum</i> Rifai strain T-22	Trianum G*	See <b>Remarks.</b>	NS	<b><i>Rhizoctonia solani</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 reporting:</b> 375 g/m <sup>3</sup> <b>Crops on substrate, when transplanting:</b> 1 g/planting hole
		Trianum P*	See <b>Remarks.</b>	NS	<b><i>Rhizoctonia solani</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)

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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)</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.</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 treated areas only after 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
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>Pythium spp.</b> For suppression. Begin applications when conditions favour disease development. Repeat application 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, spray mist has cleared and the treated surface has dried.</b>
	mono- and di-potassium salts of phosphorous acid	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>Pythium spp.</b> For suppression. 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>

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

