

# Hops

Hops are grown for their aromatic cones, which are used to enhance bitterness and flavor in beer. Though Wisconsin was the number one hops producer in the U.S. in the mid-1860s, production declined in subsequent years due to pest and disease challenges in addition to market factors. With the rising popularity of regional craft brews and locally sourced ingredients, production is again on the rise; a recent UW-Extension poll indicated close to 300 acres of hops grown currently with considerable expansion on the horizon.

## Planting and cultivation

Hops are grown as a vegetatively propagated perennial on elaborate trellis systems. In Wisconsin, hop trellis height commonly ranges from 16–20 feet, though the optimal height has not been empirically established for the region. New yards can be started with rhizomes or, more commonly, small plantlets generated from softwood cuttings. Individual plants are spaced 30–36 inches apart with approximately 12 feet between rows.

Training of the hop vines occurs in the spring when shoots are 12–24 inches long. Two to four shoots are selected and wound in a clockwise direction around each string. In some cases a second

round of training may be necessary if there are insufficient shoots the first time through.

Established plants will produce many more shoots than required for training and these are removed, most commonly with chemical desiccants, after the trained vines have developed sufficient woody tissue. This removal may occur several times during the growing season. Any male plants accidentally introduced to the hop yard should be removed as to prevent fertilization and the formation of seeds in female cones, as this is undesirable to brewers.

While hop plants may start producing cones in their first year, peak production is generally not reached until the third year. Harvest is generally not recommended in the first 1–2 years of yard establishment in order to allow sufficient development of the root system and ensure maximum yields in subsequent years.

## Irrigation

Supplemental irrigation systems are common in most commercial hop yards in Wisconsin. Typically, these are drip systems with emitters suspended approximately 12 inches from the ground.

## Nutrient management guidelines

See UW-Extension publication Nutrient Application Guidelines for Field, Vegetable, and Fruit Crops in Wisconsin (A2809) for hop fertility information. The publication can be ordered or downloaded for free by visiting <http://learningstore.uwex.edu> and entering A2809 in the search box.

## Harvest

While harvest timing is largely dependent on variety, the Wisconsin harvest season generally spans from mid-August through mid-September. Harvest timing is also influenced by the chemical properties of ripening cones. Growers frequently utilize testing services to determine peak ripeness. Most hops in the state are harvested mechanically, as hand harvesting is intensely laborious. Typically, the vines are cut by hand and transported to the harvester, use of which may be arranged with another grower if not owned. A small percentage of fresh, so-called “wet” hops are used immediately after harvest for brewing, but the majority are dried, pelletized, and frozen for storage and later use.

## Disease control in hops

Disease	Active ingredient	Rate/a of commercial product	Days to harvest	Remarks and suggestions
<b>Downy mildew</b> ( <i>Pseudoperonospora humili</i> )	ametoctradin + dimethomorph	11.0–14.0 fl oz Zampro	7	Do not apply more than 40.0 fl oz/a per season. Make no more than 3 applications per season. Do not make more than 2 sequential applications before alternating to a labeled fungicide with a different mode of action.
	<i>Bacillus pumilis</i> strain QST 2808	2.0–4.0 qt/100 gal spray volume of Sonata	0	Use when conditions favor disease and apply at 7- to 14-day intervals as needed. OMRI approved.
	basic copper sulfate	1.0–1.25 lb Cuprofix Ultra 40 Disperss	14	Apply after pruning but before training. Apply again as needed on a 10-day basis after training.
	copper ammonium complex	2.0 qt Copper Count N	14	Apply after pruning but before training. Apply again as needed on a 10-day basis after training.
	copper hydroxide	1.33 lb Champ Dry Prill 1.33 lb Champ Formula 2 Flowable 1.06 lb Champ WG 0.75–1.5 lb Kocide 3000 1.5 lb Kocide 2000 2.0 lb Kentan DF 1.33–2.67 pt NuCop 3L	14	Apply after pruning but before training. Apply again as needed on a 10-day basis after training.
	copper octanoate	0.5–2.0 gal Cueva in 100 gal water	0	Apply soon after training vines.
	copper oxychloride + basic copper sulfate	4.0–6.0 lb C-O-C-S WDG	14	Apply soon after training vines.
	copper oxychloride + copper hydroxide	1.8 pts Badge SC 0.75 lb Badge X <sub>2</sub>	14	Treat after pruning but before training.
	cuprous oxide	2.0 lb Nordox	14	Apply after pruning but before training. Apply again as needed on a 10-day basis after training.
	cyazofamid	2.1–2.75 fl oz Ranman	3	Apply prior to or at first sign of disease. Follow resistance management guidelines. Rainfast.
	cymoxanil	3.2 oz Curzate DF	7	Apply with a protectant fungicide such as copper hydroxide. Rainfast in 2 hours.
	dimethomorph	6.0 fl oz Forum	7	Do not make more than 3 applications per season. Addition of an adjuvant to spray mix is recommended. Good antisporeulant. Rainfast.
	famoxadone + cymoxanil	8.0 oz Tanos	7	Use with a tank-mix partner. Apply preventatively and on a 6- to 8-day spray schedule. Follow resistance management guidelines. Excellent curative activity. Good leaf protectant. Rainfast.
	fosetyl-al	2.5 lb Aliette 5.0 lb/100 gal spray volume Linebacker	24	Do not tank mix with coppers. Initiate application when weather conditions favor disease (warm and humid). Avoid mixing with foliar fertilizers or surfactants.
mandipropamid	8.0 fl oz Revus	7	A non-ionic surfactant is recommended with use of this product. Follow resistance management guidelines.	
mefenoxam	0.5 pt Ridomil Gold SL	45	Label allows drench and foliar applications. Follow resistance management guidelines. Can be highly effective and is a two-way systemic. However, downy mildew pathogen may have resistance.	

(continued)

Eggplant

Hops

Horse radish

Leafy greens

Melon

Mint

Onion

## Disease control in hops *(continued)*

Disease	Active ingredient	Rate/a of commercial product	Days to harvest	Remarks and suggestions
<b>Downy mildew</b> <i>(Pseudoperonospora humili)</i> <i>(cont.)</i>	monopotassium phosphate and monopotassium phosphite	2.0–4.0 qt Phorcephite 1.0–3.0 qt in 20 gal of water Rampart	0	Apply when conditions favor disease when shoots are 6–12 inches high, after training at 5–6 ft tall, about 3 weeks after second application, and during bloom.
	mono- and dipotassium salts of phosphorous acid	1.0–3.0 qt in 20 gal water Confine Extra 1.0–3.0 qt/100 gal water Fosphite 1.0–2.0 qt/a in a spray volume of 25 gal water Fungi-phite 2.0–4.0 pt Helena Prophyt 2.5 pt Phostrol	0	Apply at 2- to 3-week intervals. Do not apply at an interval less than 3 days. Apply when conditions favor disease when shoots are 6–12 inches high, after training at 5–6 ft tall, about 3 weeks after second application, and during bloom.
	potassium bicarbonate	2.5–5.0 lb/100 gal spray volume Armicarb 100	0	Do not exceed mix rate of 5.0 lb/100 gal of water. Do not store unused portion of spray for more than 12 hours prior to use.
	pyraclostrobin + boscalid	14.0 oz/100 gal spray volume Pristine	14	Use preventatively and apply at 14- to 21-day intervals as needed. Follow resistance management guidelines.
	extract of <i>Reynoutria sachalinensis</i>	1.0–4.0 qt Regalia	0	Use preventatively and apply at 7-day intervals as needed. <b>Emergence to wire-touch:</b> 1.0–2.0 qt recommended. <b>Wire-touch through harvest:</b> 2.0–4.0 qt. OMRI approved. Has some contact fungicidal activity.
<b>Powdery mildew</b> <i>(Podosphaera macularis and humili)</i>	<i>Bacillus pumilis</i> strain QST 2808	2.0–4.0 qt/100 gal spray volume of Sonata	0	Use when conditions favor disease and apply at 7- to 14-day intervals as needed. OMRI approved.
	<i>Bacillus subtilis</i> strain QST 713	4.0–6.0 qt/100 gal spray volume of Serenade ASO 2.0–3.0 lb/100 gal spray volume of Serenade MAX	0	Use when conditions favor disease and apply at 7-day intervals as needed. OMRI approved.
Melon	copper octanoate	0.5–2.0 gal Cueva in 100 gal water	0	Apply soon after training vines.
	metrafenone	15.4 fl oz Vivando	3	Do not make more than 2 applications of Vivando per year. Do not mix with horticultural oils.
	mono- and dipotassium salts of phosphorous acid	1.0–3.0 qt/100 gal water Phosphite 1.0–3.0 qt in 20 gal of water Rampart	0	Apply at 2- to 3-week intervals. Do not apply at an interval less than 3 days.
	myclobutanil	2.0–10.0 oz Rally	14	<b>Emergence to training label rate:</b> 2.0–4.0 oz. <b>Training to wire:</b> 4.0–6.0 oz. <b>Wire to 14-day prior to harvest:</b> 6.0–10.0 oz. Follow resistance management guidelines. (Former product name was Nova.)
	neem oil	0.5%–1.0% in 25–100 gal water spray volume of Trilogy	0	Use when conditions favor disease and apply at a 7- to 14-day intervals as needed. OMRI approved. Also a miticide/insecticide.
Onion	potassium bicarbonate	2.5–5.0 lb/100 gal spray volume Armicarb 100 2.5–5.0 lb Kaligreen	0	Do not exceed mix rate of 5.0 lb/100 gal of water. Do not store unused portion of spray for more than 12 hours prior to use. Apply when weather conditions favor disease and repeat on a 7- to 10-day basis.

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### Disease control in hops (continued)

Disease	Active ingredient	Rate/a of commercial product	Days to harvest	Remarks and suggestions
<b>Powdery mildew</b> ( <i>Podosphaera macularis</i> and <i>humili</i> ) (cont.)	pyraclostrobin + boscalid	14.0 oz/100 gal spray volume Pristine	14	Use preventatively and apply at 14- to 21-day intervals as needed. Follow resistance management guidelines.
	quinoxifen	4.0–8.2 fl oz Quintec	21	Follow resistance management guidelines, including “Do not apply more than 4 times per season.” Minimum spray interval is 7 days.
	extract of <i>Reynoutria sachalinensis</i>	1.0–4.0 qt Regalia	0	Use preventatively and apply at 7-day intervals as needed. <b>Emergence to wire-touch:</b> 1.0–2.0 qt recommended. <b>Wire-touch through harvest:</b> 2.0–4.0 qt. OMRI approved. Some contact fungicidal activity.
	sodium bicarbonate	4.0 oz/10 gal water spray volume Milstop	0	Begin application when weather favors disease and apply at 1- to 2-week intervals. Tighten intervals when disease pressure heightens.
	sulfur	4.0–6.0 lb Thiolux	see label	Do not apply after flowering, and grower should verify with processor before use. Do not use within 2 weeks of oil spray. Sulfur is fungitoxic in its vapor phase and therefore is effective only when air temperatures promote volatilization. Sulfur volatilizes above 65°F but becomes phytotoxic above 95°F. Using it above 85°F is not recommended. See label for details on rates and reentry intervals. Kumulus and Microthiol Disperss are labeled for spider mite control in hop.
	tebuconazole	4.0–8.0 fl oz Monsoon, ONSET 3.6L, Orius 3.6F, Tebustar 3.6L, Tebuzol 3.6F, Toledo 3.6F	14	Apply at 10- to 14-day intervals. Follow resistance management guidelines.
	trifloxystrobin	1.0 oz with every 15–30 gal spray volume Flint	14	Apply preventatively for best results. Apply on a 10- to 14-day interval. Follow resistance management guidelines.
	triflumizole	12.0 fl oz Procure 480SC	7	Use prior to or at disease onset for best results and reapply on a 14-day schedule.

OMRI-approved products are typically acceptable by organic certifiers. Several copper formulations may be approved for organic use, but this status can change. Check with your organic certifying agency prior to selection of fungicides for the production season.

Eyeglant

Hops

Horse radish

Leafy greens

Melon

Mint

Onion

## Insect control in hops

Insect	Rate/a of active ingredient	Rate/a of commercial product	Days to harvest	Remarks and suggestions
Aphids	azadirachtin	4.0–16.0 fl oz Azatin 0 15.0–30.0 oz Ecozin Plus 1.2% ME	0	See label for remarks and suggestions.
		8.0–15.0 fl oz Molt-X		See label for remarks and suggestions.
	azadirachtin + pyrethins	1.0–3.5 pt Azera		See label for remarks and suggestions.
	beta-cyfluthrin	3.2 fl oz *Baythroid XL	7	See label for remarks and suggestions.
	bifenthrin	3.2–6.4 fl oz *Bifen 2 AG Gold; *Bifen 25% EC; *Bifenthrin 2EC; *Bifenture; *Bifenture EC; *Brigade 2EC; *Fanfare 2EC, EC, ES; *Skyraider; *Sniper; *Tailgunner; *Tundra EC 4.4–7.4 fl oz *Bifender FC 8.0–16.0 oz *Brigade WSB	14	See label for remarks and suggestions.
	bifenthrin + avermectin	8.5–17.0 fl oz *Athena	28	See label for remarks and suggestions.
	bifenthrin + imidacloprid	7.6–25.6 fl oz *Avenger S3, *Avenger Systemic, *Swagger 3.8–12.8 fl oz *Brigadier, *Tempest	28	See label for remarks and suggestions.
	heat-killed <i>Burkholderia</i> spp.	1.0–8.0 qt Venerate XC	0	See label for remarks and suggestions.
	<i>Chromobacterium</i> <i>subtsugae</i>	1.0–3.0 lb Grandevo	0	See label for remarks and suggestions.
	cyfluthrin	3.2 fl oz *Tombstone, *Tombstone Helios	7	See label for remarks and suggestions.
	flonicamid	1.7–2.8 fl oz Beleaf 50 SG	10	See label for remarks and suggestions.
	flupyradifurone	7.0–10.5 fl oz Sivanto 200 SL, Sivanto prime	21	See label for remarks and suggestions.
	imidacloprid ( <i>foliar</i> )	2.1 fl oz Malice 75 WSP 3.2 fl oz Advise Four, Agri Star Macho 4.0, Imidacloprid 4F, Mana Alias 4F, Midash Forte, Montana 4F, Nuprid 4F, Provoke, Wrangler 6.4 fl oz Advise 2FL, Agri Star Macho 2.0 FL, AmTide, Montana 2F, Nuprid 2SC 8.0 fl oz Pasada 1.6F, Prey 1.6, Provado 1.6, Sherpa	28	See label for remarks and suggestions.

\*Restricted-use pesticide.

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## Insect control in hops *(continued)*

Insect	Rate/a of active ingredient	Rate/a of commercial product	Days to harvest	Remarks and suggestions
<b>Aphids</b> <i>(cont.)</i>	imidacloprid ( <i>soil</i> )	2.8–8.4 fl oz Admire Pro, Nuprid 4.6F Pro 9.6 fl oz Advise Four, Agri Star Macho 4.0, Imidacloprid 4F, Mana Alias 4F, Midash Forte, Montana 4F, Nuprid 4F, Provoke, Wrangler 19.2 fl oz Advise 2FL, Agri Star Macho 2.0 FL, Alias 2F, AmTide, Malice 2F, Montana 2F, Nuprid 2SC, Widow	60	See label for remarks and suggestions.
	imidacloprid + beta-cyfluthrin	3.2 fl oz *Leverage 360	28	See label for remarks and suggestions.
	malathion	0.63 pt Malathion 8 Aquamul 1.0 pt Cheminova, Drexel Malathion 5EC, Malathion 5, Malathion 57 EC, Malathion 57%	10	See label for remarks and suggestions.
	mineral oil	1.0–2.0 gal PureSpray Green in at least 50 gal water		Discontinue use at burr development.
		1.0–2.0 gal SuffOil-X/100 gal water	0	See label for remarks and suggestions.
	naled	1.0 pt *Dibrom 8 Emulsive	7	See label for remarks and suggestions.
	neem oil (clarified hydrophobic extract)	1.0–2.0% Trilogy		Can be used up to day of harvest.
	potassium salts of fatty acids	M-Pede, Des-X	0	See label for remarks and suggestions.
	pymetrozine	4.0–6.0 oz Fulfill	7	See label for remarks and suggestions.
	spirotetramat	5.0–6.0 fl oz Movento	7	See label for remarks and suggestions.
thiamethoxam	8.0 fl oz Platinum 2.67 fl oz Platinum 75 SG	65	See label for remarks and suggestions.	
<b>Army-worms</b>	azadirachtin	4.0–16.0 fl oz Azatin 0	0	See label for remarks and suggestions.
	<i>Bacillus thuringiensis</i>	0.5–2.0 lb Biobit HP, DiPel DF, XenTari 1.0–4.0 pts DiPel ES	0	See label for remarks and suggestions.
	bifenthrin	3.2–6.4 fl oz *Bifen 2 AG Gold; *Bifen 25% EC; *Bifenthrin 2EC; *Bifenture; *Bifenture EC; *Brigade 2EC; *Fanfare 2EC, EC, ES; *Skyraider; *Sniper; *Tailgunner; *Tundra EC	14	See label for remarks and suggestions.
		8.0–16.0 oz *Brigade WSB 4.4–7.4 fl oz *Bifender FC		
bifenthrin + avermectin	8.5–17.0 fl oz *Athena	28	See label for remarks and suggestions.	

\*Restricted-use pesticide.

*(continued)*

Egplant

Hops

Horse radish

Leafy greens

Melon

Mint

Onion

## Insect control in hops (continued)

Insect	Rate/a of active ingredient	Rate/a of commercial product	Days to harvest	Remarks and suggestions
<b>Armyworms</b> (cont.)	bifenthrin + imidacloprid	7.6–25.6 fl oz *Avenger S3, *Avenger Systemic, *Swagger 3.8–12.8 fl oz *Brigadier, *Tempest	28	See label for remarks and suggestions.
	heat-killed <i>Burkholderia</i> spp.	1.0–8.0 qt Venerate XC	0	See label for remarks and suggestions.
	<i>Chromobacterium subtsugae</i>	1.0–3.0 lb Grandevo	0	See label for remarks and suggestions.
	naled	1.0 pt *Dibrom 8 Emulsive	7	See label for remarks and suggestions.
	spinosad	1.25–2.0 oz Entrust 4.0–6.0 fl oz Entrust SC, SpinTor	1	See label for remarks and suggestions.
	spinetoram	2.5–4.0 oz Delegate WG	1	See label for remarks and suggestions.
<b>Cutworms</b>	azadirachtin	4.0–16.0 fl oz Azatin 0	0	See label for remarks and suggestions.
	bifenthrin	3.2–6.4 fl oz *Bifen 2 AG Gold; *Bifen 25% EC; *Bifenthrin 2EC; *Bifenture; *Bifenture EC; *Brigade 2EC; *Fanfare 2EC, EC, ES; *Skyraider; *Sniper; *Tailgunner; *Tundra EC 8.0–16.0 oz *Brigade WSB 4.4–7.4 fl oz *Bifender FC	14	See label for remarks and suggestions.
	bifenthrin + avermectin	8.5–17.0 fl oz *Athena	28	See label for remarks and suggestions.
	bifenthrin + imidacloprid	7.6–25.6 fl oz *Avenger S3, *Avenger Systemic, *Swagger 3.8–12.8 fl oz *Brigadier, *Tempest	28	See label for remarks and suggestions.
	spinetoram	2.5–4.0 oz Delegate WG	1	See label for remarks and suggestions.
	<b>Flea beetles</b>	beta-cyfluthrin	3.2 fl oz *Baythroid XL	7
	cyfluthrin	3.2 fl oz *Tombstone, *Tombstone Helios	7	See label for remarks and suggestions.
	imidacloprid + beta-cyfluthrin	3.2 fl oz *Leverage 360	28	See label for remarks and suggestions.
	<b>Leafhoppers</b>	azadirachtin	4.0–16.0 fl oz Azatin 0 15.0–30.0 oz Ecozin Plus 1.2% ME 8.0–15.0 fl oz Molt-X	0
bifenthrin + imidacloprid		7.6–25.6 fl oz *Avenger S3, *Avenger Systemic, *Swagger 3.8–12.8 fl oz *Brigadier, *Tempest	28	See label for remarks and suggestions.
	potassium salts of fatty acids	M-Pede, Des-X	0	See label for remarks and suggestions.
	rosemary oil	1.0–4.0 pt Ecotrol EC	0	See label for remarks and suggestions.

\*Restricted-use pesticide.

(continued)

## Insect control in hops *(continued)*

Insect	Rate/a of active ingredient	Rate/a of commercial product	Days to harvest	Remarks and suggestions
<b>Lepidopterous (moth and butterfly) caterpillars</b>	<b>This is a large category of insects. Read the individual insecticide label to make sure your specific species is included.</b>			
	azadirachtin	4.0–16.0 fl oz Azatin 0 15.0–30.0 oz Ecozin Plus 1.2% ME	0	See label for remarks and suggestions.
		8.0–15.0 fl oz Molt-X		See label for remarks and suggestions.
	azadirachtin + pyrethrins	1.0–3.5 pt Azera		See label for remarks and suggestions.
	<i>Bacillus thuringiensis</i>	0.25–1.0 lb Javelin WG 0.5–1.5 lb Deliver	0	See label for remarks and suggestions.
	bifenthrin	3.2–6.4 fl oz *Bifen 2 AG Gold; *Bifen 25% EC; *Bifenthrin 2EC; *Bifenture; *Bifenture EC; *Brigade 2EC; *Fanfare 2EC, EC, ES; *Skyraider; *Sniper; *Tailgunner; *Tundra EC 4.4–7.4 fl oz *Bifender FC 8.0–16.0 oz *Brigade WSB	14	See label for remarks and suggestions.
	bifenthrin + avermectin	8.5–17.0 fl oz *Athena	28	See label for remarks and suggestions.
	bifenthrin + imidacloprid	7.6–25.6 fl oz *Avenger S3, *Avenger Systemic, *Swagger 3.8–12.8 fl oz *Brigadier, *Tempest	28	See label for remarks and suggestions.
	mineral oil	1.0–2.0 gal SuffOil-X/100 gal water	0	See label for remarks and suggestions.
	rosemary oil	1.0–4.0 pt Ecotrol EC	0	Treats early stages only.
spinetoram	2.5–4.0 oz Delegate WG	1	See label for remarks and suggestions.	
<b>Loopers</b>	azadirachtin	4.0–16.0 fl oz Azatin 0	0	See label for remarks and suggestions.
	<i>Bacillus thuringiensis</i>	0.5–2.0 lb Biobit HP, DiPel DF, XenTari 1.0–4.0 pts DiPel ES	0	See label for remarks and suggestions.
	beta-cyfluthrin	3.2 fl oz *Baythroid XL	7	See label for remarks and suggestions.
	bifenthrin	3.2–6.4 fl oz *Bifen 2 AG Gold; *Bifen 25% EC; *Bifenthrin 2EC; *Bifenture; *Bifenture EC; *Brigade 2EC; *Fanfare 2EC, EC, ES; *Skyraider; *Sniper; *Tailgunner; *Tundra EC 4.4–7.4 fl oz *Bifender FC 8.0–16.0 oz *Brigade WSB	14	See label for remarks and suggestions.
	bifenthrin + avermectin	8.5–17.0 fl oz *Athena	28	See label for remarks and suggestions.

\*Restricted-use pesticide.

*(continued)*

Eyeglant

Hops

Horse radish

Leafy greens

Melon

Mint

Onion



## Insect control in hops *(continued)*

Insect	Rate/a of active ingredient	Rate/a of commercial product	Days to harvest	Remarks and suggestions
<b>Loopers</b> <i>(cont.)</i>	bifenthrin + imidacloprid	7.6–25.6 fl oz *Avenger S3, *Avenger Systemic, *Swagger 3.8–12.8 fl oz *Brigadier, *Tempest	28	See label for remarks and suggestions.
	heat-killed <i>Burkholderia</i> spp.	1.0–8.0 qt Venerate XC	0	See label for remarks and suggestions.
	<i>Chromobacterium subtsugae</i>	1.0–3.0 lb Grandevo	0	See label for remarks and suggestions.
	cyfluthrin	3.2 fl oz *Tombstone, *Tombstone Helios	7	See label for remarks and suggestions.
	imidacloprid + beta-cyfluthrin	3.2 fl oz *Leverage 360	28	See label for remarks and suggestions.
	spinosad	1.25–2.0 oz Entrust 4.0–6.0 fl oz Entrust SC, SpinTor	1	See label for remarks and suggestions.
<b>Two-spotted spider mites</b>	spinetoram	2.5–4.0 oz Delegate WG	1	See label for remarks and suggestions.
	abamectin	1.75–3.5 fl oz *Agri-Mek SC 4.0–8.0 fl oz *Abba Ultra 8.0–16.0 fl oz *Abacus, *Abba 0.15, *Abba 0.15 EC, *Agri-Mek 0.15 EC, *Nufarm Abamcetin 0.15 EC, *Reaper 0.15 EC, *Reaper Advance, *Reaper ClearForm, *Timectin, *Zoro		See label for remarks and suggestions.
	acequinocyl	31.0 fl oz Kanemite 15 SC	7	See label for remarks and suggestions.
	bifenazate	0.75–1.5 lb Acramite 50WS	14	See label for remarks and suggestions.
	bifenthrin	3.2–6.4 fl oz *Bifen 2 AG Gold; *Bifen 25% EC; *Bifenthrin 2EC; *Bifenture; *Bifenture EC; *Brigade 2EC; *Fanfare 2EC, EC, ES; *Skyraider; *Sniper; *Tailgunner; *Tundra EC 4.4–7.4 fl oz *Bifender FC 8.0–16.0 oz *Brigade WSB	14	See label for remarks and suggestions.
	bifenthrin + avermectin	8.5–17.0 fl oz *Athena	28	See label for remarks and suggestions.
	bifenthrin + imidacloprid	7.6–25.6 fl oz *Avenger S3, *Avenger Systemic, *Swagger 3.8–12.8 fl oz *Brigadier, *Tempest	28	See label for remarks and suggestions.
	heat-killed <i>Burkholderia</i> spp.	1.0–8.0 qt Venerate XC	0	See label for remarks and suggestions.
	<i>Chromobacterium subtsugae</i>	1.0–3.0 lb Grandevo	0	See label for remarks and suggestions.

\*Restricted-use pesticide.

*(continued)*

## Insect control in hops *(continued)*

Insect	Rate/a of active ingredient	Rate/a of commercial product	Days to harvest	Remarks and suggestions
<b>Two-spotted spider mites</b> <i>(cont.)</i>	etoxazole	3.0–4.0 fl oz Zeal 6.0–8.0 fl oz Zeal SC	7	See label for remarks and suggestions.
	fenpyroximate	2.0–3.0 pt Portal XLO	15	See label for remarks and suggestions.
	malathion	1.0 pt Cheminova, Drexel Malathion 5EC, Malathion 5, Malathion 57 EC, Malathion 57%	10	See label for remarks and suggestions.
	mineral oil	1.0–2.0 gal PureSpray Green in at least 50 gal water 1.0–2.0 gal in 100 gal water Drexel Damoil, Glacial Spray Fluid, Omni Supreme Spray, Ultra-Pure Oil		Discontinue at burr development.
		1.0–2.0 gal SuffOil-X/100 gal water	0	See label for remarks and suggestions.
	neem oil (clarified hydrophobic extract)	1.0–2.0% Trilogy		Can be used up to day of harvest.
	paraffin oil	1.0–2.0 gal JMS Stylet-Oil/100 gal water		Discontinue sprays at burr development.
	potassium salts of fatty acids	M-Pede, Des-X	0	See label for remarks and suggestions.
	rosemary oil	1.0–4.0 pt Ecotrol EC	0	See label for remarks and suggestions.
	spirotetrafen	18.0–24.7 fl oz Envidor 2 SC	14	See label for remarks and suggestions.
	spirotetrafen	5.0–6.0 fl oz Movento	7	See label for remarks and suggestions.
	sulfur (elemental)	0.3–7.5 gal Suffa	not listed	See label for remarks and suggestions.

\*Restricted-use pesticide.

## Weed control in hops

Weed	Rate/a of active ingredient	Rate/a of commercial product	Days to harvest	Remarks and suggestions
<b>Annual weeds</b>	2.0–4.0 lb norflurazon	2.5–5.0 lb Solicam DF	60	Controls several broadleaves and grasses. Apply as a directed spray. Wait at least 6 months after planting hops before applying. Apply to clean soil surface either in fall after tillage or in spring. Use lower rate on coarse soils and higher rate on fine soils.
	0.5–0.75 lb trifluralin	several manufacturers		Controls several annual grasses and a few broadleaf weeds. Apply and incorporate 1–2 inches when crop is dormant. Do not spray over hop crowns. Will not control emerged weeds. Rate varies by soil texture.

\*Restricted-use pesticide.

*(continued)*

Egplant

Hops

Horse radish

Leafy greens

Melon

Mint

Onion

## Weed control in hops *(continued)*

Weed	Rate/a of active ingredient	Rate/a of commercial product	Days to harvest	Remarks and suggestions
<b>Annual weeds</b> <i>(cont.)</i>	0.19 lb flumioxazin	6.0 oz Chateau SW	30	<p>Controls several broadleaf weeds and some annual grasses.</p> <p><b>Sucker control:</b> Apply as a directed spray after hops are at least 6 ft tall. Direct spray to the lower 2 ft of hops.</p> <p><b>PRE weed control:</b> Apply to dormant hops November through February as a 1–1.5 ft band to each side of the hop row.</p> <p>Do not apply with an adjuvant or allow spray to contact green stems (unless for sucker control), foliage, flowers, or cones, or unacceptable injury may occur.</p>
<b>Emerged broadleaves</b>	0.5 lb acid equivalent 2,4-D	several manufacturers	28	Make directed applications to row middles for control of small broadleaf weeds. Up to 3 applications per season are allowed with at least 30 days between applications. Avoid drift—do not allow spray to contact hop foliage or apical buds.
<b>Emerged grasses</b>	0.068–0.12 lb clethodim	9.0–16.0 oz Select Max	21	Controls most annual grasses and several perennial grasses, but not broadleaves. Apply to actively growing grasses, including appropriate adjuvant as directed by the label. Rate depends on targeted grass species. Wait at least 14 days between applications and do not exceed total seasonal maximum use rates.
	0.125 lb clethodim	several manufacturers	21	Controls most annual grasses and several perennial grasses, but not broadleaves. Apply to actively growing grasses, including appropriate adjuvant as directed by the label. Rate depends on targeted grass species. Wait at least 14 days between applications and do not exceed total seasonal maximum use rates.
<b>Emerged weeds</b>	0.03 lb carfentrazone-ethyl	2.0 oz Aim EC	7	<p>Available in Wisconsin through December 31, 2019 as a Special Local Needs (24c) label. For sucker management and control of some young, actively growing broadleaf weeds.</p> <p><b>Sucker control:</b> Apply to the bottom 1.5 ft of the hop plant and to the sucker mat that extends from the base of the plant to 1.5–2 ft into the row. See label for adjuvant requirements.</p> <p><b>POST weed control:</b> Weeds need to be newly emerged and actively growing. Apply using shielded or hooded sprayers. Avoid upward spray drift to new hop growth. Avoid applications until newly trained hops have developed sufficient barking and are high enough up the string to avoid contact with the apical bud. Allow 14 days between applications and do not exceed 7.6 fl oz/a per season.</p>
	glyphosate	several manufacturers and formulations	14	Apply to actively growing weeds as a row middle, shielded, wiper, directed, or spot treatment application. Glyphosate will injure or kill hops. Do not allow contact of spray with green hop stems or foliage.

\*Restricted-use pesticide.

Eggplant

Hops

Horseradish

Leafy greens

Melon

Mint

Onion