

PNW Plant Disease Management Handbook

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Hop (*Humulus lupulus*)-Downy Mildew

By D. H. Gent and C. M. Ocamb

Cause The fungus-like microorganism, *Pseudoperonospora humuli*, persists from year to year in infected hop crowns or plant debris in soil. It is an obligate parasite specific to hop. Disease is promoted by wet or foggy weather.

Symptoms In early spring, spike-like infected vines rise among normal shoots from the crown. Spikes are silvery or pale green, rigid, stunted, and brittle. The undersides of leaves may be covered by profuse sporulation by the pathogen and appear dark purple to black. Tips of normal branches may become infected and transformed into spikes. Leaves of all ages are attacked, resulting in brown angular spots. Flower clusters become infected, shrivel, turn brown, dry up, and may fall. Cones also are affected, becoming brown. Severe infection in some susceptible cultivars may produce a rot of the perennial crowns.

Cultural control

- 'Fuggle' and 'Tettnang' are resistant. 'Willamette', 'Mt. Hood', 'Chinook', 'Liberty', 'Cascade', 'Bullion', and 'Brewers Gold' are tolerant. 'Clusters', 'Galena', and 'Nugget' are susceptible.
- Destroy escaped hop vines near or in hop yards.
- Prune crown before growth starts in the spring or burn back green tissue before training. Complete removal of green tissue or pruning of entire hill is necessary for most effective disease management.
- Remove diseased hills and mark for replanting.
- Train vines early to prevent them from coming in contact with soil.
- Begin suckering as soon as vines are strung. Continue at regular intervals until warm, dry weather prevails (June to July).
- Strip leaves from vines at a height of 4' soon after training to reduce the spread of downy mildew up the canopy.
- Avoid overhead irrigation, especially during and after burr development.

Chemical control

Note Using metalaxyl products is strongly discouraged in the Willamette Valley of Oregon due to resistant pathogen strains. Metalaxyl-resistance is also found in the Yakima Valley of Washington. Insensitivity to Aliette (fosetyl-Al) is widespread in strains of *P. humuli* found in Oregon and northern Idaho. The highest labeled rates of Aliette should be used where insensitive strains are known to occur.

Drench crowns after pruning but before shoots are 6 inches long and/or before training.

- Copper products:



Aerial spike present on hop vine.

Photo by David H. Gent, 2006



Hop cone with downy mildew infection.

Photo by Cynthia M. Ocamb, 2002



Note the shoots with shortened internodes, characteristic of hop downy mildew.

Photo by Cynthia M. Ocamb, 2004

- Champ Formula 2 at 1.33 pints/A. Do not apply within 14 days of harvest. 48-hr reentry.
- Kocide 3000 at 0.75 to 1.75 lb/A. Do not apply within 14 days of harvest. 48-hr reentry.
- Nordox 75 WG at 1.25 lb/A on 10-day intervals as needed. Apply up to 14 days before harvest. 24-hr reentry.
- Metalaxyl products such as Ridomil Gold SL at 0.5 pint/A or MetaStar 2E AG at 1 quart/A in at least 20 gal water as soil drench over crowns when plants are 6 inches or less, tank-mix with a copper fungicide registered for hop. Do not apply within 45 days of harvest. 48-hr reentry.

Apply during the season.

- CAA-fungicide (Carboxylic Acid Amides) formulations (Group 40) in combination with another fungicide that has a different mode of action. Do not apply more than once before alternating to a different mode of action.
 - Revus at 8 fl oz/A. Do not apply within 7 days of harvest. 4-hr reentry.
- Copper products are not effective as stand-alone materials. Care must be taken to avoid build-up in the soil.
 - Champ Formula 2 at 1.33 pints/A. Do not apply within 14 days of harvest. 48-hr reentry.
 - C-O-C-S WDG at 4 to 6 lb/A. Not widely used due to low efficacy. 24-hr reentry.
 - Cueva at 0.5 to 2 gal/100 gal water on 7- to 10-day intervals. May be applied on the day of harvest. 4-hr reentry. ☐
 - Cuprofix Ultra 40D at 1 to 1.5 lb/A on 7- to 10-day intervals. Discontinue use 2 weeks before harvest. 48-hr reentry.
 - Kocide 2000 at 1.5 lb/A or Kocide 3000 at 0.75 to 1.5 lb/A on 10-day intervals. 48-hr reentry.
 - Nordox 75 WG at 1.25 lb/A on 10-day intervals as needed. Apply up to 14 days before harvest. 24-hr reentry.
 - Nu Cop 50 WP at 2 lb/A on 10-day intervals. Do not apply within 2 weeks of harvest. 48-hr reentry. ☐
- Cymoxanil products (Group 27) such as Curzate 60DF at 3.2 oz/A or Tanos at 8 oz/A. Use only in combination with another protective fungicide. Do not make more than one (1) application before alternating with a fungicide that has a different mode of action. Do not apply within 7 days of harvest. 12-hr reentry.
- Folpan 80 WDG at 3 lb/A on 28-day intervals. Do not apply within 14 days of harvest. Folpan 80 WDG when used for downy mildew control will provide some suppression of powdery mildew. 24-hr reentry.
- Phosphonates formulations (Group 33) are effective.
 - Agri-Fos at 2.5 pints/A in 100 gal water or 2.5 teaspoons per gal of water. When conditions favor disease, applications should occur when shoots are 0.5 to 1 foot long, post training when bines are 5 to 6 feet high, 21 days after the second application, and during bloom. 4-hr reentry. ☐
 - Fosetyl-AL products such as Aliette WDG at 2.5 lb/A (SLN OR-040018 for air application). Do not tank-mix with copper products. Do not apply within 24 days of harvest. 12-hr reentry.
 - Fosphite at 1 to 3 quarts/100 gal water/A on 14- to 21-day intervals. 4-hr reentry.
- Topaz (Group 3) at 1 to 3 quarts/100 gal water/A on 14- to 21-day intervals. 4-hr reentry.
- Strobilurin compounds (Group 11) such as Flint and Pristine will provide suppression of downy mildew when used for powdery mildew control.
- Zampro (Group 40 + 45) at 11 to 14 fl oz/A. Do not apply more than two (2) applications before alternating to a fungicide with a different mode of action. Preharvest interval is 7 days. 12-hr reentry.

Biological control Efficacy unknown in the Pacific Northwest.

- Regalia (extract of *Reynoutria sachalinensis*) at 1 to 2 quarts/50 gal water on 7- to 10-day intervals. Can be applied up to and on the day of harvest. 4-hr reentry. ☐
- Sonata at 2 to 4 quarts/100 gal water or per acre, depending on growth stage, on 7- to

14-day intervals. Can be applied up to and on the day of harvest. 4-hr reentry. ☐

Pscheidt, J.W., and Ocamb, C.M. (Senior Eds.). 2014. Pacific Northwest Plant Disease Management Handbook. © Oregon State University.

Use pesticides safely!

- Wear protective clothing and safety devices as recommended on the label. Bathe or shower after each use.
- Read the pesticide label—even if you've used the pesticide before. Follow closely the instructions on the label (and any other directions you have).
- Be cautious when you apply pesticides. Know your legal responsibility as a pesticide applicator. You may be liable for injury or damage resulting from pesticide use.

Trade-name products and services are mentioned as illustrations only. This does not mean that the participating Extension Services endorse these products and services or that they intend to discriminate against products and services not mentioned.

☐ - Homeowner packaging commonly available. ☐ - Acceptable in organic production.