Common Hop Pests & Diseases and Their Control

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March 10, 2016
UVM Extension Hops Website

- Informational Articles
- Blog
- YouTube Videos
- Wiki
- Other tools

www.uvm.edu/extension/cropsoil/hops
Plants that are weakened due to water stress are more susceptible to pest damage.

- Water stress during July and the beginning of August can cause a significant reduction in
  - stomatal conductivity
  - net photosynthesis
- Results in a reduction in the weight of the hop’s green mass, cones, and roots, and overall a reduction in hop cone yield.
- Plants that are weakened due to water stress are also more susceptible to spider mite damage.
  - Continued fine tuning of irrigation timing and quantity will likely improve hop yields.
Irrigation

- 30” per season
  - ~5,600 gallons per 3’x100’ row
- Especially important in July – August
- 300-450 gallons of water to produce 1 lb hops in the Yakima Valley

In 2015, Truro, NS had 15.7” from May – August

In 2015, Truro, NS had 5.9” for July and August

Fig. 3. Cumulative water use of hop during the growing season.

Evans, R., Irrigation of Hop, Washington State University
Irrigation

• Drip irrigation is best
  – Why water the weeds?
• Don’t put directly on the crown

www.uvm.edu/extension/cropsoil/hops
Wet season, *above average rainfall*, but irrigation still improved yields dramatically.

![Graph showing yield comparison](image)

*Figure 1: Irrigated plants produced more hops yield than non-irrigated plants for all varieties and ages combined.*

Irrigated 3-year old Nugget yielded **3 times** more than non-irrigated 3-year old Nuggets.
Watering/Irrigation

www.uvm.edu/extension/cropsoil/hops

Hop Resources

Hopyard Construction
- Hop Trellising and Budgets by Edward Page, through Ron Godin's site at Colorado State (Great pictures)
- Hopyard Construction: Budgeting and Economics by Edward Page and Ron Godin (Similar to the above, except with Year 3 results from the low-trellis trials)
- Simple Earth Hops, WI - Trellising Hardware Information
- University of Minnesota has been doing research on low-trellis vs. high-trellis hopyards. Find out more about their work here. Also includes a Trellis Cost Calculator!
- Potential sources of wooden hop poles
- Watch Roger Rainville construct the UVM Extension research hopyard on YouTube!
- Borderview Farm hopyard construction costs

Hardware
- Brookdale Fruit Farm, Irrigation and Row Crop Supplies
- Fehr Bros. Industries, Inc.
- Gorst Valley Hops
- Safeland Industrial Supply

Irrigation
- Watch UVM Extension’s YouTube video on setting up irrigation in your hopyard!
- Irrigation parts list from the UVM Extension hopyard
- Aroostook Hops in Maine received a Northeast SARE Farmer Grant. Their findings on the importance of irrigation in a Northeastern hopyard are well worth a read!

$1,200 to $1,500 per acre
Scouting How To

• Scout weekly
• Target sampling 10% of your yard
  – Larger growers: sample 25-30 plants in your yard
• 2-3 leaves per plant *from different heights*
• Sample from different varieties
• Sample from all over the yard
• The underside of the leaf is where most of the action is
Disease triangle

Susceptible Host

Pathogen

Conducive Environment
Downy Mildew

- Perfect conditions this every spring
- High humidity
- Mild to warm temperatures (15° to 21°C)
- Basically: Wet at moderate temperatures for four to eight hours = infection

- Most difficult to control
Stripping!

- Improves air circulation
- Things dry out faster
- Go as high as 4-5’ (once plants are 8’)

**Pro Tip:** Build your hopyard with prevalent wind direction going down the rows
Downy Mildew

- Promoted by wet conditions
- Specific to hops
- Attacks growing point, leaves and cones
- In the wood of the plant
  - Persists in crown from year to year

This is why overhead irrigation is bad
Downy Mildew

Shows up early in the year
Downy Mildew
Downy Mildew

Will show up in apical meristem (growing point)
Can affect basal shoots.
Can affect growing points after the crop has already been trained – will un-train itself.
Can also affect side arms
Downy Mildew

Spread: Airborne spores, infected planting materials, soil/crop debris
Life cycle of *Pseudoperonospora humuli* on hop

- Sporangioles emerge with sporangia on underside of leaf
- Zoospores are released from mature sporangium
- Zoospores infect leaves, cones and shoots
- Cycle of sporulation/infection repeats throughout the season
- Mycelia grow systemically throughout the plant infecting the crown and buds
- Infected shoots emerge in spring
- Mycelia overwinter in buds and crown

**Crowning**

Prepared by V. Brewster, Compendium of Hop Diseases and Pests.
Fungicides

- ALWAYS FOLLOW THE LABEL!
- ROTATE BETWEEN GROUP NUMBERS!

<table>
<thead>
<tr>
<th>Pest</th>
<th>Group</th>
<th>Active Ingredient</th>
<th>Pesticide Product Name</th>
<th>Rate</th>
<th>Restricted-Entry Interval (REI)</th>
<th>Pre-harvest Interval (days)</th>
<th>Remarks</th>
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<tr>
<td>DISEASES:</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Downy Mildew</td>
<td>M</td>
<td>Copper</td>
<td>Copper 53W Wettable Powder</td>
<td>4-5 kg/1000 L</td>
<td>48 hrs</td>
<td></td>
<td>Four applications at weekly intervals. Maximum 4 applications per year</td>
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<tr>
<td></td>
<td>4</td>
<td>Metalaxyl-M and S-isomer</td>
<td>Ridomil Gold 480 EC</td>
<td>570 mL/ha</td>
<td>12 hrs</td>
<td>135</td>
<td>Only 1 application per year. Apply as a soil drench, do not as foliar application</td>
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<tr>
<td></td>
<td>7, 11</td>
<td>Boscalid and Pyraclostrobin</td>
<td>Pristine WG</td>
<td>0.105 Kg</td>
<td>8 days for hand set irrigation, 46 days for harvesting, and 12 hours for all other activities.</td>
<td>46</td>
<td>Begin applications prior to disease development and continue on a 10- to 14-day interval. Use the shorter interval and the higher rate when disease pressure is high. Should be alternated with another mode of action fungicide registered for the same pest after each application. Maximum 3 applications per year. Suppression only</td>
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<tr>
<td></td>
<td>21</td>
<td>Cyazofamid</td>
<td>Cyazofamid 400SC</td>
<td>0.15 to 0.2 L/ha</td>
<td>12 hrs</td>
<td>3</td>
<td>For downy mildew control, make applications on a 7 to 14-day schedule beginning when disease is first seen or weather and downy mildew disease pressure are expected to initiate a disease epidemic. Use the low rate and long interval for preventative applications or very low disease pressure, increasing the rate and shortening the interval as disease pressure and/or fast crop development increases up to the maximum rate and shortest interval. Use water spray volume of at least 935 L/ha</td>
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<tr>
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<td>40</td>
<td>Dimethomorph</td>
<td>Acrobat 50 WP</td>
<td>450 g/ha</td>
<td>18 days</td>
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<td>Maximum 3 applications per year. Must be applied as a tank mix with another fungicide active against downy mildew. Suppression only</td>
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<td>Mandipropamid</td>
<td>Revus</td>
<td>600 mL/ha</td>
<td>12 hrs</td>
<td>7</td>
<td>Post-emergent foliar broadcast</td>
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Crowning

- Aim for top ½” of established crown
- Will nick off any infected buds, basal spikes
- Don’t leave too late or will affect crop development
  - Dependent on variety!
  - Varieties that mature latest should be crowned (and trained) first
Powdery Mildew

- Good sanitation
- Prune bottom 4-5’ of bine
- Good airflow
<table>
<thead>
<tr>
<th>Variety</th>
<th>Usage</th>
<th>Powdery Mildew</th>
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Twospotted Spider Mites
*Tetranychus urticae*

- Survival: Wide host range (180+ species); overwinter as diapausing females (red) on hop crowns and plant/soil debris
- Spread: Can begin laying eggs in as early as 2 days old and hatch 2-5 days later
- Yield loss: feeding on leaves and cones mostly lowers quality, but can lead to brewer rejection
Two spotted spider mites

• Like it hot and dry
• No economic threshold
  – June to Early July: 1-2 females per leaf
  – After Mid July: 5-10 adults per leaf
  – Some research has suggested that hops can tolerate >90 mites per leaf

• Spraying as a last resort
• Beneficial insects are key to control!!!
Two-spotted spider mites and spider mite destroyer lady beetles

- Two-spotted spider mites
- Mite destroyer larva
- Mite destroyer adult
- Mite destroyer pupa
Mite destroyers

Can eat up to 6 mites a day!
Leafhoppers don’t happen every year, usually around 1st or 2nd cut in hay fields. They are blown in on storms, then leave.

SCOUT EARLY

Not a pest in the major hop growing regions of the world, minimal in Nova Scotia
Figure 3. Sooty mold in hop cone
Caterpillar Pests

Corn borer

Hop looper/Green cloverworm
Corn borer
Eastern comma butterfly
Eastern Comma Butterfly
Pest control
Beneficial Insects

- Spined soldier bug
- Syrphid fly
- Ladybird beetle/Lady bugs
Spined soldier bug (Beneficial!)
Syrphid fly – Beneficial!
Lacewing – Beneficial!

http://bugguide.net/node/view/309040
Lady beetles – Beneficial!