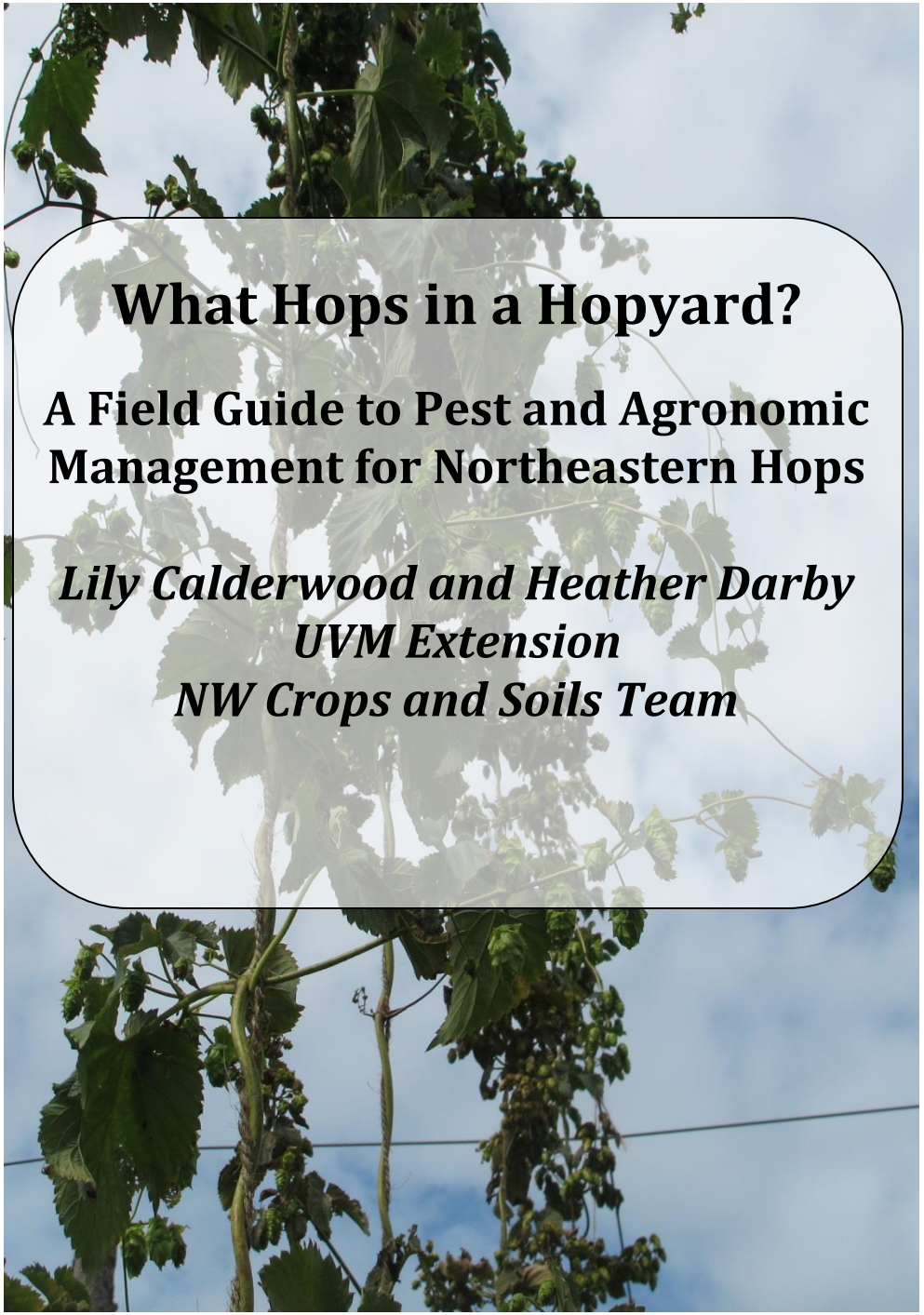

What Hops in a Hopyard?

A Field Guide to Pest and Agronomic Management for Northeastern Hops

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Pest and Natural Enemy Presence throughout Growing Season

PESTS	April	May	June	July	August	September
Hop downy mildew						
Eastern comma larvae						
Potato leafhopper						
Two spotted spider mite						
Japanese beetle						

NATURAL ENEMIES	April	May	June	July	August	September
Parasitoids						
Spiders						
Lady beetles						
Spider mite destroyers						
Lacewings						

Pesticide Consideration

Pesticides may pose risk to humans, animals, or the environment. At the same time, pesticides can be useful because of their ability to control disease-causing organisms, insects, weeds, or other pests. Therefore before using any pesticide, be sure to read the label in its entirety. The pesticide label is your guide to using pesticides safely and effectively.

Keep in mind that not all chemicals are legal in every state; be sure to check with your local University Extension or State Agency of Agriculture Department. It is also important to remember that while a chemical may be legal and labeled for use in a state there is no assurance that the material is effective against a particular pest on a particular crop, even if it is listed on the label. Also be sure to adhere to pre-harvest intervals and use proper personal protection.

April

Agronomic Practices:

- **First leaf out.**
- **Weed control**. Control weeds either by hand, mechanical cultivation, or chemical application.
- **Crown.** Cut back top 1" of crown and remove any downy mildew infested vegetation.

PEST: →**Hop downy mildew.** If downy mildew is present very early in the season, the disease is likely systemic, meaning that the disease will come back every year. Hop downy mildew is a hop specific fungal pathogen called *Pseudoperonospora humuli*. People, farm machinery, hand tools, and irrigation lines are vectors commonly seen to transmit hop downy mildew. Importantly, hop downy mildew may be present in your newly purchased rootstock.

Symptoms:

1. Spiked, pale green shoots at the base of the crown seen immediately in early spring as your hops emerge. This indicates the overwintering of downy mildew.
2. Leaf necrosis or browning of leaf edges and tips.
3. Leaf chlorosis or the lack of leaf chlorophyll resulting in leaf yellowing. Leaf veins may remain green. This symptom should not be confused with a nutrient deficiency.

Management of Downy Mildew:

1. Plant downy mildew resistant varieties.
2. Crowning can be done mechanically by cutting the first growth of every infested plant down to the rootstock to prevent the fungus within the plant to emerge and sporulate, infecting other plants.

May

Agronomic Practices:

- **Shoot growth and weeding.**
- **Hang and secure strings.** Hops have the potential to grow 20 inches in a day so it is best to weed and string early.
- **Train Bines.** It is best to train hop bines in mid-May.
- **Irrigate and Fertilize.** Hops require 10-14 inches of water a day. Adequate water and soil nutrition correlates to healthier plants that are more resilient to pests and abiotic stress.

PESTS: → **Potato leafhopper (*Empoasca fabae*).** Potato leafhopper is a new pest on hops. Depending on weather conditions, adult females will arrive to Northern Vermont between mid-May and early June.

→ **Eastern comma butterfly larvae (*Polygonia comma*).** We report Eastern comma caterpillars as pests yet have not seen them as an economically damaging pest at our research hopyard. Killing adults, pupae, and larvae by hand while scouting is the most effective control.

Management of potato leafhopper:

1. N**atural enemy insects** are known to control potato leafhopper. The population of this pest can grow exponentially causing significant plant stunting in June and July during critical plant and cone development. The image is a lacewing egg. Natural enemy insects appear in all life stages.

2. Several **insecticides** (organic and conventional) are used against this pest. These sprays can kill most beneficial insects leaving your hopyard without natural pest control. There is not an accurate economic threshold for potato leafhopper on hops.

June

Agronomic Practices:

- **Train bines.** Bines should be wound clockwise around rough twine.
- **Weed and extra bine removal.** This improves airflow mitigating downy mildew risk.
- **Scout for insect pests and natural enemies.** Spending time to look closely at your plants will pay off. Look at the underside of several leaves in all areas of your hopyard weekly throughout the season.

PESTS: →**Potato leafhopper.** Adults and nymphs are both damaging to hop plants and will both be present this month. In Northern Vermont there can be up to 3 generations of this pest per season.
→**Eastern comma larvae.** The caterpillar larval stage of the "Hop Merchant" can remain destructive into June.

Symptoms:

1. **Two spotted spider mite:** Small numbers of brown spots on leaf surfaces, known as stippling may occur this month as the adult population colonizes leaves.
2. **Eastern comma larvae.** Larvae chew leaves and the occasional side arm away.

Management:

Two spotted spider mites. Scouting should begin early this month by looking for webbing on the underside of leaves at the vein-petiole junction. Miticides can be used to control this pest when it has reached high density. Soapy water or Neem Oils can be effective as organic control for low to medium density spider mite presence.
Downy Mildew. If persistent and spreading, a fungicide can be used to decrease severity.

July

Agronomic Practices:

- **Strip bines.** Once hops are 6-10ft tall, leaves should be clipped off from the bottom 4ft of plants to increase air flow, combating fungal disease.
- **Irrigate.** Irrigation is critical as resources are allocated toward cone production in July.
- **Control pests.** If pest scouting results are above threshold numbers and damage is clearly progressing application of organic or conventional pesticides may be necessary.

PESTS: →**Potato leafhopper.** Still present yet as the month continues populations fade.
→**Two spotted spider mite.** As the summer dries out and the heat persists, spider mites thrive. Populations can be localized in one corner of your hopyard at first and then expand.
→ **Hop aphids.** Our results suggest that it is common to observe aphids in your hopyard between June and August peaking in late July-early August. Hop aphids are lemon shaped as shown in the image.

Symptoms:

1.**Stippling** is characteristic of spider mite feeding while V-shaped leaf necrosis or **"hopper burn"** is characteristic of potato leafhopper feeding.
2. **Natural enemy insects** continue to appear in all life stages. Spider mite destroyer larvae, a type of lady beetle, are shown in the image.

Management:

1.**Two spotted spider mite.** Spider mite destroyers are predatory beetles of the two spotted spider mite. They will occur naturally in a hopyard but can also be purchased for release. If **4 spider mites per leaf is exceeded**, a pesticide application may be necessary.

August

Agronomic Practices:

- **Prepare for Harvest.** By harvesting a handful of each variety in mid to late August, cone moisture can be determined. Please refer to the UVM Extension fact sheets for detailed instruction.
- **Irrigate and Control Pests.** Be mindful of the weeks to harvest indicated on any organic or conventional pesticide.

PESTS: →**Two spotted spider mite.** Still present. →**Potato leafhopper.** By the end of summer there are very few potato leafhoppers present but their damage may remain visible on highly damaged plants.

Symptoms of Two Spotted Spider Mite:

1. An overall **brown hue** may be visible as you step away from your hopyard. This is likely due to continued spider mite damage or wind damage. Wind can rip leaves toward the end of the season.
2. A **secondary outbreak** of spider mites will occur if broad spectrum pesticides are applied to your hopyard.

These organic or conventional sprays will eliminate natural enemy arthropods, leaving a hopyard with no natural pest control.

Management:

All pests have made their impact on your hop plants at this time. Continuing to irrigate and control spider mites adequately will continue to supply hop plants with requirements for cone maturity until harvest. Remove diseased bines from hopyard.

ⓘ *For more detailed information on Hopyard Pests and Control please visit our website www.uvm.edu/extension/cropsoil.*

You may also see…

Pests:

- ✓ Hop aphid
- ✓ Thrips (various species)
- ✓ Japanese beetle
- ✓ European corn borer larvae
- ✓ White tailed deer

E. corn borer frass

Hop aphid-Sooty mold

Natural Enemies:

- ✓ Lacewing
- ✓ Minute pirate bug
- ✓ Spined soldier bug
- ✓ Syrphid flies
- ✓ Long-legged flies
- ✓ Soldier flies

Minute pirate bug

Syrphid fly

Spined soldier bug