NORTHWEST CROPS & SOILS PROGRAM

2015 Hop Pest Scouting Report

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During the 2015 growing season, the major pest challenges we encountered at the hopyard at the Borderview Research Farm in Alburgh, Vermont were potato leafhopper (*Empoasca fabae*), and hop downy mildew (*Pseudoperonospora humuli*), as well as a few secondary plant diseases.

Potato Leafhopper

The severity of potato leafhopper damage, called "hopperburn" (see Figure 1), depends on when this migratory pest arrives in the spring, as well as the weather conditions throughout the season and hop variety. During the 2015 growing season, leafhopper populations were the most abundant we've seen over the last four years.

Figure 1. Potato leafhopper damage (hopperburn) and nymphs (inset).

IPM Strategies

Most integrated pest management (IPM) programs include weekly monitoring of the pest population. In hops, weekly scouting the underside of three leaves per plant in each variety is recommended. Potato leafhoppers appear to have feeding preferences for different varieties so be sure to scout all varieties in the hop yard.

Trap cropping may be one effective IPM strategy in hops—trap crops are types of plantings that attract a pest away from the cash crop. Our 2014 research revealed that potato leafhoppers prefer to feed on red clover (over hops) planted in the drive row. If interested in this trap crop, it is suggested that planting a full stand of un-mowed clover or alfalfa in the drive rows and/or along the perimeter of the hop yard. If the legume stand is mowed, leafhoppers will jump over to feed on hop plants.

In years with severe leafhopper outbreaks, additional control options may be required. Insecticides are an option especially in years of severe infestation; however, options are limited for certified organic growers. It should be noted that first year plants are far more susceptible to potato leafhopper damage than older, more mature stands of hops. Therefore, insecticide usage should be reserved for more susceptible varieties and younger plants. For organic operations, OMRI-approved products with azadirachtin or pyrethrin as active ingredients are effective against potato leafhopper. For conventional

operations, products with active ingredients beta-cyfluthrin or imidicloprid are used for potato leafhopper control. As always, pesticides used must be registered for use on hops in your state. Read and follow pesticide labels carefully. Be aware that broad-spectrum insecticides kill natural predators and often lead to secondary outbreaks of other pests such as two-spotted spider mite.

Natural Enemies. Populations of predatory arthropods including spiders, minute pirate bugs, lady beetles, spider mite destroyers, and parasitoid wasps have been abundant in our research hop yard since 2013 and populations remained healthy in 2015. Two spotted spider mite and hop aphid populations are regulated below economic thresholds by our resident natural enemy community. We have not needed to spray any insecticide in our research hop yard for three years.

Hop Downy Mildew and Other Diseases

The moist growing season we experienced in 2015 created a habitable environment for fungal pathogens. Therefore, we observed some severe discoloration from diseases on hop cones (Figure 2).

Figure 2. Discoloration on hop cones from downy mildew and/or *phoma.*

Hop Downy Mildew. Hop downy mildew is prevalent in most, if not all, hop yards in the Northeast. The pathogen has been systemic in our research hop yard in Alburgh since 2012. During the 2015 growing season, we documented the presence of disease on a number of basal and aerial spikes in addition to assessing the severity of new infection on hop leaves.

Management Tactics. It is possible to manage downy mildew in our region; however, management does require a multi-pronged approach which includes crowning, meticulous forecasting, fungicide applications, and removal of infected plant material.

Crowning—the removal of the first flush of hop growth—is used as an early season preventative measure against downy mildew. It is implemented in early spring when it is almost guaranteed that the environment is habitable (cool and wet) for the spread of downy mildew spores. To identify the best timing to crown hop plants, we have conducted a crowning date experiment on Cascade and Nugget varieties. Hop plants crowned early in mid-April (April 14, 2014 and April 23, 2015) had higher hop yield per acre than plants crowned later (May 12, 2014 and May 13, 2015) as well as plants that were not crowned (please see our 2015 Crowning Report for more information). We now understand that crowning seems most effective if plants are cut back before hop shoots emerge from the ground. This reduces the amount of time that plants are exposed to downy mildew infection during habitable weather conditions.

In 2015, we calculated the number of days that had ideal downy mildew conditions using a Pacific Northwest forecasting model based on temperature and humidity. We found that 45% of the days between April 3, 2015 and September 30, 2015 exhibited conditions favorable for hop downy mildew. Predicting habitable conditions for downy mildew allowed us to determine our spray schedule such that applications occurred before times of high infection risk (humidity/rain events).

Given the cool, wet spring and continued moisture throughout the 2015 season, spraying downy mildew fungicides that contained copper as the active ingredient was required as frequently as possible according to fungicide labels. Spraying fungicides is currently necessary to produce high quality hops in

our region and so we plan to continue monitoring the temperature and humidity to predict favorable downy mildew conditions accurately for our area.

In 2015, we also began a project to test the efficacy of several promising biofungicide products labeled for downy mildew control. Biofungicides are naturally occurring substances that may control diseases and are typically approved for organic production. Please refer to our website for our first year trial results.

For downy mildew management on our research hop yard during 2015, we applied Champ® WG and biofungicides regularly until we reached the pre-harvest interval date listed on the product labels. There were three weeks (July 27 to August 25) between the end of spray application and the beginning of hop harvest.

Secondary Diseases. At harvest, we did notice discoloration on hop cones (Figure 3), an indication of secondary disease. The secondary diseases identified on the cones included *Alternaria* and *Phoma sp. Cercospera*. *Fusarium* was also identified but present on cones to a much lesser degree.

Figure 3. *Alternaria* and *Phoma* cone browning from least severe (top) to most severe (bottom).

In New York, Cornell Extension identified *Phoma* and *Botrytis* on hop cones. There is still much to learn about the secondary diseases that appear to colonize hop cones as harvest approaches. At this time, it is unclear if the termination of fungicidial sprays just prior to harvest allows an open window for these diseases to colonize and quickly deteriorate hop quality.

For more information on hop production and current research, please visit our website at: www.uvm.edu/extension/cropsoil/hops.

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