

Scouting for powdery mildew

When to scout

Hop powdery mildew is a disease capable of emerging at any point in the growing season. As such, proper scouting should be practiced all season. Early-season control of powdery mildew is strongly correlated with mid- to late-season control on cones.

There are two crucial periods for monitor for presence of powdery mildew:

1. When buds begin to emerge in the spring, scouting and removal of heavily diseased shoots as well as small pockets of infection in the basal foliage will limit the starting disease pressure in your yard.
2. Approximately the week prior to bloom through three weeks post-bloom. During this period, the developing cones are highly susceptible to new powdery mildew infections. Your most efficacious fungicides should be saved for use during this time, as any powdery mildew infections on young cones will result in the most severe yield loss, cone browning, and reduction in alpha-acids content.

After about 3 weeks of development, the cones begin to acquire a partial age-related resistance to new infection.



Where to scout

Where to scout? At very low rates, hop powdery mildew can overwinter on dormant buds located at or a few centimeters below the soil. When these buds break ground in the early spring, they will emerge covered in white growth of powdery mildew. They are likely to be the first source of mildew in the yard each season. Young shoots buried in surrounding older foliage is also a micro-climate ideal for powdery mildew. Powdery mildew can grow on all above-

ground plant tissue, including on both sides of leaves. Young leaves and cones that are still expanding are the most susceptible tissues to new infections, and will likely bear colonies easiest to diagnose as the classic powdery white colonies.

How to scout

While walking your rows, be sure to emphasize scouting the basal foliage, as well as the young leaves and hop cones. When disease pressure is low, we suggest scouting at least 100 to 200 plants, evenly dispersed around the yard. All plant tissue can be infected by powdery mildew, but these are the ones that are mostly likely to bear new infections with the characteristic white powdery growth.

Older infection sites will appear more matte gray. Should you suspect powdery, one option is to pull the suspected leaf or cone, and use a 10X field hand lens to get a closer look. If the colony is sporulating, you will see translucent chains of bead-like spores stacked on one another.

You can also cut the bine containing the suspected infected tissue, place it in a loosely covered container with a damp paper towel, leave it on your counter, and check for spore production the next day.

Spores can be produced on both sides of leaves, which is in contrast to downy mildew spores, which are darkly pigmented and produced exclusively on the underside of leaves. Infected hop cones may have partially distorted growth, a pale browning of bracts and bracteoles, and may bear white mildew growth beneath the bracteoles.



Scouting for powdery mildew – sexual state

The fungus responsible for hop powdery mildew, *Podosphaera macularis* has two distinct genders. When spores of both genders land on the same host tissue, grow and come in contact with one another, they are capable of mating to produce structures termed chasmothecia.

Chasmothecia function as a second, more efficient overwintering structure, capable of surviving the winter without being attached to living hop tissue. This is in contrast to the bead-like

asexual spore which is produced in the presence of only one gender, and must overwinter on living tissue of dormant buds or greenhouse-produced plants.

Mature chasmothecia are thick-walled, black spores that to the naked eye look like fine flecks of pepper densely dusted on hop leaves and cones. Knowing that both mating types are present in your yard will help better predict the initial powdery mildew disease pressure the following season, which ultimately factors into determining the intensity of your spray program.

Chasmothecia can form on all part of above ground hop tissues. They are most easily identified on hops leaves late in the growing season, typically under conditions of moderate to high disease pressure. When formed, there will often be many chasmothecia clustered together. Even to the naked eye, but especially while looking through a hand lens, they will be black, round structures embedded within the typical white powdery growth.



Should you identify powdery mildew in your hop yard, please contact Bill Weldon at ww395@cornell.edu. There is an on-going project monitoring powdery mildew populations in the U.S.

Considering varietal resistance to powdery mildew

When considering which varieties to grow in your yard, it is important to acknowledge that hop varieties vary in their susceptibility to hop powdery mildew, along with many other pathogens.

The first component of a strong management program involves planting varieties that possess at least some level of resistance to powdery mildew. The resistances of the varieties in your yard, along with the prevalence of weather conditions optimal for powdery mildew and scouting to determine the yards initial disease pressure, ultimately guide the appropriate intensity of your spray program.

There are strains of hop powdery mildew that vary in their ability to infect typically resistant hop varieties. For example, in the Pacific Northwest region there is a mildew strain capable of overcoming the genetic resistance of the popular variety 'Nugget', as well as a strain that has adapted to grow on the previously resistant variety 'Cascade'. There are also hop powdery mildew strains in Europe capable of overcoming the resistances of 'Eastern Gold' and 'Zenith' varieties. These strains have not been found in the U.S. Your state's hops extension team is a good resource for staying up to date on which strains of powdery mildew are in your region.

Varieties resistant to powdery mildew in the U.S. (Gent, unpublished data):

- Banner

- Comet
- Chrystal
- Eastern Gold
- Omega
- Pride of Kent
- Santiam
- Savinja Golding
- Southern Brewer
- Styrian
- Sunbeam
- Sunshine
- Zenith

Varieties that recently lost resistance in the Pacific Northwest:

- Nugget
- Cascade

Varieties moderately resistant to powdery mildew (Field Guide for Integrated Pest Management in Hops, 2015):

- Fuggle
- Hallertau Tradition
- Newport
- Teamaker

Authors: Bill Weldon, David Gent and David Gadoury – November 2017