

# Plant Pathology Seminar Series

## “Environmental and Host Effects on Hop Downy Mildew”

Kaitlin (Miller) Hadaway

Hop (*Humulus lupulus* L.) is a perennial specialty crop grown worldwide. The crop's marketable product are cones that become pelletized and added during the beer brewing process for flavor and aroma. Over one-third of global hop production occurs in the Pacific Northwest of the United States, predominantly in the Yakima Valley of Washington State and the Willamette Valley of Oregon (Kopp, 2011). Among several biotic constraints, downy mildew (*Pseudoperonospora humuli*), an oomycete that thrives in humid regions, is considered the most economically important pathogen of hop production (Kopp 2011; O'Neal et al. 2015). The fungus-like organism overwinters in infected buds or crowns and begins its life cycle within stunted basal spikes in the spring. Infection spreads progressively up the hop trellis systems throughout the growing season causing chlorotic, down-turned aerial spikes. In some seasons hop downy mildew is undetectable while complete losses can occur under favorable conditions in others (O'Neal et al. 2015). Hop downy mildew epidemics are influenced by specific weather conditions including high relative humidity, leaf wetness, and rain events (Royle 1973; Gent and Ocamb, 2009). High rates of infection can be attributed to multiple spore dispersal events combined with one large rain event, or small spore dispersal events combined with a few short rain events (Royle 1973). Currently, the most common strategy for control of hop downy mildew is to apply protective fungicides prior to rain events or at times of high relative humidity. Predictive models have been developed to advise growers on how to optimize fungicide sprays for controlling downy mildew in hops (Gent and Ocamb, 2009; O'Neal et al. 2015). Despite advances in fungicide application technology and timing, the use of host plant resistance to control hop downy mildew is promising for implementing sustainable control measures in an environmentally benign manner. In recent years, strategies have focused on identifying reliable molecular markers associated with host plant resistance to enhance the process of selecting resistant breeding materials (Henning et al. 2015; Henning et al. 2016). Phenotype ratings of hop plants infected with downy mildew are correlated with single-nucleotide polymorphisms (SNPs) found within a mapping population. SNPs associated with resistant phenotypes are utilized for developing genetic linkage maps, overall leading to the identification of markers for use in marker-assisted selection. Quantitative resistance controlled by multiple genetic loci has been the main source of resistance to date, complicating the advancement of marker-assisted selection (Henning et al. 2015; Henning et al. 2016). Four molecular markers discovered within one mapping population have been validated using genotyping-by-sequencing and melt curve analysis. However, these markers have yet to be validated within other mapping populations for their reliability in identifying sources of resistance against the downy mildew pathogen (Henning et al. 2015; Henning et al. 2016).

4:10 pm | Monday, October 1 | Johnson Hall 343

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College of

Agricultural, Human,  
& Natural Resource Sciences

WASHINGTON STATE UNIVERSITY

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