A spore trapping network for the early detection of potato pathogens in the USA

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Introduction

Foliar diseases are a significant challenge to growers. Notable diseases include late blight, caused by *Phytophthora infestans,* which can cause complete crop loss in potatoes. Currently in the US, many foliar pathogens are managed on a calendar-based schedule. This is often with no knowledge of the local optimum conditions for disease development or if spores are present in the area at the required threshold for disease development. Recent developments in spore sampling technology and molecular diagnostics mean that airborne spores of these pathogens can be detected and results disseminated in a timely manner. If spore samplers are placed in a network, coupled with disease-weather models, this could provide a powerful tool to warn Idaho growers of disease risk, thereby allowing early treatments or conversely alleviate the need for unnecessary treatments in the absence of disease pressure. Recently the University of Idaho and potato industry partners have invested in a network of 15 Burkard multi-vial cyclone spore samplers. These samplers can sample continuously for 7 days, automatically changing the sampling vial daily. These spore samplers have been deployed throughout southern Idaho from May 2018. Further traps were placed in Washington, Oregon and Colorado in 2019. The aim of the study was to monitor trends in airborne spore levels over the growing season and determine the potential for disease prediction and early warning to growers.

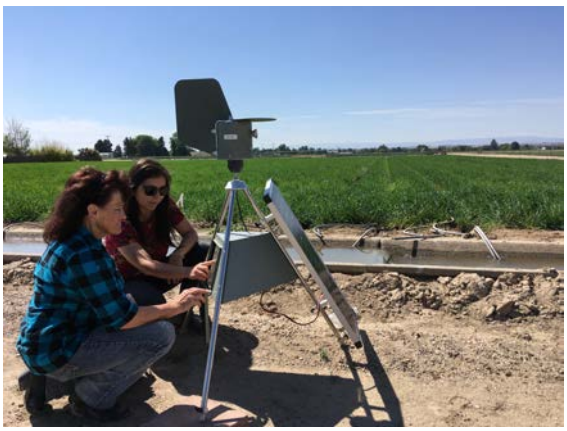

Figure 1. Burkard cyclone multi-vial spore sampler

Methods

Burkard multi-vial cyclone samplers were used (Figure 1). The Burkard samplers were programmed to sample for a 24-hour period before moving the sampling position to the next vial. Samples were processed within 24 hours of arriving at the lab and results communicated to industry via email. DNA was extracted using Wizard Magnetic DNA Purification System for Food (Promega) in conjunction with a Kingfisher ML magnetic particle processor (ThermoFisher). Real-time PCR assays are used to quantify the levels of DNA of each of the pathogens (Table 1).

Table 1. Target pathogens and qPCR assay used

Target	Disease	qPCR assay used
Alternaria alternata	Brown spot	Yamamoto *et al.* (2012)
Alternaria solani	Early blight	This study
Botrytis cinerea	Gray mold	Belen Suarez *et al.* (2005)
Phytophthora infestans	Late blight	Lees *et al.* (2012)
Sclerotinia sclerotiorum	White mold	Ziesman *et al.* (2016)

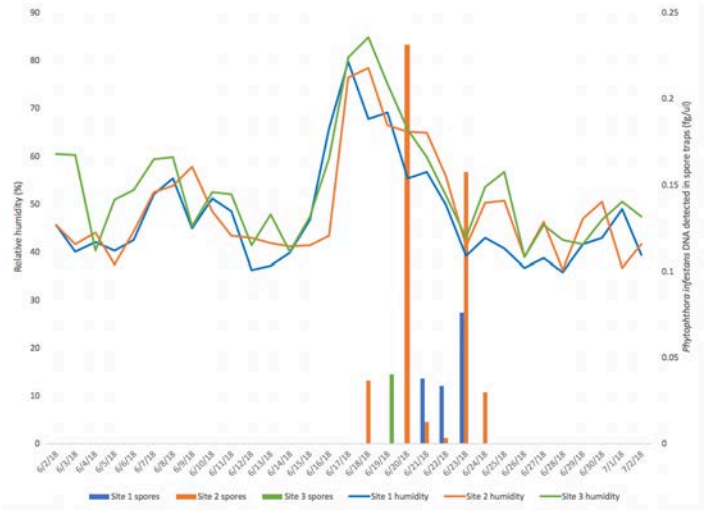

Figure 2. DNA levels of *Phytophthora infestans* spores collected in spore traps plotted alongside relative humidity levels.

Results and Conclusions

All pathogens listed in Table 1 were detected. In 2018, *Alternaria alternata* and *Botrytis cinerea were* widespread, although levels of these pathogens appeared to decrease over the season as conditions became drier and warmer. *Sclerotinia sclerotiorum* was first detected at one site on June 11th with multiple sporadic occurrences from then on. *Alternaria solani* was detected at four sites the week of 17th of June. *Phytophthora infestans* was also detected that week at three sites which may have been associated with an unusual period of high humidity (Figure 2). No late blight were outbreaks were reported in 2018 in Idaho. Similar results were observed in 2019 except a late blight outbreak was observed in Idaho in August in one area. Spores were detected one week prior to symptoms at a spore trap 10 miles down wind of the outbreak. This study shows that detection of spores and rapid dissemination of results is possible. It also shows that *P. infestans* spores are present in Idaho and closely associated with humidity levels.

References

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Acknowledgments

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