

## Investigating the use of impaction samplers and qPCR methods for detection of foliar pathogens in potato fields, 2024

Sarah Ruth<sup>1</sup>, Mio Satoh-Cruz<sup>1</sup>, Jack Pritchard<sup>1</sup>, Azamat Sardarbekov<sup>1</sup>, Steve Whittington<sup>2</sup>, Chris Long<sup>1</sup>, and Jaime F. Willbur<sup>1</sup>; <sup>1</sup>Department of Plant, Soil and Microbial Sciences; <sup>2</sup>Michigan State University Extension, Montcalm County Office.

Following a potato late blight outbreak in Montcalm County in 2022, and repeated late blight detections in Michigan and neighboring regions since 2019, we investigated low-cost spore samplers to support visual scouting efforts. Spore samplers coupled with quantitative PCR assays had potential to be an efficient and inexpensive tool for early detection of late blight outbreaks. We repeated testing of rotating arm impaction samplers deployed in the 2024 growing season to: 1) monitor for *P. infestans* sporangia in commercial fields 2) investigate the range of detection from an inoculated field.

### Materials and Methods

#### *i. Commercial detection*

Rotating arm impaction samplers were built according to the Check et al. (2024) (Fig. 1). Samplers were placed near six commercial potato fields located in Montcalm County. One sampler was deployed at each commercial site and at the Montcalm Research Center in Stanton, MI. The Montcalm fields were selected for proximity to previous late blight detections in 2022. Each week, sampling rods were collected and transported to MSU where their DNA was extracted, and a quantitative polymerase chain reaction (qPCR) assay was performed (Lees et al. 2012).

#### *ii. Range from an inoculated source*

The range of detection for these spore samplers was evaluated using an inoculated potato research trial located at the Plant Pathology Farm in East Lansing, MI. The field was initially inoculated on August 21, however, symptom development was unsuccessful so an additional inoculation was performed on September 12. Late blight symptoms were then first detected visually on September 16. One sampler was placed on the eastern edge of the field and served as a positive control. Two more were placed 500 m northeast of the inoculated field, a distance which has previously been used as an outer limit of spore sampler detection (Aylor et al. 2011). One trap was maintained at a height of 4 ft, the other was positioned at 20 ft to better capture long-distance sporangial movement. All three samplers were monitored weekly.



**Fig. 1.** Rotating arm impaction sampler deployed in a commercial potato field in 2023.

### Results and Conclusions

#### *i. Commercial detection*

In 2024, late blight was detected in commercial potato fields and confirmed July 23 and August 5 in St. Joseph County, Michigan. However, our spore traps were not located near the incident site as sampling was only conducted in Montcalm County in 2024. From the six samplers placed in commercial fields in Montcalm, no detectable levels of *P. infestans* DNA were obtained from the qPCR results. In one location, a very weak suspect signal was detected (Cq value = 39.0) on September 06, 2024, however, no symptoms were observed and the timing was near vine kill. This value corresponds with <1 infectious sporangia detected and the participating operations were notified accordingly.

ii. *Range from an inoculated source*

The sampler placed immediately at the edge of the inoculated field detected *P. infestans* the same week as visual symptom development, after the second inoculation, and for several subsequent weeks. However, no positive detections were made at 4- or 20-ft samplers placed 500 m from the inoculated site (Table 1).

**Table 1.** Cq values obtained from samplers near an inoculated late blight field at the plant pathology farm in East Lansing, MI. Samples were collected weekly, and dates represent the last date of the sampling period. Dates marked with a “-” had no detectable level of late blight in the qPCR test. Dates marked with an “x” were not sampled at that location. The field was inoculated twice on August 21 and September 12 and the first visual detection was made on September 16. On September 23, a wide range of well-developed foliar symptoms were observed.

Location	Sampler Height (ft)	July		August							September										
		29	5	12	19	26	27	28	29	30	28	3	4	5	6	9	13	16	20	25	30
Field edge	4	x	x	x	x	-	-	-	-	-	-	-	-	-	38.3	-	33.6	35.4	27.8	31.5	31.1
500m NE	4	-	-	-	-	x	x	x	x	-	x	x	x	x	-	x	x	x	-	x	x
500m NE	20	-	-	-	-	x	x	x	x	-	x	x	x	x	x	x	x	x	x	x	x

### Overall Summary

Second-year testing demonstrated that the rotating arm impaction samplers, combined with qPCR assays, could be used to detect late blight from fields in Michigan and may be useful to augment visual scouting efforts. Across two years of testing, these samplers did offer timely *P. infestans* confirmation (with a lower limit of detection at 1 sporangia/sample) of sporulating lesions in adjacent fields within the week of earliest visual symptoms.

Similar to the previous year, however, spore trap distance and height will be an important consideration since the sampler located 500 m NE from the inoculated field failed to detect at 4- or 20-ft. This indicated that low-cost stationary spore traps may not have a far-reaching detection range, as expected based on previous studies. In the second year of trap deployment, there also were some technical difficulties that interfered with continuous sample collection. In the future, a permanent technician to maintain and repair existing samplers would be recommended to facilitate reliable and larger-scale monitoring efforts.

### Acknowledgements

We would like to thank the grower cooperators who allowed us to test samplers in their fields, our fellow researchers and undergraduate research assistants in the Michigan State University Potato and Sugar Beet Pathology and Potato Outreach programs, the Montcalm Research Center, the Michigan Potato Industry Commission, and Michigan State University Project GREEN for the continued support of our research.

Check et al. 2024. It’s a Trap! Part I: Exploring the Applications of Rotating-Arm Impaction Samplers in Plant Pathology. *Plant Dis.* 108:1910-1922. <https://doi.org/10.1094/PDIS-10-23-2096-FE>

Check et al. 2024. It’s a Trap! Part II: An Approachable Guide to Constructing and Using Rotating-Arm Air Samplers. *Plant Dis.* 108. <https://doi.org/10.1094/PDIS-01-24-0131-SR>