Executive Summary

Project Title: Investigating *Phytophthora sojae* Populations Across North Dakota Soybean Production Systems

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Why the research is important to North Dakota soybean farmers:

Phytophthora root and stem rot, caused by Phytophthora species, is one of the most devastating diseases to soybeans in the state of North Dakota. Being most prevalent during years with excessive moisture, this disease can lead to crop loss throughout the entire growing season. To manage this disease, resistance is the most effective management strategy with the ability to eliminate the development of PRSR if using Rps genes in soybean varieties. However, there are multiple Rps genes available commercially, and not all Rps are effective against all populations of Phytophthora across the state. The research conducted here investigates the distribution of *Phytophthora sojae* across the state, the examination of a new Phytophthora species that has previously been reported to be pathogenic on soybean, and the screening of these populations for the effectiveness of Rps genes.

Research conducted:

During the 2023-2024 season, 147 soil samples were collected from across North Dakota with the help of stakeholders, county Extension agents, and industry representatives. These samples represent a wide coverage across the state for all soybean growing regions. These soil samples were processed by sieving the soil to break up clumps. Then soil was placed into cups and flooded to trigger Phytophthora to 'wake up' and produce viable spores. Then small leaf discs of a susceptible soybean were floated at the top of this flooded soil to allow infection into the leaf. These leaves were then transferred to selective growth media for the growth of the pathogen out of the leaf. These isolates were then transferred to new plates to identify their species using microscopy. Probable samples were then used for DNA extractions for molecular identification using ITS sequencing.

Findings of the Research:

From this research during the 2023-24 season, one interesting find was the general widespread presence of Pythium species across the soil samples collected. The vast majority of isolated species have been identified as Pythium by either morphological or molecular methods. So far only 10 isolates appear to be Phytophthora. The possible reason for so few Phytophthora isolates could be the dry conditions present during the 2023 field season which made it difficult to identify field areas with high Phytophthora pressure. However, these results may also indicate that many of the suspected Phytophthora incidences may be more complicated than we had previously believed and may involve the presence of Pythium species at a higher level than previously suspected. These

results will need to be confirmed in future years of testing to confirm if this is true for North Dakota soybean production fields.

Benefits and Recommendations to the North Dakota Soybean Farmers and Industry:

The results of this study thus far allow farmers to better understand the pathogen presence within their fields. From this research, Pythium species appear to be more prevalent than previously believed. This impacts management strategies as there currently is no genetic resistance similar to Phytophthora Rps genes available commercially, and farmers may need to rely more on seed treatments to properly control seedling disease and stand-loss issues due to these different pathogens. However, further work is still needed to better understand the distribution and status of Phytophthora populations across the state in a different field season.

Acknowledgements:

A special acknowledgment and thank you is needed for all the county Extension agents and the industry representatives that help to collect soil samples from across the state. This allowed for a much greater reach and higher resolution of sampling than was expected. Finally, we would like to thank the North Dakota Soybean Council for their support in this research.

Figure Captions:

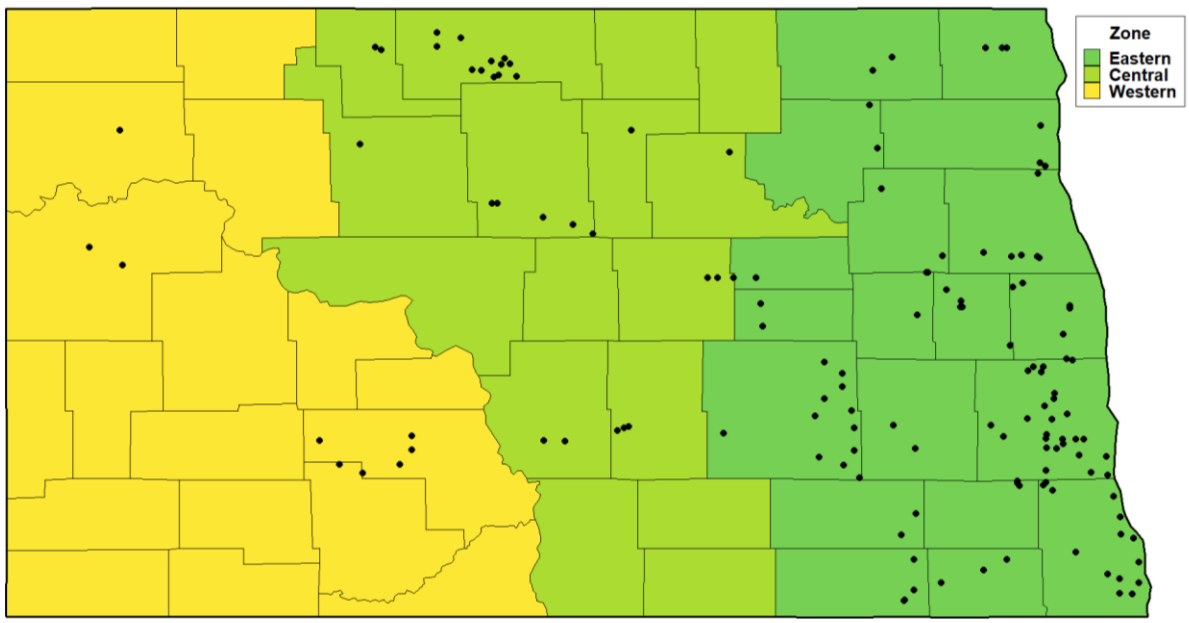

Figure 1. Map of North Dakota with locations of soil samples collected for evaluation of *Phytophthora sojae* populations.

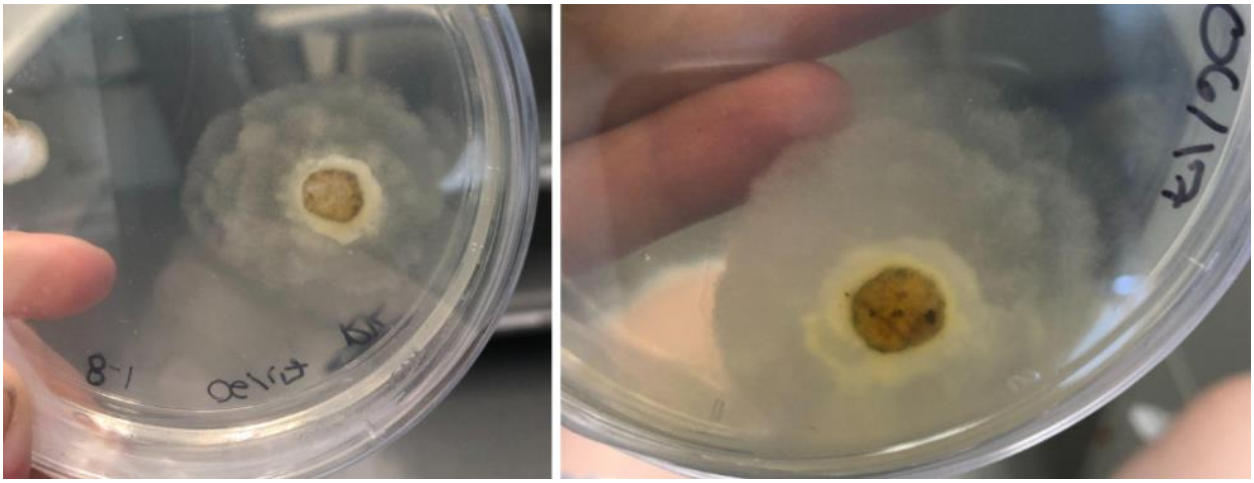

Figure 2. Oomycete growth from susceptible soybean leaf discs.