

Protecting yield through sustainable disease management

Acharya, J., Lerch, E., Matthiesen, R., Schmidt, C., Serrano, M., Shriver, J., Silva, V. and Robertson, A.E.

Introduction

Diseases reduce yield and quality. The **disease triangle** (Figure 1) is a fundamental concept in Plant Pathology. Manipulating any side of the disease triangle reduces disease and therefore protects yield and quality.



What is sustainable disease management?

Targeted use of management tools to reduce disease. These tools include manipulating the host (e.g. breeding for resistance), manipulating the pathogen (e.g. applying fungicides), or manipulating the environment (e.g. tiling, planting date, rotation).

What do we do in the Robertson Lab?

In our lab, we do lab, growth chamber, greenhouse, and field studies to improve our understanding of how the host, pathogen, and environment interact to cause disease. These data allow the development of improved tools and recommendations that enable Iowa corn and soybean farmers to protect yield and quality using sustainable disease management practices.

Recent pertinent publications

Acharya, J., Bakker, M., Moorman, T., Lenssen, A., Kaspar, T., and Robertson, A.E. 2017. The effect of rye termination date on corn seedling disease risk. *Plant Dis.* 101:591-600.

Abeyssekara, N.S., Matthiesen, R.L., Cianzio, S., Bhattacharya, M., and Robertson, A.E. 2016. Identification of novel sources of partial resistance in soybean using an inoculum mixture of three *Phytophthora sojae* isolates. *Crop Science* 56:2322-2335.

Mbofung, G., Sernett, J., Horner, H.T. and Robertson, A.E. 2016. Comparison of susceptible and resistant maize hybrids to colonization by *Clavibacter michiganensis* subsp. *nebraskensis*. *Plant Dis.* 100: 711-717.

Matthiesen, R., Ahmad, A., and Robertson, A.E. 2016. Temperature affects virulence and fungicide sensitivity of four species of *Pythium* on corn and soybean. *Plant Dis.* 100: 583-591.

Ahmad, A., Acharya, J., Mbofung, G., Schmidt, C., and Robertson, A.E. 2015. Characterization and comparison of *Clavibacter michiganensis* subsp. *nebraskensis* strains recovered from epiphytic and symptomatic infections of maize in Iowa. *PLoS ONE* 10(11): e0143553. doi:10.1371/journal.pone.0143553

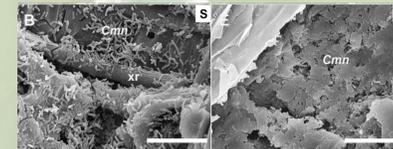
Mallowa, S.O., Esker, P.D., Paul, P.A., Bradley, C.A., Chapara, V.P., Conley S.P., and Robertson, A.E. 2015. Effect of maize hybrid and foliar fungicides on yield under low foliar disease severity conditions. *Phytopathology* 105:1080-1889.

The host

Resistant hosts are the cornerstone of sustainable disease management. Host resistance can be identified by screening diverse germplasm. Understanding mechanisms of resistance enables improved host resistance.



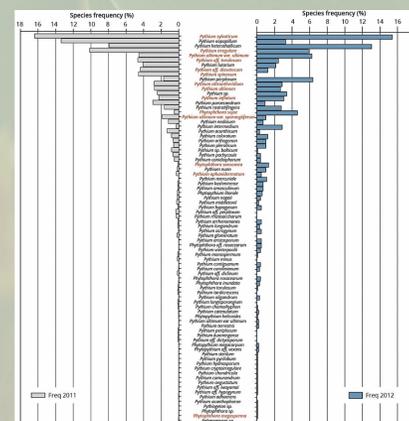
QTL for resistance to *Pythium* spp. have been identified in the SoyNAM population.



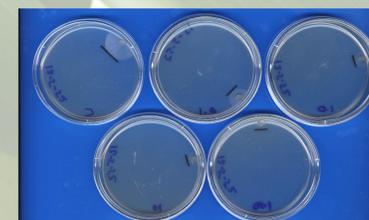
In Goss's wilt resistant corn (R), the pathogen is surrounded by an extracellular matrix that appears to affect colonization and movement.

The pathogen

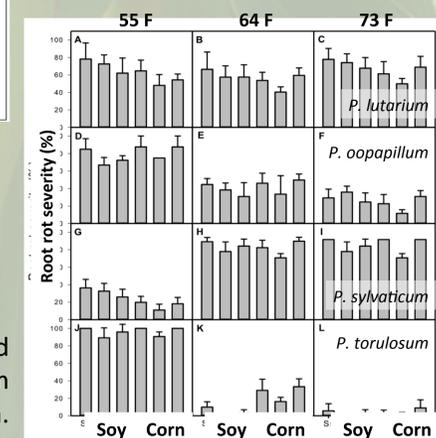
Knowing the species that cause disease and their characteristics (conditions favoring infection, fungicide sensitivity, etc.) are important to enable targeted deployment of effective disease management tools.



Oomycete pathogens recovered from diseased soybean seedlings in the North Central Region in 2011 and 2012.



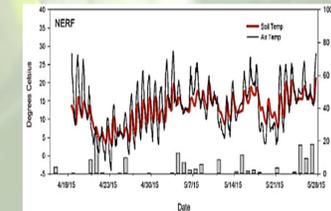
Evaluating fungicide sensitivity of pathogens.



Temperature affects infection and disease development of *Pythium* spp on corn and soybean.

The environment

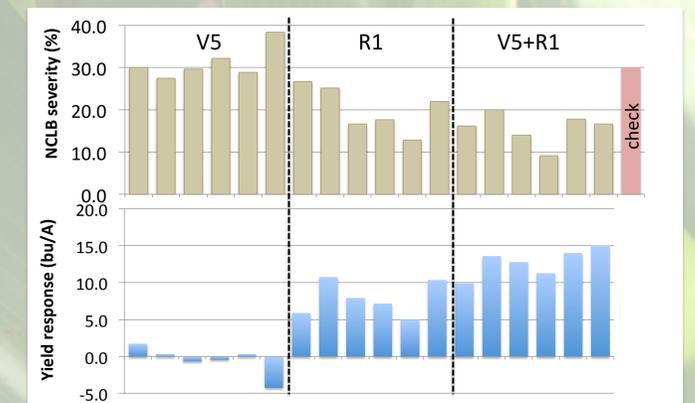
Understanding how weather conditions during the growing season, and various cultural practices, impact disease enables improved disease management recommendations that utilize the correct tools at the right time



Cold, wet periods after planting increase the risk of damping off and stand loss. Seed treatments protect germinating seed and are a good management tool to use in cool, wet springs



Terminating winter rye cover crops within a week of planting corn increases the risk of seedling disease, stand loss, and yield loss.



The optimum time to apply foliar fungicide to corn to reduce disease and protect yield is at flowering (R1). Early applications have no effect of disease and consequently do not protect yield.

Funding Sources

