

Management of *Phytophthora* root and stem rot of soybeans

Anne E. Dorrance, Associate Professor, Plant Pathology, The Ohio State University

Introduction

Historically, *Phytophthora* root and stem rot is a disease that can cause total losses in yield if the wrong variety is planted in a field with high inoculum and saturated soil conditions develop. There have been sporadic epidemics over the past sixty years, with the highest losses recorded in the late 1960's and 1970's. In the past ten years there have been more reports of extensive replanting early in the growing season and higher levels of *Phytophthora* stem rot later in the growing season. This piece will describe how to recognize this historically important disease but also describe the current management strategies and how to determine when to use fungicide seed treatments.

Symptoms

Soybeans are susceptible throughout the growing season to infection from *Phytophthora sojae*, which causes *Phytophthora* root and stem rot. Shortly after planting, infected seeds and seedlings will fail to emerge or they will turn a light brown color and die. Many other seedling pathogens will also cause similar symptoms, such as *Pythium* and *Fusarium* spp.. When checking stands, these seedlings will appear as dried carcasses or large empty spots. Later in the season, the stem rot phase is much easier to diagnose. A chocolate brown canker which goes from the below ground up the stem is the classic symptom. The tissue inside is discolored. There are cases where the canker may only go up one side of the stem but in all cases, it starts below the soil surface and is continuous.

This can be easily confused with flooding injury which can occur if plants were submerged by water for a day or more or older plants are in standing water for more than 3 days. With flooding injury, a crust will often form on the soil surface, residue from green algae and a stagnant smell may result from submerged condition. For older plants that are injured, the roots are killed and the outer layer can be easily be pulled off of the root leaving a white "rat tail" appearance.

Management with host resistance

There are two types of resistance used to manage *Phytophthora sojae* and both have their drawbacks. The most popular are the *Rps* genes, these are sold in varieties as *Rps1a*, *Rps1c*, *Rps1k*, *Rps3* or *Rps6*. When they work, they are 100% effective and when they don't work – then the plant has nothing. Due to this "all" or "nothing" type of response, this leads to selection and shifts in the races (pathotypes) that are present in fields. Currently across the Midwest, many fields have populations where *Rps1a* would not be effective; this is followed by *Rps1c* and *Rps1k*.

The second type of resistance is partial resistance, also known as field resistance, quantitative resistance and tolerance. In this type of resistance, some disease does develop, the roots are colonized but the stem rot phase never develops. When levels of partial resistance are high in a variety then there are no widespread losses. When the two types of resistance are combined (*Rps1c* or *Rps1k* plus high partial resistance), these varieties tend to rank at the top of the yields across years and environments when *Phytophthora sojae* is yield limiting.

Tiling and tillage

Phytophthora sojae is a water mold and it needs saturated soils to form its spore-bearing structures called sporangia. While the soil is still saturated, swimming spores are released from the sporangia and are then attracted to growing soybean roots and germinating seeds. The length of the time the soil is saturated, then serves as the infection period. The shorter the time soils are saturated, then the less time *P. sojae* has to form sporangia and for the swimming spores to find roots. Both tiling and tillage help to reduce the time that the root zone remains saturated following heavy rains.

Seed treatments

There are really only two active ingredients that have high levels of efficacy towards *Phytophthora sojae* and they are metalaxyl sold as Allegiance and mefenoxam sold as Apron XL. On the labels there is a range for the rate of the product to be applied to the seed. The low rates of both products, 0.2 fl oz of Allegiance and 0.16 fl oz of Apron XL, are not effective in controlling *Phytophthora sojae*. The highest rates at 1.5 fl oz Allegiance and 0.64 fl oz of Apron XL have the best control. Seed treatments provide protection from the time of planting until that plant reaches approximately the V1 growth stage. If the proper environmental conditions (saturated soils) do not occur in this time frame, then there will be no benefit from the seed treatment. If saturated soils do occur, then we have had differences of 3 to 30 bu, depending on the length of the saturation period and the susceptibility of the variety. In Ohio, we have seen the greatest benefits in wet springs and in many cases, replanting is totally avoided. For your fields, to assess if a seed treatment could be beneficial here are 3 questions:

1. Has *Phytophthora sojae* been a problem on this field?
2. Has this field ever had to be replanted as a result of extensive damping-off?
3. Is this field poorly drained?

If you've answered yes to all three, then you should see a benefit to using a seed treatment, especially in wet springs.