Rhizoctonia bare patch and root rot: Distribution and management

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Rhizoctonia is a fungus that attacks the roots of wheat and barley, causing root rot and subsequent economic loss for producers. In the dryland wheat cropping area of the inland Pacific Northwest, there are two primary species—*Rhizoctonia solani* AG-8 and *Rhizoctonia oryzae* (also known as *Waitea circinata*). Young seedlings are especially susceptible to these root-infecting fungi. We find more damage in spring-planted wheat, because the disease is more severe under the cool, wet soil conditions that are often present in the spring.

IMPACT

Bare patch disease caused by *Rhizoctonia* fungus increases during the transition from conventional tillage to no-till, but eventually declines to background levels. Higher levels are seen in lower precipitation areas, and lower populations in higher precipitation areas. Growers have both cultural and chemical tools available to combat this disease. Treatment and planting time intervals are critical for bare patch disease control. Seed treatments do not always result in increased yields. As part of the REACCH project, we hope to develop models that will predict the distribution of these and other soilborne pathogens under future climate scenarios.

Because the roots are destroyed, plants are unable to take up sufficient water and nutrients. They become more prone to drought stress, and yield is reduced. *Rhizoctonia* can cause stunting of plants, resulting in uneven heights across a field. The first seedling roots are rotted, leaving the tips a brown color. Further down the root, areas are rotted away, leaving a pinched-off appearance, with the center of the root intact. These are the typical symptoms seen in the higher precipitation areas of 18 inches or more in eastern Washington and northern Idaho, where annual cropping systems are common.

However, another symptom, called bare patch, is seen in certain areas of the state, especially in the Dayton-Walla Walla and Ritzville-Connell areas, where no-till or other tillage reduction practices are used. The field may be covered with large patches several yards across, where the wheat or barley is severely stunted or absent. Essentially no yield comes from these patches (Figure 1). This disease increases during the transition from conventional to no-till. In some cases, the disease may decline over a period of many years, and we are attempting to explain how microbial communities naturally suppress or combat the disease.

With funding from the Washington Grain Commission, we developed molecular techniques that allow us to quantify the pathogen in the soil to answer the question, Where and how much fungus is present? These techniques can detect and quantify specific pathogens because each has a unique DNA fingerprint. Over the course of 3 years, we sampled grower fields and Washington State University variety testing sites throughout the state of Washington. As part of the REACCH project, we also analyzed how these populations are related to the climatic differences across the state, primarily based on precipitation and temperature.

What have we discovered about the distribution of this pathogen and disease? With *Rhizoctonia solani* AG-8, we tend to find higher populations in the lower precipitation areas, especially those having sandier soils. Figure 2 shows a map of these sampling sites. The purple and star symbols show sites with higher levels of DNA in the soil, compared to the yellow and orange sites. The populations tend to be lower in the Palouse of eastern Washington, where we typically do not see bare patch, but find uneven stands and root rot.

On the other hand, *Rhizoctonia oryzae* is more evenly distributed across eastern Washington (Figure 3). High and low DNA sites are evenly distributed across the region. When we look at the correlations between populations of *R. solani* AG-8 and precipitation, we find a negative relationship; the higher populations are seen in lower precipitation areas, and lower populations in higher precipitation areas (Figure 4). The DNA values are on a log scale, so the sites in the low (200 mm) precipitation areas may have 10 to 100 times more DNA than sites in the 600 mm zones. As part of the REACCH project, we hope to develop models that would predict the distribution of these and other soilborne pathogens under future climate scenarios.

How can growers manage this disease? They have two sets of tools in the toolbox—cultural and chemical. For cultural control, reduction of the green bridge is essential, especially for spring wheat. *Rhizoctonia* and other soilborne pathogens also grow on

Figure 1. *Rhizoctonia bare patches in spring wheat, Ritzville, Washington. Photo by Timothy Paulitz.*

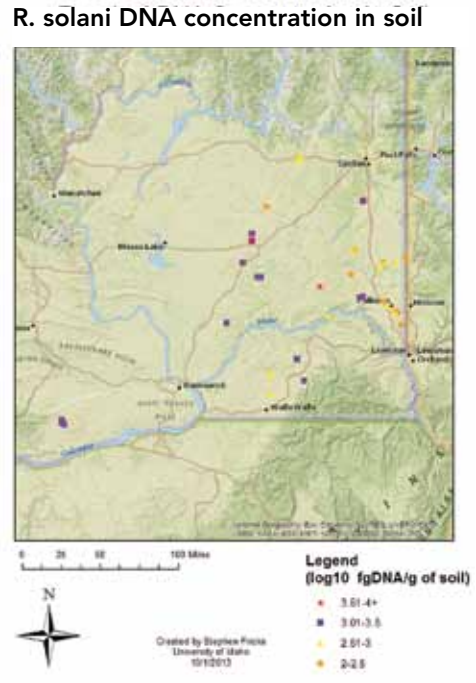

Figure 2. *Map showing concentration of DNA of* Rhizoctonia solani *AG-8 in soils across eastern Washington (grower fields and variety testing sites), sampled in 2006–2008.*

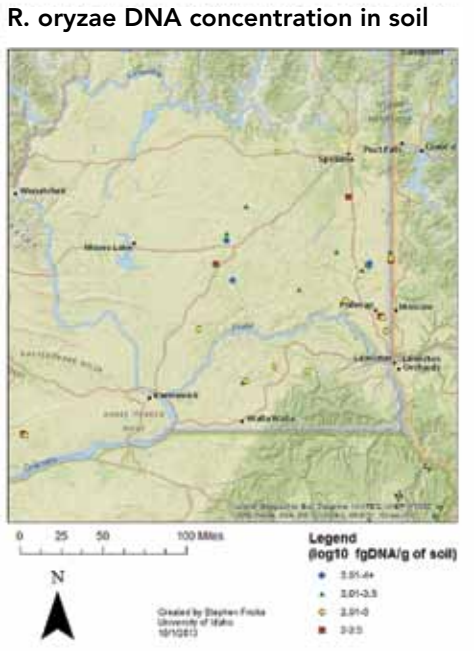

Figure 3. *Map showing concentration of DNA of* Rhizoctonia oryzae *in soils across eastern Washington (grower fields and variety testing sites), sampled in 2006–2008.*

the roots of grassy weeds and volunteers. When these weeds are treated with glyphosate prior to planting, the fungus can grow on the dying weeds and build up to a high level. This is because the fungus can grow on both living and dead tissue. If the crop is planted into these dying plants, the fungus will bridge over to the young wheat or barley seedlings; hence the name "green bridge." But if a sufficient time is allowed for the weeds to die before planting, the pathogen population cannot survive well, and damage is reduced. This interval should be at least 2 weeks, preferably 3 weeks.

The second tool is seed treatments with chemicals such as Dividend, Raxil, and newer classes of SDIs (succinate dehydrogenase inhibitors) such as Vibrance Extreme (sedaxane + difeneconozole + mefanoxam). Studies have shown that seed treatments will improve the health of young seedlings, although treatments do not always result in statistical increases in yield.

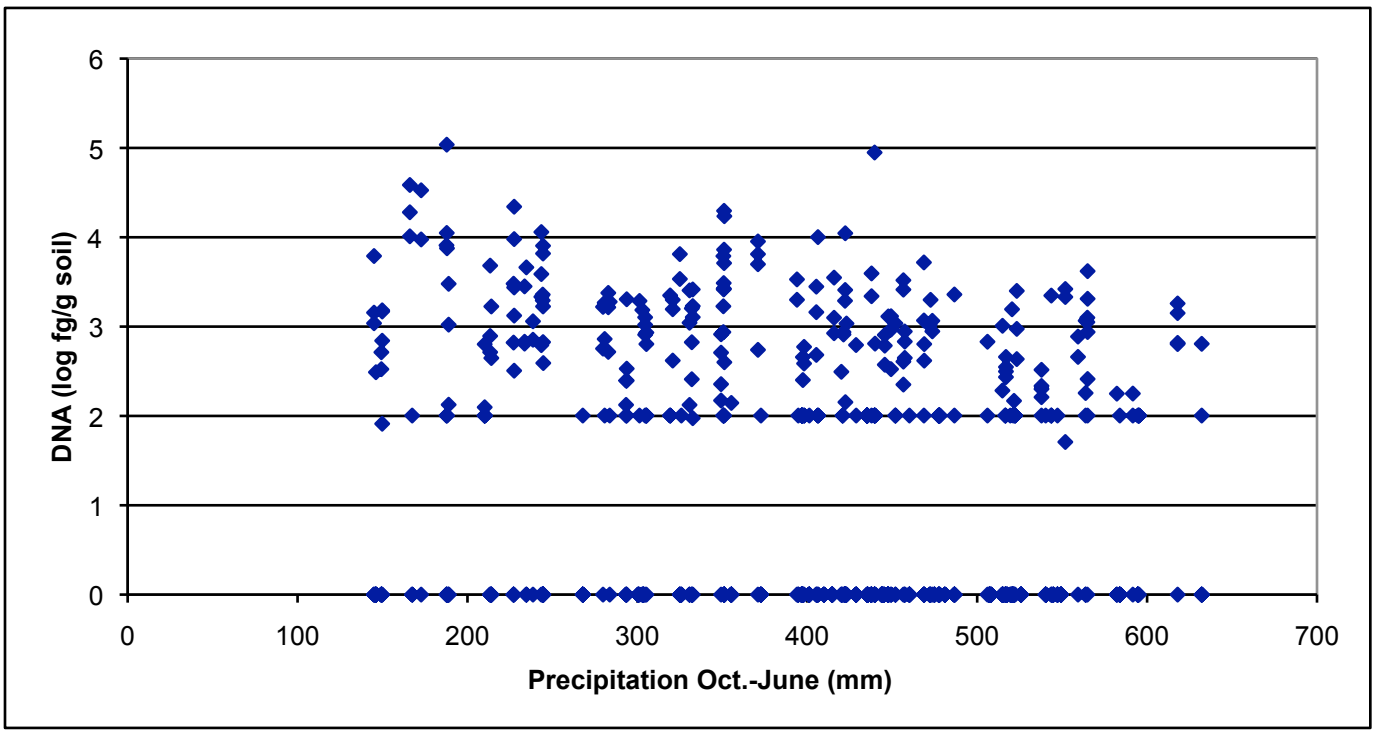

Figure 4. *Relationship between DNA concentration of* Rhizoctonia solani *AG-8 and cumulative precipitation from October to June. Data pooled from 3 years of sampling in grower fields and variety testing sites.*

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