Suppression of *Rhizoctonia bare patch* in long-term no-till cropping systems

William Schillinger (william.schillinger@wsu.edu) WSU and Tim Paulitz USDA-ARS

The soilborne fungus *Rhizoctonia solani* AG-8 is a major concern for farmers who practice no-till farming in the inland Pacific Northwest. Bare patches caused by *Rhizoctonia* spp. first appeared in 1999 during year 3 of an 18 year no-till cropping systems experiment near Ritzville, WA (10.6 inches of annual precipitation). We mapped the extent and pattern of patches from 1999 to 2014 at the 20 acre study site with a backpack-mounted GPS equipped with mapping software. Bare patches appeared in winter and spring wheat (*Triticum aestivum*), spring barley (*Hordeum vulgare*), yellow mustard (*Brassica hirta*), and safflower (*Carthamus tinctorius*) (Figure 1).

IMPACT

Rhizoctonia bare patch is a soil-borne fungal disease that appeared in year 3 of a long-term no-till cropping systems experiment near Ritzville, WA. Bare patches appeared in all crops and, at the peak of the infestation, occurred on up to 18% of land area. Areas of bare patches began to decline in year 8 and reached near zero levels by year 11. This study provided the first direct evidence of natural decline of *Rhizoctonia* bare patch in no-till cropping systems in North America.

At its peak in years 5 to 7, bare patches occupied as much as 18% of total plot area in continuous annual monoculture spring wheat (Figure 2). The area of bare patches began to decline in year 8 and reached near zero levels by year 11. No measurable patches were present in years 12 to 18. Patch area was significantly greater in continuous spring wheat compared with spring wheat grown in a two-year rotation with spring barley (Figure 2). Additionally, the 18 year average grain yield for spring wheat in rotation with spring barley was significantly greater than for continuous spring wheat. Russian thistle (*Salsola tragus*), a troublesome broadleaf weed with a fast-growing taproot, was the only plant that grew within the patches (Figure 3). This is the first direct evidence of natural suppression of *Rhizoctonia bare patch* with long-term no-till cropping in North America. This suppression also developed in a rotation that contained broadleaf crops (yellow mustard and safflower) in all but five years of the study, and the suppression was maintained when safflower was added back to the rotation.

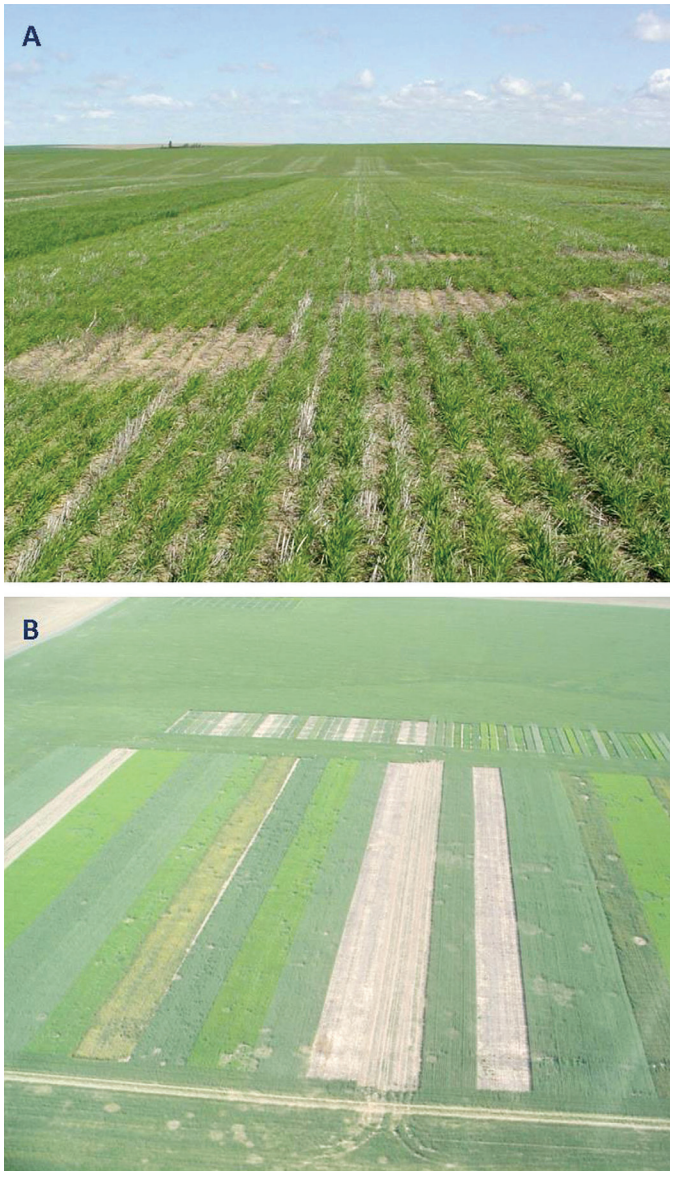

Figure 1. *Bare patches caused by* Rhizoctonia solani AG-8 *in a long-term no-till cropping systems experiment near Ritzville, WA. (a) Spring barley (left) and spring wheat (right) during the juvenile growth period in early May 2003. (b) Aerial overview of one replicate of the large-scale experiment in early July 2006, at which point* Rhizoctonia bare patch *was in decline. Photo by Bill Schillinger.*

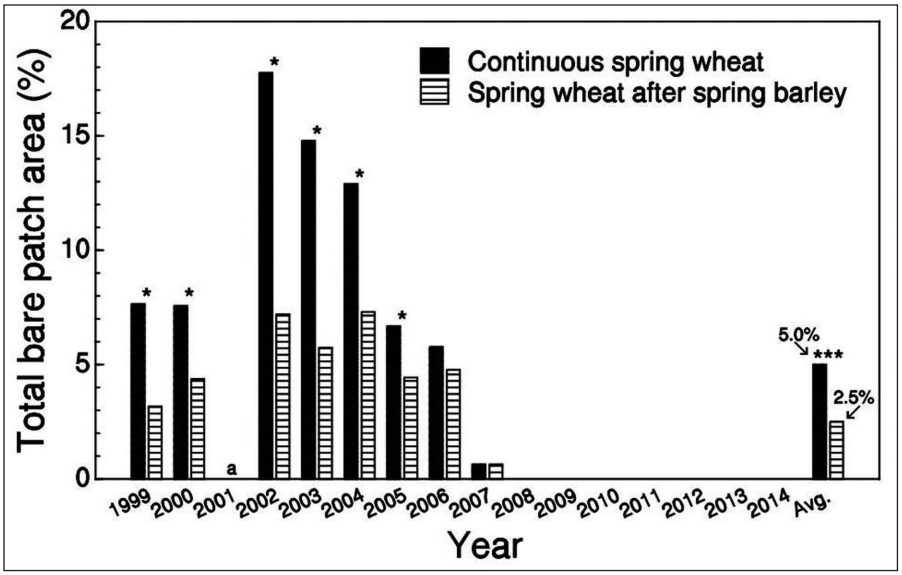

Figure 2. *Total bare patch area caused by* Rhizoctonia solani AG-8 *was significantly greater during years 3 to 9 (1999 to 2005) in continuous annual spring wheat compared to spring wheat grown in a 2-year rotation with spring barley. The crops were grown no-till in all years. At its peak in 2002, bare patches occupied as much as 18% of total plot area. Bare patch area began to slowly decline in 2003 and, by 2008 and thereafter, was nearly totally suppressed.*

[a] Patch area was not measured in 2001 due to severe drought, which made it difficult to discern bare patches from water-stressed crops.

**** Significantly different at P < 0.001.*

Figure 3. *Russian thistle, shown here in spring barley, was the only plant that grew in bare patches. Its taproot was able to penetrate through the layer of* Rhizoctonia inoculum *to access soil water present beneath patches. Cereal and oilseed crops grown in the large-scale experiment did not send roots underneath the bare patches, thus leaving "islands" of stranded water. Photo by Bill Schillinger.*