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Early season disease management in soybeans

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Abstract
Damping off and seed rot, caused by Phytophthora sojae, is an important early season disease of soybean in Iowa. The disease is favored by warm (>60 F), wet soil conditions. P. sojae is an oomycete that survives in the soil as thick-walled oospores. When soil conditions are warm and wet, the oospores germinate, producing sporangia, which in turn produce many zoospores. These spores have flagella that enable them to swim in freestanding water. The zoospores are attracted to soybean roots by root exudates, where they infect seedling roots and cause disease. Thus, wet soils are essential for infection by P. sojae.

Disciplines
Agronomy and Crop Sciences | Plant Pathology

Plant Diseases

Early season disease management in soybeans

by Sarah Cerra and Alison Robertson, Department of Plant Pathology, and Silvia Cianzio, Department of Agronomy

Damping off and seed rot, caused by *Phytophthora sojae,* is an important early season disease of soybean in Iowa. The disease is favored by warm (>60 °F), wet soil conditions. *P. sojae* is an oomycete that survives in the soil as thick-walled oospores. When soil conditions are warm and wet, the oospores germinate, producing sporangia, which in turn produce many zoospores. These spores have flagella that enable them to swim in freestanding water. The zoospores are attracted to soybean roots by root exudates, where they infect seedling roots and cause disease. Thus, wet soils are essential for infection by *P. sojae.*

Damping off also can be caused by *Fusarium* spp. and *Pythium* spp. *Pythium* is also an oomycete and thus wet conditions are also necessary for infection. However, *Pythium* infection is favored by cool (<60 °F) soil temperatures.

A major disease management practice in Iowa to reduce losses due to *P. sojae* has been the use of soybean cultivars with Rps 1-k genes. However, some growers continue to have problems with early season Phytophthora seed rot and damping off. Prior to 1994, Rps 1-k protected soybean yields from all but 5 percent of *Phytophthora* isolates in Iowa. Today, at least 50 percent of *Phytophthora* isolates can overcome the gene.

The use of a partially resistant (tolerant) variety of soybean in combination with seed treatment fungicides has been suggested as a viable Phytophthora disease management option. Partial resistance is coded for by multiple genes and protects soybean against all *P. sojae* isolates with minimal yield loss. However, partial resistance does not "kick in" before the first true leaf stage and thus germinating seedlings are susceptible to infection. Therefore, the application of fungicide seed treatments should facilitate protection of soybean seedlings until partial resistance becomes active.

The fungicide seed treatments Apron XL® and Apron Maxx® previously have been shown to have significant results when Phytophthora disease pressure is high. A study done in Ohio in 2003 showed fungicide seed treatments increased grain yield by more than three times the cost of the treatment in four of five trials.

Postemergence damping off caused by *Phytophthora.* *(X. B. Yang)*

Greater than average rainfall occurred at these trial sites, resulting in increased Phytophthora pressure.

In 2005, we examined the value of partially resistant varieties of soybean in combination with seed treatment to reduce yield loss due to *P. sojae.* This trial was done near Eddyville, Iowa, at a site with a history of severe Phytophthora damping off in the 2004 growing season. Six cultivars of soybeans with varying resistance to *P. sojae* (two susceptible cultivars, two cultivars with partially resistant cultivars, one cultivar with the Rps 1-k gene, and one cultivar with the Rps 1-k gene and the Rps 6 gene) were planted. Each cultivar was treated with either Apron XL® or Apron Maxx® at the recommended rates. Untreated seed served as a check. Apron XL® contains metalaxyl, which is active against oomycetes. Apron Maxx® is a combination of two compounds: mefenoxam, which protects against oomycetes, and fludioxonil, which protects against *Fusarium.* Our results were inconclusive (Figure 1); however, no significant rain events occurred in the four weeks post planting. In addition, soil moisture levels in the south-eastern part of the state remained very low for much of the season.

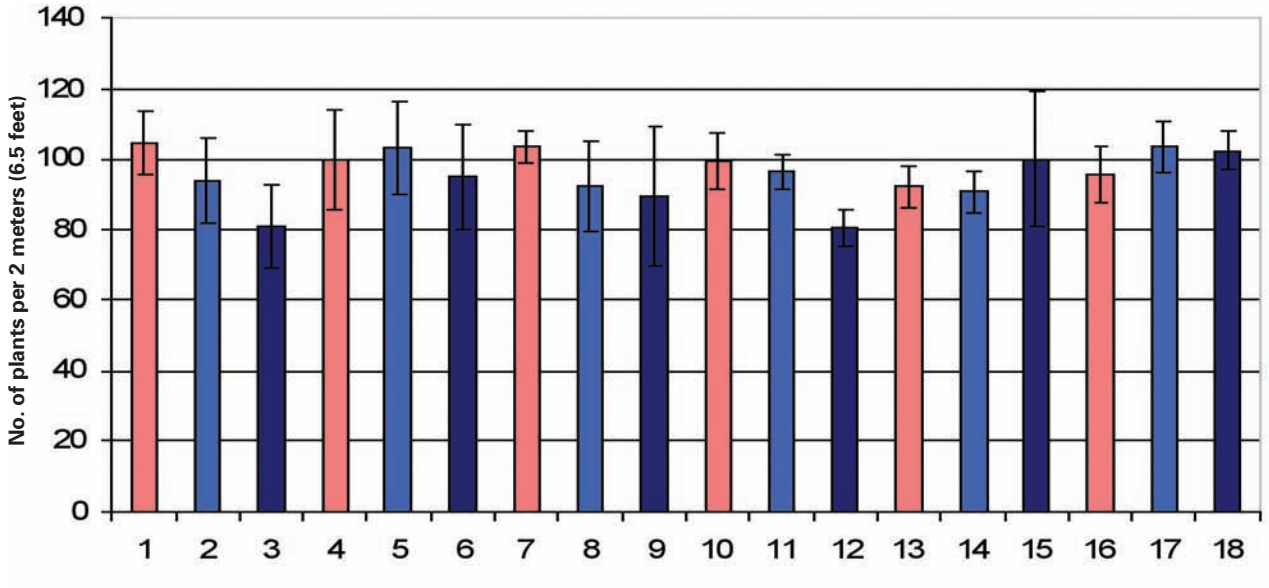

Figure 1. Soybean seeding stand count 3 weeks after planting. Red bars are the control. Light blue bars are seeds with Apron XL® and dark blue bars are seeds treated with Apron Maxx®.

This spring, some growers may be considering using soybean seed treatment fungicides. Although this research and other soybean seed treatment research at Iowa State University have shown no consistent significant yield improvement, enough data have been collected from across the Midwest to show that soybean seed treatment fungicides can provide effective protection against pathogens that are carried on the seed and those present in the soil that result in early season disease, such as seed decay, seedling blights, and root rots. At a cost of approximately $2.50 per acre, seed treatments are a fairly cheap form of crop insurance.

Seed treatment fungicide applications may be worth considering in fields that:
(1) have a history of early seedling diseases such as damping off or seed rot,
(2) are prone to water logging, or
(3) are being planted early, when cool soil temperatures could prolong germination.

A comprehensive list of soybean seed treatment fungicides that are currently available was recently compiled by Laura Sweets at the University of Missouri (**http://ipm.missouri.edu/ipcm/archives/v16n1/ipmltr2.htm**).

Sarah Cerra is a graduate assistant working toward a master's degree in plant pathology. Alison Robertson is an assistant professor of plant pathology with extension and research responsibilities in field and forage crops. Silvia Cianzio is a soybean breeding researcher with an interest in cultivar and germplasm line development for brown stem rot and Phytophthora.