

Pathogens and pests that attack seeds can cause severe yield losses in the field or during storage and transport (Figure 1). These infections reduce seed quality and viability and risk introducing novel pathogens and pests into new production areas. This includes pathogens that cause bacterial tan spot, frogeye leaf spot, Fusarium root rot, and Diaporthe diseases on other plant parts as well as many viruses. It is important to monitor seedborne pathogens and pests to aid in soybean production management strategies that may include planting high quality seeds, soybean cultivar selection and optimum seed storage conditions. To detect bacterial and fungal pathogens, seed plating assays are often used. When seeds are incubated on a growth medium, bacteria and fungi grow out from the infected seed. Many of the fungi can be identified visually to fungal genus, however, bacteria need further tests for proper identification. Molecular diagnostics is used to speciate fungi and bacteria as well as to detect any viral infections. Insects can usually be detected through visual monitoring.



Figure 1. Purple seed stain (left), downy mildew (center), and bruchid feeding (right) are seed borne diseases and pest damage that were recorded from our soybean seed assays.

Seed sampling and plating

Seeds from 10 locations throughout Zimbabwe (Figure 2) were collected after the 2018/2019 growing season and sent to the Soybean Innovation Laboratory at the University of Illinois in Urbana, IL. The seeds were evaluated for overall seed health, seed germination, and incidence of seedborne pathogens and pests. A sample was selected for each of the 30 genotypes at each of the 10 locations. The seed samples were surface disinfected and placed onto a nutrient-rich agar to encourage germination and microbial (bacterial and fungal) growth (Figure 3). After seven days germination was recorded, and microbes were quantified and identified. Average seed germination rates ranged from 45-79% with an average of 62% germination overall all 10 locations. Soybean cultivar S1187-5-37 had the highest average germination at 89% while SNK500 had the lowest average germination rate at 32% (Figure 4).



Figure 2. Trial sites in Zimbabwe, 2018/2019

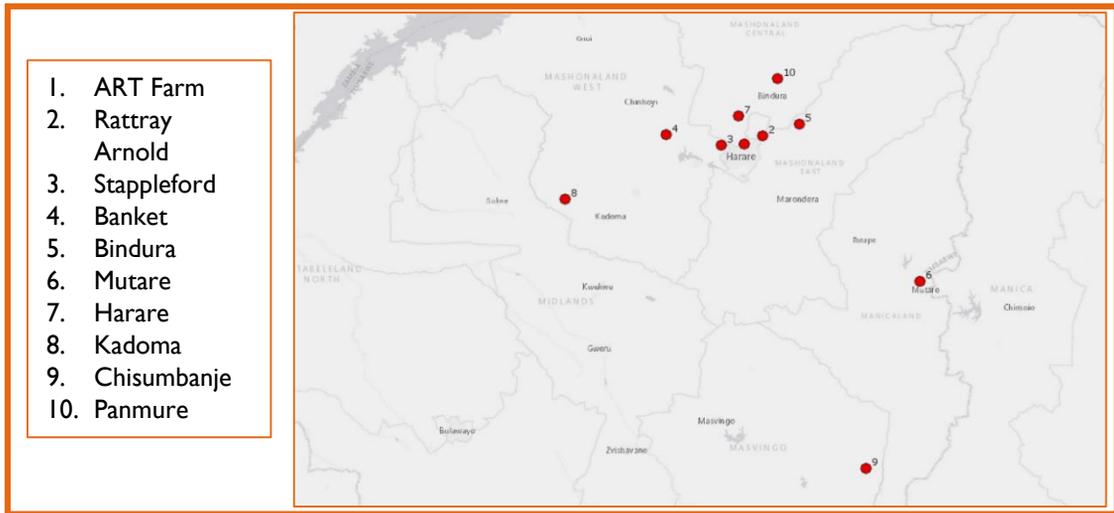


Figure 3. Surface disinfected seed plated on to nutrient rich agar to encourage microbial growth. Seeds just plated on medium (left), 2 days after planting (center) and 6 days after plating (right).

Disease evaluation

Seed health ratings were taken based on the overall appearance of disease or malformity of the seed based on a visual 0 to 5 rating scale where 0 indicated normal appearing seed to 5 indicated 90-100% of the seeds appear misshaped and/or discolored. Seed health ratings ranged from 1.1 to 2.8 with an average of 2.1 over the 10 locations. SC Signal had the lowest rating of 1.2 and SNK500 had the highest rating at 2.8 (Figure 5).



Disease evaluation

The trial location in Mutare had the lowest level of overall microbial incidence with an average of 20% infected seed per plate, while Kadoma had the highest level of seed infection with an average of 80%. Soybean cultivar Panorama 358 had the lowest infection rate of 30%, while S1150-5-22 had the highest level of infection with 60%. Bacterial colonies were the most abundant microbe found with an overall average of 9% incidence with the highest incidence at Panmure with 21% of the seeds colonized by bacteria. Soybean cultivar TGx 2002-35FM had the lowest incidence of bacteria at 3% while Panorama 29I had the highest incidence at 24%. The genus *Cercospora* occurred on 8% of the seeds with the highest incidence of 28% at the Kadoma location. Tikolore was the cultivar that had the highest incidence with *Cercospora* which was 18%, while MRI DNA had the lowest at 2%. Other pathogens found include species within the genera *Aspergillus*, *Fusarium*, and *Diaporthe* but at lower levels.

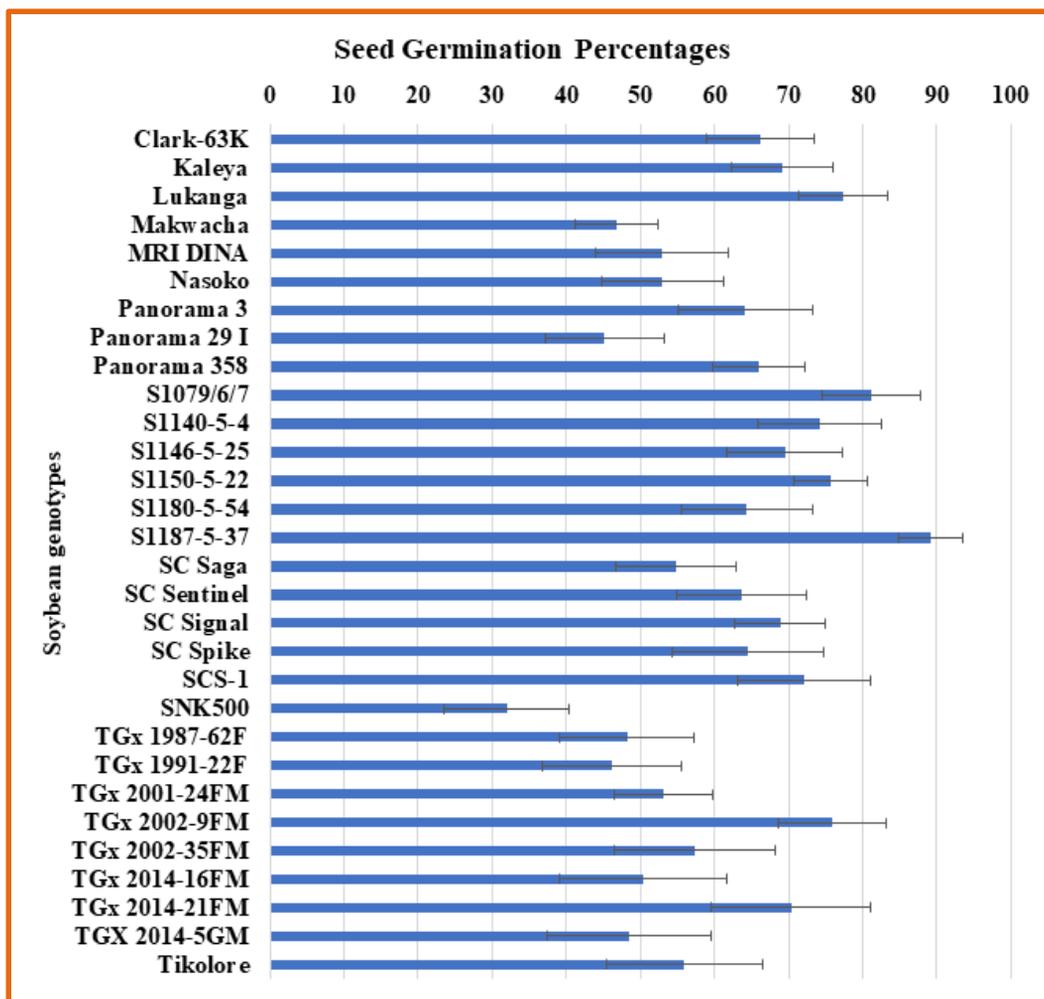


Figure 4. Seed germination percentage for 30 soybean genotypes averaged across 10 locations representing a total of 100 seeds. Lines beyond the bars represent the standard error of the mean.

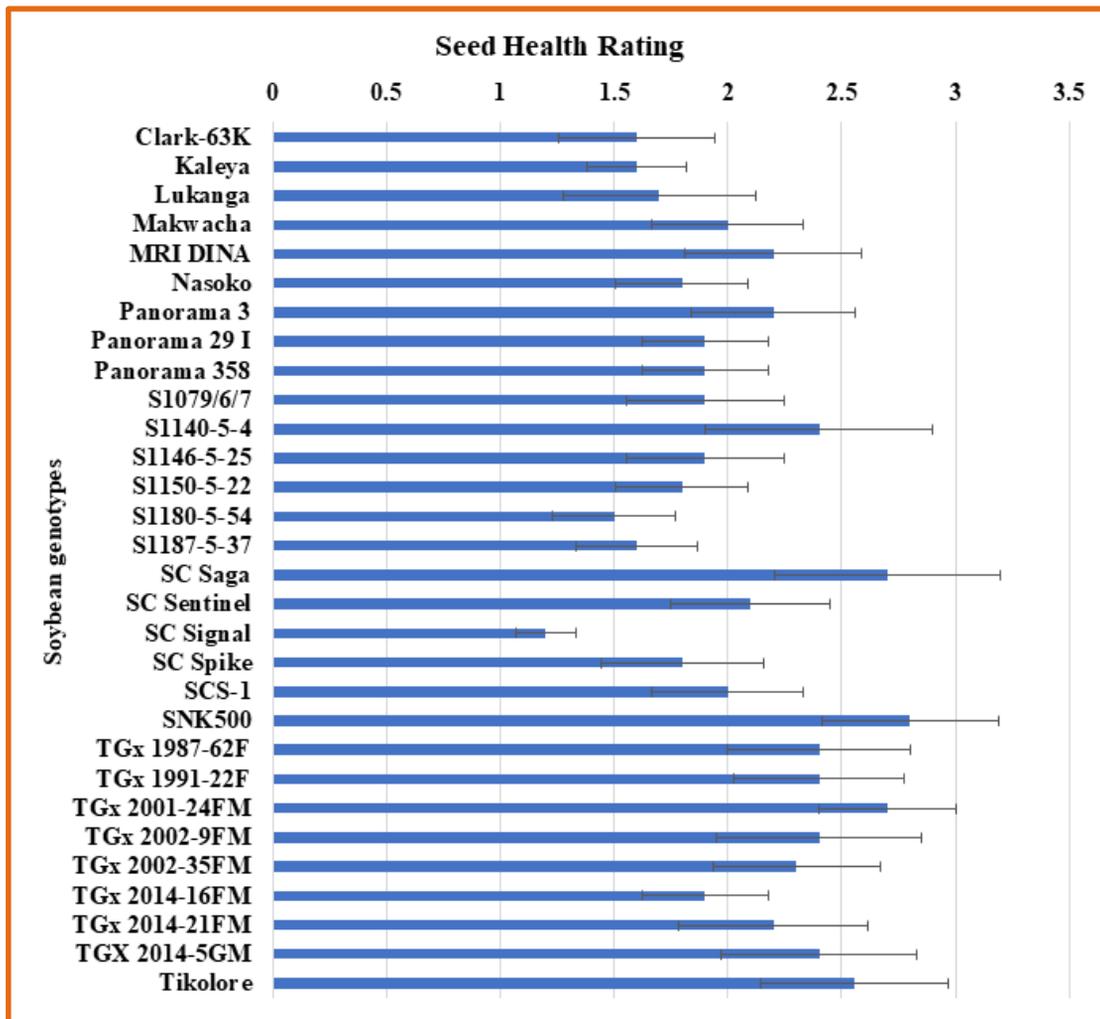


Figure 5. Seed health ratings for 30 soybean genotypes averaged across 10 locations. Ratings were based on a 0-5 scale where 0 = visually healthy appearing seeds to 5 = 91 to 100% of the seed are misshaped and/or discolored.

For further information please contact the SIL researchers below:

Michelle Pawlowski:

Plant pathologist (USDA – ARS)

mpawlow4@illinois.edu

Glen Hartman:

Plant pathologist (USDA – ARS)

mpawlow4@illinois.edu