KSC Report for: "Mitigating soybean root and seedling diseases in Kansas." (Year 2)
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Introduction:

From 2012 to 2020, SDS, Fusarium diseases, charcoal rot, and Phytophthora root rot cost Kansas soybean farmers an average of 7.8% of production per year. Through past KSC support, the Row Crops Pathology Lab at KSU has taken a leadership role in soybean root health research with an emphasis on diseases. Our priorities are the discovery of plant resistance, management strategies, and new disease information to help Kansas producers increase their yields and profits over the long-term.

Objectives & Activities:

1. Discover resistance to fungal diseases: SDS, Fusarium diseases, and charcoal rot.

So far, three methods are being tested to assess resistance to these diseases in soybean germplasm: rolled-towel, layer-cake, and seed-plate assays. Most efforts have focused on these in vitro/growth chamber/greenhouse assays for the purpose of finding higher throughput methods to discover resistance, rather than relying on long-term and environmentally confounded field studies.

2. Evaluate the management strategies for fungal pathogens: SDS and Fusarium diseases.

During the first year, small-scale studies were conducted to determine the effect of *B. juncea* against the SDS and Fusarium seedling/root pathogens. *B. juncea* extracts were obtained from vegetative, flowering, and senescent plants and were tested against *F. virguliforme* and other *Fusarium* spp. directly to see if the cover crops exert any antifungal activity on their own. In general, the plant extracts themselves do not show much pathogen inhibition. One hypothesis

Cover crops studies: Unfortunately, *Brassica juncea* cover crops failed in southeast Kansas this spring, and therefore this part of the project could not be completed.

Fungicides: Testing of strobilurin fungicides have dominated our experiments in the lab so far. In this regard, we have tested azoxystrobin, picoxystrobin, pyraclostrobin, and trifloxystrobin against *F. virguliforme* (the causal agent of SDS) and *F. proliferatum* (a common soybean seedling pathogen) (Figure 2). So, far the *F. proliferatum* isolates we've tested on azoxystrobin do not appear to differ in their sensitivity to this fungicide active ingredient. However, the average EC50 threshold across the isolates tested is 18.5 μg/mg. However, one *F. proliferatum* isolate, RCPL0165, exhibited significantly greater tolerance to picoxystrobin than the others. Interestingly, *F. proliferatum* isolates proved to be most sensitive to pycraclostrobin among the four strobilurins tested. However, the isolates were not different from one another.

3. Assess the impact of re-emerging root pathogens: *Phytophthora sojae* in southeastern Kansas.

We have moved beyond SE KS to collect *P. sojae* isolates. So far this year, we have collected diseased plants (Figure 3) from Riley and Nemaha counties. Currently, plant tissues are in culture to isolate pure cultures of *P. sojae*. Once enough isolates are collected, they will be maintained in the Row Crops Pathology Lab culture collection. As time allows: (i) Pathogenicity will be estimated based upon the degree of root rot caused by each isolate. (ii) Tolerance or

sensitivity to metalaxyl and mefanoxam, common fungicide active ingredients, used against this pathogen, will be estimated for each isolate. (iii) If time and resources allow, SEK *P. sojae* races will be determined using soybean differentials.

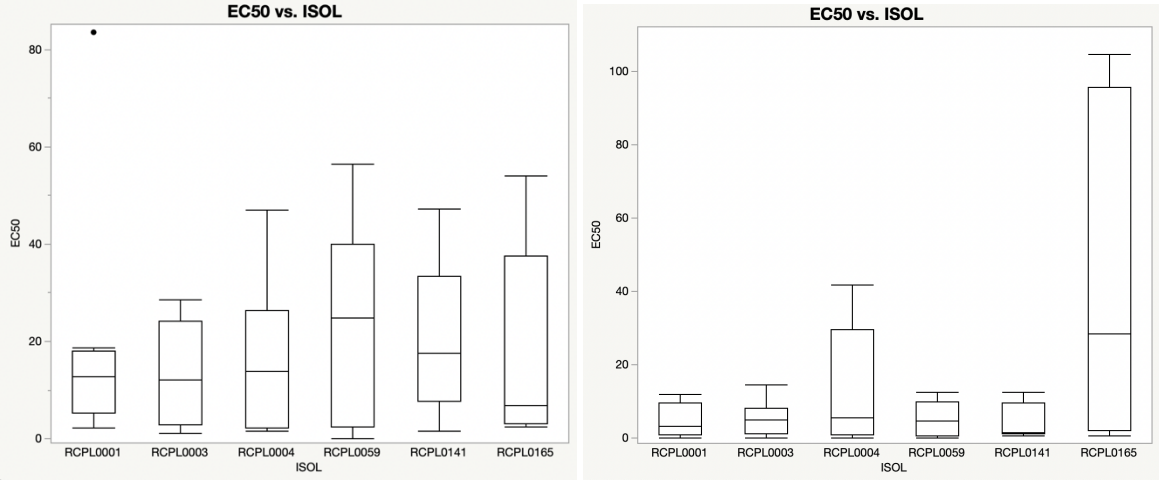

Figure 2. Response (EC50) of six *Fusarium proliferatum* isolates from Kansas soybean seedlings grown on azoxystrobin (*top left*), picoxystrobin (*top right*), pycraclostrobin (not shown), and trifloxystrobin (center).

Figure 3. Example of dark lesions produced by *Phytophthora sojae* at the base of soybean plants.