KANSAS SOYBEAN COMMISSION QUARTERLY REPORT OF PROGRESS

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Title: "Soybean production systems to control charcoal rot and other soil-borne diseases"

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Previous research sponsored by the Kansas Soybean Commission demonstrated that a high-glucosinolate mustard with biofumigant properties (Mighty Mustard Pacific Gold, Johnny's Select Seed) reduces *M. phaseolina* population levels in soil and in soybean plants. The research in this new proposal builds on the previous results by developing management practices that incorporate use of mustard as a cover crop in soybean production systems, included double-cropped soybeans. The mustard cover crop was tested for its impact on soil health, fungal disease presence, and soybean growth and yield.

The mustard seed was planted in late March at two locations: Columbus, KS and Ashland Bottoms, KS, when soil temperatures were consistently above 50 F. The mustard grew till bloom, and then was killed with herbicide. Four different treatments were implemented to test the potential impact of mustard biomass on charcoal rot fungus prior to planting the soybean seeds: planting directly into the standing mustard plants; rolling the mustard plants; mowing the mustard plants; and disking the mustard plants. The mustard does not produce much biomass, and so managing the biomass is relatively easy. A fifth control plot had no mustard cover crop. All plots were planted with an early maturing cultivar, AG4135, that has been shown to be particularly susceptible to charcoal rot.

Soil samples were collected after implementing the cover crop residue management treatments. Additional soil samples were taken in the fall at the same time that soybean plant samples were taken at the R7-8 stage. The numbers of colony forming units (CFU's) are being measured in the plant and soil samples at the Department of Plant Pathology at Kansas State University. Soybean yields were measured in each plot at harvest.

A second experiment tested the efficacy of mustard in wheat to control charcoal rot in double-cropped soybeans. Soil and plant samples for that study were taken when the soybeans were at the R7-8 stage, and the number of colony forming units measured. Soybean yield was measured at maturity.

No difference in soybean yield between treatments (rolling, mowing or planting into standing mustard) was measured, though differences in yield trends were observed between locations. The disked treatment had the highest yield at Parsons, but was the lowest yield at Ashland Bottoms. There were no measured differences in soybean yield components between treatments.

Other fall-planted cover crops (barley, oats, rye, wheat, sunn hemp, clover, radish, canola and mustard) showed no differences in soybeans yields. Notably, no yield loss was observed following wheat at Parsons, but a 22% yield reduction in soybean yield was observed at Ashland Bottoms after wheat, potentially due to the lack of moisture at Ashland Bottoms in the spring of 2017. Spring planted cover crops (spring oats, spring barley, sunn hemp, clover, radish, mustard, and cow peas) did not impact soybean yields at Parsons.

The most susceptible cultivar (4.1) showed a 12% yield increase with either biological or chemical treatment for charcoal rot in 2016. The average yield across all cultivars increasing 5% for chemical and 7% for biological control in 2016, though the combined treatment (chemical + biological) did not show a cumulative yield increase. In contrast, only a very minor increase in yield with mustard cover crop was observed in 2017 (2%), with no yield improvement with chemical control. The early variety (4.1) was again the most sensitive.

Information on charcoal rot infestation in the plants and soils is being compiled. Soil microbial activity will be determined using the phospholipid fatty acid assay (PLFA) for treatments showing differences in CFUs.