Evaluation of Current Soybean Production Practices on *Phomopsis Longicolla* Infection

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Introduction

Phomopsis longicolla Hobbs causes seed decay in soybean [*Glycine max* L. (Merr.)] and is one of the most economic important soybean diseases worldwide (Wyllie and Scott, 1988). *Phomopsis longicolla* infects by penetrating the seed coat and colonizing the embryo and/or endosperm of the soybean seed (Singh and Sinclair, 1986) causes a reduction in seed viability, vigor, seed quality, as well as reduces seed yield which affects the profitability of commercial producers as well as seed producers (Hartman et al., 1999). Relative humidity levels of 100% and temperatures around 25° C at the R7 growth stage facilitate optimum growth of this pathogen making temperate and tropical soybean producing climates more susceptible to this pathogen (Balducchi and McGee, 1987). Control measures to reduce the negative effects of this pathogen have yielded limited success and some previously used fungicides are no longer registered for use on soybean leaving soybean producers as well as soybean seed producers vulnerable. This issue has created the need for research into how current soybean production practices affect *P. longicolla* infection.

Objectives

1. To evaluate the effect of current management decisions on *Phomopsis longicolla* infection of soybean throughout the Cornbelt in the United States.

2. To determine regions of the United States soybean production area that incur more *Phomopsis longicolla* infection.

Materials and Methods

This study was conducted in 2009 at three locations each in Louisiana, Arkansas, Kentucky, Iowa, Minnesota, and Michigan. Plots were arranged in a randomized complete block design with four replications and nine treatments. Nine treatments, composed of a variation of seven different management criteria, were applied in accordance with the treatment structure at each location (Table 1). Plot dimensions ranging from 4.6 to 6.1 m wide and 6.1 to 15.2 m long based on each location's equipment availability. Prior to planting soil samples were taken to determine fertility levels as well as soybean cyst nematode (*Heterodera glycines*) populations. Locally adapted high yielding soybean cultivars were selected for each location and weed pressure was managed using a pre-plant product followed by two or more post applications of glyphosate (N-(phosphonomethyl)glycine) (Monsanto, St. Louis, MO) as needed in the different states. Insect pressure was to be managed based upon each individual state's IPM recommendation.

Upon harvest, a 0.9 Kg seed sub-sample was collected and sent to Iowa State University for seed quality testing. A warm germination test was conducted to determine seed viability, an accelerated aging test was conducted to determine seed vigor, and a culture plate test was conducted to determine the incidence of percent *Phomopsis longicolla* infection. The warm germination and accelerated aging results are not presented in this poster.

The culture plate test was conducted by placing 100 seeds into a 0.05% NaCl solution for 1 minute. Seeds were then placed on acidified potato-dextrose agar (APDA) (pH 4.5) at 10 seeds/plate and allowed to incubate for 4-7 days at 24°C. Cultures were then visually evaluated for *Phomopsis longicolla* colonies growing from seeds. The percentage of infected seeds was calculated.

Data were subjected to an analysis of variance using the PROC MIXED procedure of SAS version 9.2. Data were analyzed by region with location and replication treated as random effects and treatments treated as a fixed effect. Mean comparisons were made using Fisher's protected LSD test ($P \leq 0.10$).

North Region: MN & MI

Central Region: IA & KY

South Region: AR & LA

Treatment Table

Table 1. Management treatments composed of the seven input variables. Treatments are in a non-factorial arrangement. A '+' indicates a treatment is applied whereas a '-' indicates a treatment is not applied. A 'W' indicates wide rows (≥76 cm) and an 'N' indicates narrow rows (≤76 cm).

Management Treatment	Seed Treatment	Fungicide Treatment	Seed Inoculant	Soil Fertilizer	Foliar Fertilizer	Row Spacing	Seeding Rate (seeds ha^{-1})
1	-	-	-	-	-	W	345,800
2	+	+	+	+	+	N	345,800
3	+	+	+	+	+	W	345,800
4	+	+	+	+	-	N	345,800
5	+	+	+	-	+	N	345,800
6	+	-	+	+	+	N	345,800
7	-	+	+	+	+	N	345,800
8	+	+	+	+	+	N	592,800
9	+	+ (R3&R5)§	+	+	+	N	592,800

§ Indicates two applications of foliar fungicide. The first treatment was the application of pyraclostrobin fungicide at the R3 growth stage. The second treatment was the application of azoxystrobin + propiconazole fungicide at the R5 growth stage.

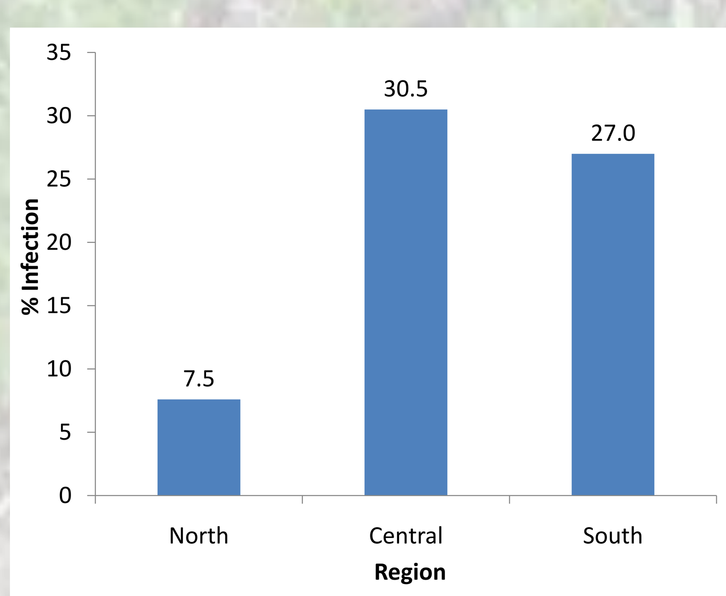

Figure 1. *Phomopsis longicolla* infection by region. LSD (0.10) = 19.5.

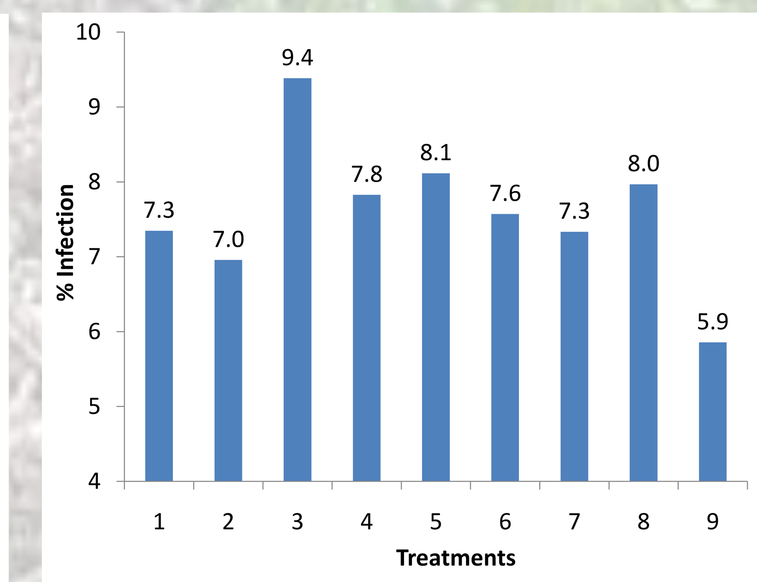

Figure 2. Percent *phomopsis longicolla* infection across treatments in the north region. LSD (0.10) = 3.3.

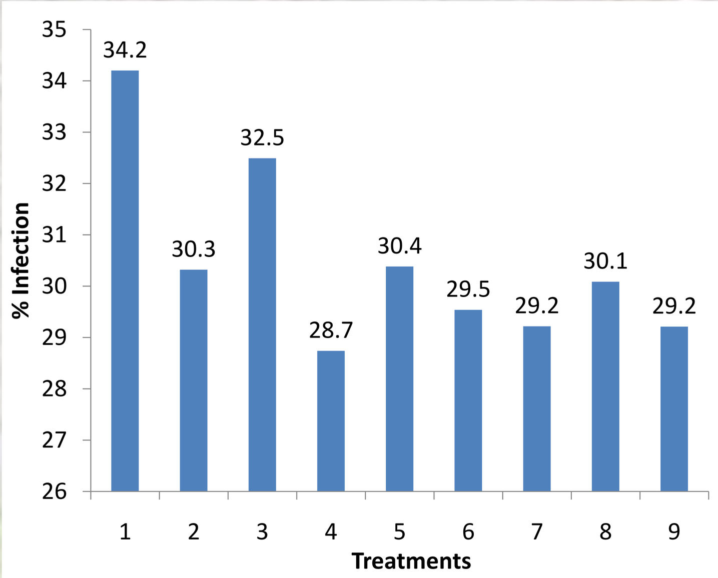

Figure 3. Percent *phomopsis longicolla* infection across treatments in the central region. LSD (0.10) = 3.3.

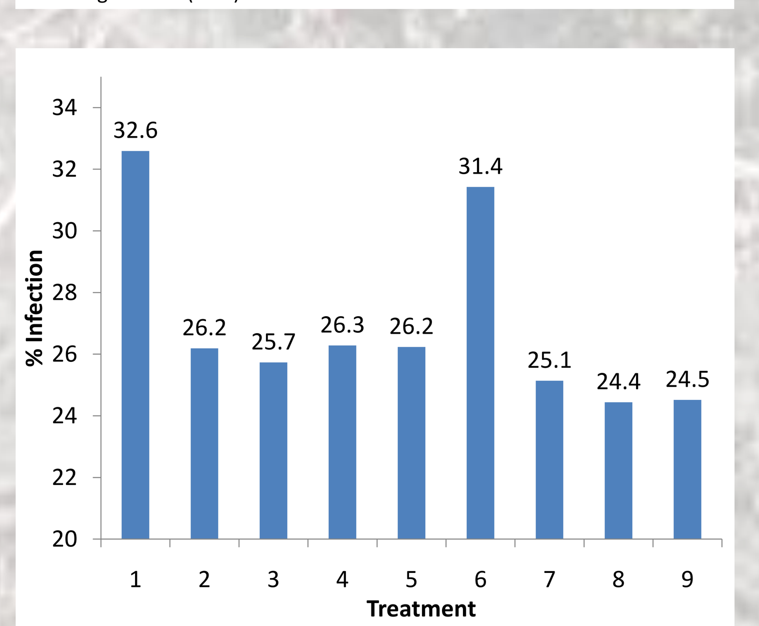

Figure 4. Percent *phomopsis longicolla* infection across treatments in the south region. LSD (0.10) = 3.6.

Poor quality seed from Louisiana

Seed infected with *Phomopsis longicolla*

Seed Science Center at Iowa State University

Results

Level of *Phomopsis longicolla* infection differed among regions (Figure 1). No differences in *Phomopsis longicolla* infection were observed between the central (30.5%) and southern (27.0%) region but both were significantly higher than the northern region (7.5%).

A treatment by region interaction was observed. In the northern region, small differences were observed with treatment 9 having a significantly lower *Phomopsis longicolla* infection than treatment 3 (Figure 2). Except for treatment 3, treatment 1 had a significantly higher level of *Phomopsis longicolla* infection than the other treatments in the central region (Figure 3). In the southern region, treatments 1 and 6 had a significantly higher *Phomopsis longicolla* infection than the other treatments (Figure 4).

Summary

The first year's data indicates that management decisions do impact *Phomopsis longicolla* infection. Inconsistency existed among treatment response to *Phomopsis longicolla* infection. No conclusive observations among the various inputs could be drawn. In both the central and southern regions, which were also the two regions with the highest level of *Phomopsis longicolla* infection, treatment 1 tended to have the highest level of *Phomopsis longicolla* infection. This study will continue in 2010.

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