

Comparison of Soybean Production Techniques with Plant Disease Development in the Red River Valley

Introduction

Soil-borne disease issues continue to plague soybean production across Minnesota. Routinely, heavy soils and wet fields promote root disease development. Generally, an initial period of low disease pressure is expected when growing a newly introduced crop in a region. Spread of soil-borne pathogens requires the presence of a suitable host before populations can cause widespread crop damage. The objective of this research was to determine if specific production practices such as rotation, tillage, varieties grown, soil fertility, or herbicide application contributed to disease development.

Materials and Methods

A survey was conducted during the 2004 growing season where 36 fields located in 11 NW MN counties from the Canadian border to Wilkin and Ottertail counties, were identified for specific cropping histories of interest (Table 1). Producer records and observations provided crop production practice histories beginning in 1997 and extending through the survey year. During July, soil samples and a total of 25 soybean plants (growth stages: unifoliate to first trifoliate leaves) were collected. Collected plants were rated for leaf and root disease, and leaves stored for serology tests (soybean mosaic virus, alfalfa mosaic virus, and bean pod mottle virus). The percent leaf area killed from disease and root rot ratings (where 0=healthy, 1=discolored, 2=defined lesion, and 3=root rot) were assigned each plant that was collected. Root tissue isolations were made to isolate those pathogens present. During August, soil was collected once again and analyzed for soybean cyst nematode. Plants in the R2-R5 growth stages were examined for leaf and root disease and leaves were stored for serology tests as described above. Root tissue isolations were conducted and chlorosis ratings were taken from each plant on a 0 to 4 scale where 0= no chlorosis and 4=severe chlorosis.

Results and Discussion

Crop rotation use varied widely between fields. Soybean was grown eight of eight years in a single field while five fields had three years of continuous soybean. Planting two consecutive years of soybean was common.

The cool, wet growing season during 2004 promoted diseases caused by pathogens with lower temperature requirements for infection and disease development. Brown spot (caused by *Septoria glycines*) was the most severe aboveground disease, while downy mildew (caused by *Peronospora manshurica*) and bacterial blight (caused by *Pseudomonas savastanoi* pv. *glycinea*) were much less prevalent. Downy mildew infections increased substantially between the first and second plant collections. Root diseases were widespread and often severe. Fusarium root rot (caused by *Fusaria* spp.) was most prevalent. Pythium root rot (caused by *Pythium* spp.), Phytophthora root rot (caused by *Phytophthora sojae*), and Rhizoctonia root rot (caused by *Rhizoctonia solani*) were also present, but to a lesser degree. Correlations indicate a signifi-

cant relationship between root rot ratings from plants collected during July and cropping system (Figure 1), and significance between plants collected during August and cropping system (Figure 2). *Fusaria* spp. populations (pathogenic as well as saprophytic) were correlated with herbicide use, and *Rhizoctonia* spp. populations were correlated with cropping system. Serology tests from plant tissues collected in July and August from all fields were uniformly negative for soybean mosaic virus, alfalfa mosaic virus, and bean pod mottle virus. No soybean cyst nematodes were detected.

Yield data remains incomplete, making additional comparisons difficult. Many fields were damaged due to an untimely frost. Reported yields range from 0 to 40 bu/a.

Further studies are needed to investigate the relationship that specific classes of herbicides have with increasing or decreasing populations of *Fusaria* spp. recovered from soybean plant roots.

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For additional information:

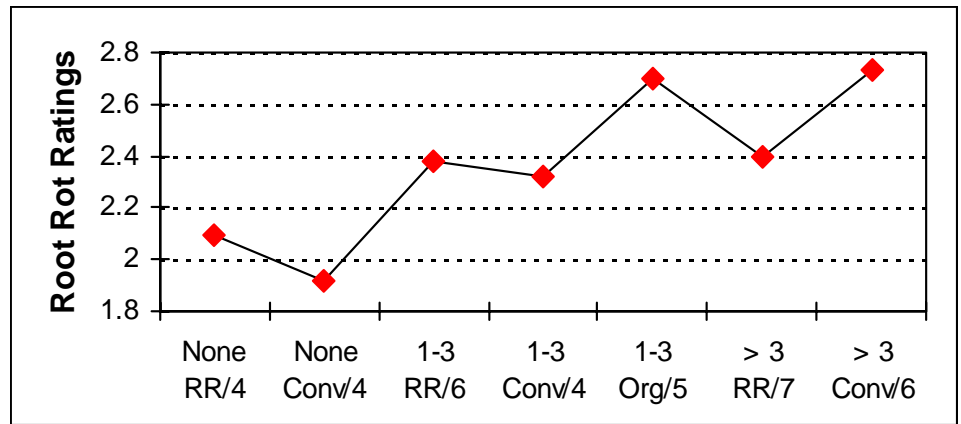
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Table 1. Field cropping history categories of fields that were surveyed.

Soybean Rotation 7 years to present	Conventional (Conv)	Roundup Ready (RR)	Organic (Org)
No soybean	4	4	---
1 - 3 yrs soybean	4	6	5
> 3 yrs soybean	6	7	---
TOTAL	14	17	5

Figure 1. Root disease ratings (scale of 0 to 3) from soybean plants collected during the July survey. Line graph points reflect the cropping system (None=no soybean history, 1-3= 1-3 yrs of soybean in the last 7 years, >3= more than 3 years of soybean in the last 7 years; Roundup Ready, Conventional, or Organic and the number of fields contributing to each point (4 fields, 6 fields, etc.).



*Figure 2. Root rot ratings and percent leaves killed due to disease from soybean plants collected during the August survey. See axis key in Fig. 1. *Percent leaf disease was significantly correlated with cropping system.*

