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Evaluation of Organic Soybean Rust Treatmentsfor Organic Production

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Abstract

Asian soybean rust (ASR), which arrived in the U.S. in 2004, has the potential to be the single most important impediment to economical organic soybean production in the U.S., with the potential economic impact of ASR in organic systems ranging from $30 to $120 million in soybean yield loss. The fungus(*Phakopsora pachyrhizi*)survives year-round in warm areas, such as the southern United States. During a growing season, the pathogen is disseminated by northward seasonal wind.

Keywords

Horticulture, Agronomy

Disciplines

Agricultural Science | Agriculture | Agronomy and Crop Sciences | Horticulture

Evaluation of Organic Soybean Rust Treatments for Organic Production

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Introduction

Asian soybean rust (ASR), which arrived in the U.S. in 2004, has the potential to be the single most important impediment to economical organic soybean production in the U.S., with the potential economic impact of ASR in organic systems ranging from $30 to $120 million in soybean yield loss. The fungus (*Phakopsora pachyrhizi)* survives year-round in warm areas, such as the southern United States. During a growing season, the pathogen is disseminated by northward seasonal wind.

Iowa State University has been awarded a grant from USDA to investigate "Strategies for Management of Asian Soybean Rust in Organic Systems," which includes treatments allowable under certified organic conditions. Trials were established in 2005 in an area of Florida where rust is present to examine the effect of these treatments on ASR development and spread. Dry conditions across the south in 2007 kept soybean rust out of Iowa until very late in the season, when the first official incidence of ASR was reported in Adair County. Trials were established in Iowa, Pennsylvania, and Michigan in 2006 and 2007 to examine yield effects of these treatments under non-rust conditions.

Materials and Methods

In the soybean rust treatment trial, Blue River 34A7 soybeans were planted at the Neely-Kinyon Farm on May 23, 2007 at 200,000 seeds/acre. Plots measuring 10 × 20 ft were laid out in a randomized block design. There were four replications of the following treatments: MicroAF™ (TerraMax, Inc., Cottage Grove, MN) at 1 gallon/acre, Sonata® (AgraQuest, Inc., Davis, CA) at 1 gallon/acre, and Suregard Lime Sulphur Solution (Value Garden Supply, St. Joseph, MO) at 0.5 gallon/acre. All treatments were compared with a control. Treatments were applied on July 13, 2007, at the R-1 stage. Leaves were inspected on June 27 and July 12 for disease incidence before the treatments were sprayed, and on July 24, and August 6 and 20, by randomly selecting one leaf from the top, middle, and bottom sections of four plants per plot and recording incidence of disease. Plots were maintained with rotary hoeings on June 1, 8, and 19; cultivation on June 13 and 26, and July 26; and walking on July 17, 2007. Soybeans were harvested on October 27 with a combine. The percentage of stained soybeans in each treatment was determined by counting the number of stained soybeans in a 200-gram sample that was randomly collected from the harvest of each plot.

Results and Discussion

Soybean rust was not observed in the organic plots in 2007. Disease incidence was very low overall in 2007, ranging from 0 to 2.3% of leaves infected (Table 1). The treatments had no effect on yield, where soybeans averaged 63 bushels/acre across all treatments (Table 1). There was no effect of the treatments on soybean diseases or grain quality (Table 1). Other diseases observed in 2007 include frog eye leaf spot, *Cercospora* leaf blight, bacterial pustule, bacterial blight, brown spot, and downy mildew. The most prevalent diseases were bacterial blight and bacterial pustule (Table 1 and Figure 1). The highest number of infected leaves from bacterial blight occurred on July 12, while peak incidence of bacterial pustule was recorded on July 24. We will continue to test products in 2008, and monitor treatment effects on all soybean diseases, in the event of rust appearing during the growing season in 2008.

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Table 1. Yield and grain quality in soybean rust treatment trial.

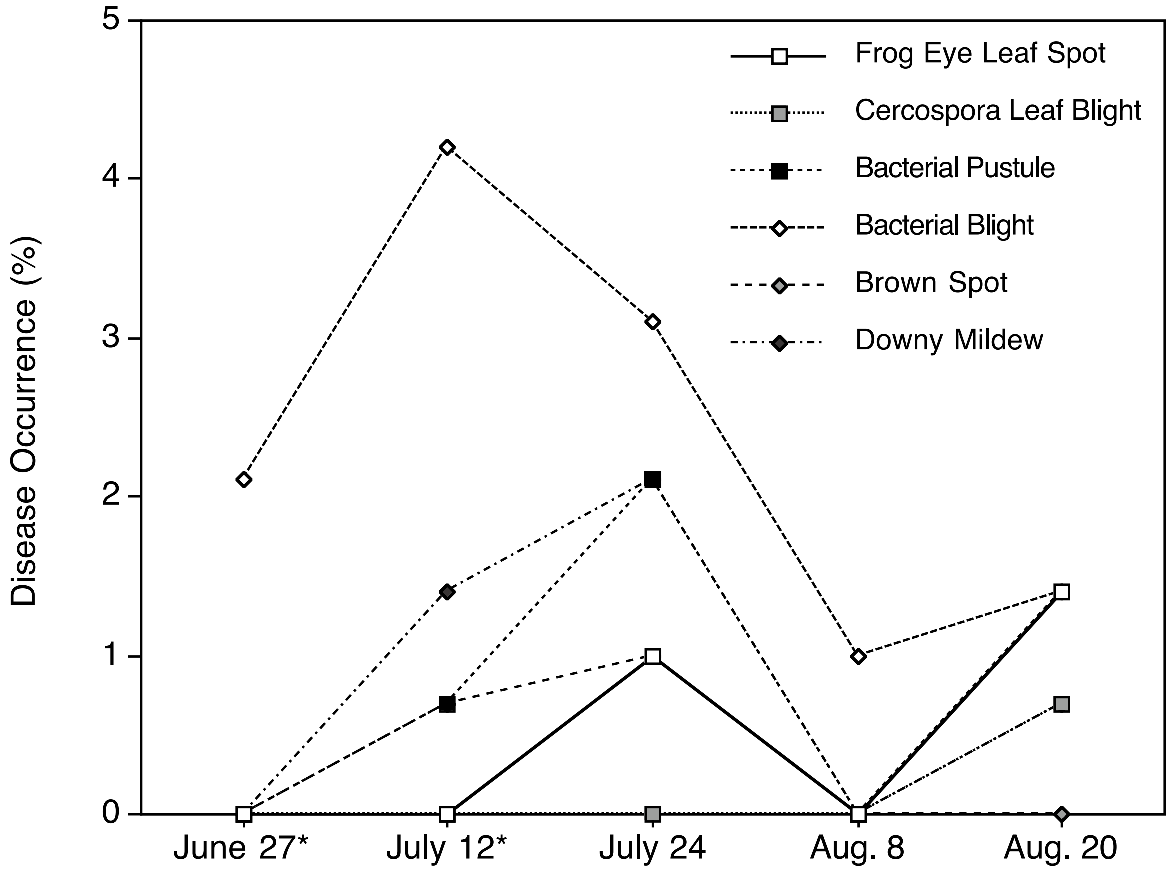
Treatment	Yield (bu/acre)	Protein (%)	Oil (%)	Saturated fatty acids (%)	Carbohydrates (%)	Moisture (%)	Linolenic acid (%)
Control	64.11 [z]	34.62	18.54	14.94	24.34	14.08	8.25
Sonata®	64.08	34.37	18.68	14.95	24.45	14.05	8.18
SureGard	64.98	34.19	18.71	14.78	24.60	13.97	8.18
MicroAF™	58.63	34.30	18.52	15.27	24.68	14.13	8.07
LSD 0.05	NS	NS	NS	NS	NS	NS	NS

[z]Means within a column are not statistically different (NS), or different at P ≥ 0.05 (Fisher's protected LSD test).

Table 2. Disease incidence in soybean rust treatment trial.

	Average number of leaves infected (%)					
Treatment	Frogeye leaf spot	*Cercospora* leaf blight	Bacterial pustule	Bacterial blight	Brown spot	Downy mildew
Control	0.00 [z]	0.80	1.50	2.30	0.80	0.80
Sonata®	1.50	0.00	1.50	2.30	0.00	1.50
SureGard	0.00	0.00	1.50	1.50	0.80	1.50
MicroAF™	0.15	0.00	0.00	1.50	0.00	0.00
LSD 0.05	NS	NS	NS	NS	NS	NS

[z]Means within a column are not statistically different (NS), or different at P ≥ 0.05 (Fisher's protected LSD test).



* Data were taken before the treatment application on July 13.

Figure 1. Disease occurrence in soybean rust treatment trial.