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Soybean plant health: Foliar fungicide and insecticide effects on soybean disease suppression, senescence and yield I.

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Summary

Foliar fungicides and mixes of fungicide and insecticide were applied to R3 stage soybeans. The following treatments, at labeled rates, were evaluated for insect control, disease control and yield: 1) Untreated check (control), 2) Domark, 3) Orthene 97, 4) Domark+ Orthene 97, 5) Domark+ Orthene97 + Quadris, 6) Domark + Quadris, 7) Headline+ Warrior, 8) Quadris + Warrior. Injury symptoms were not observed with any treatments. Brown spot was the major foliar disease. Brown stem rot incidence was 40-60% plants infected. Thirty-three DAT, Treatments containing Warrior and Domark+ Orthene 97 had fewer soybean aphids than the untreated check. Untreated, Domark alone and Orthene alone had greater defoliation than other treatments. Treatments containing Headline or Quadris had lower Septoria severity. No yield differences among treatments were detected.

Background

Even before it was identified in the southern United States in November, 2004, Asian soybean rust (ASR) caused by the fungus *Phakospora pachyrhizi* has been of concern to Minnesota soybean growers. This trial was implemented to examine the effect of fungicides on soybean rust. In the absence of ASR, the effects on endemic diseases and plant growth could be examined. Additionally, SW Minnesota has had several significant soybean aphid outbreaks with some fields at or near economic (action) threshold each year since 2002. Soybean producers and industry have expressed an interest in the prophylactic treatment of both disease and insects. This is one of several trials examining the economics of these practices.

Objective

This trial was designed to examine: 1) Fungicide effects on soybean disease incidence and severity under SW MN conditions 2) Effect of fungicide applications on plant health and 3) The effect of prophylactic foliar insecticide application on soybean yield 4) the effect of prophylactic fungicides and insecticides on yield.

Site and application description

The trial was planted at the University of Minnesota, Southwest Research and Outreach Center near Lamberton, Redwood County, Minnesota. Site and treatment application details are shown in table 1 and 2 respectively. Early season weather was cool and very wet, leading to delayed planting. The latter part of the season was normal to dry. Detailed temperature and rainfall information for this trial can be found at: <http://swroc.coafes.umn.edu/Weather/weather.htm>.

Infection symptoms of several above ground soybean diseases were observed early in the growing season. Most prevalent were bacterial blight (*Pseudomonas syringae*) and Brown spot (*Septoria glycines*), the former not controllable with fungicides. Both these diseases were present in the lower canopy season long. *Septoria*, in particular, was at 100% incidence and responsible for lower canopy leaf loss at the time of the first fungicide application. Other late season diseases observed include *Phyllosticta* leaf spot (*Phyllosticta sojicola*), brown stem rot (*Phialphora gregatum*), pod and stem blight (*Diaporthe phaseolorum* var. *sojae*) Anthracnose (*Colletotrichum* spp.) and charcoal rot (*Macrophomina phaseolina*), the later disease often observed but much more aggregated in distribution. White mold (*Sclerotinia sclerotiorum*) was also observed. Other diseases observed at low levels included *Cercospora* blight (*Cercospora kikuchii*) and downy mildew (*Peronospora manshurica*).

Methods

This trial was located in a soybean field bulk planted May 19 using a 6-row, 30-inch John Deere MaxEmerge II vacuum planter. A late group 1, Roundup Ready, SCN resistant soybean variety, Pioneer 91M91, was planted at 165,000 seeds/acre at a 1 ½ inch depth.

Six-row x 30 foot plots were measured and alley ways tilled prior to fungicide applications. Plots were aligned to correspond to the planter. A Tractor mounted 10-foot offset boom sprayer (R& D Sprayers, Opelousas, LA) modified to use compressed air was used to apply all treatments. 8003 XR flat fan nozzles on 18-inch spacing were operated at 20 PSI and 20 GPA spray volume. On July 18, R3 (early pod set) soybean growth stage, fungicide and insecticide applications were applied to rows 2 through 5 leaving a 2 row untreated border between individual plots for driving and minimization of drift. Soybean aphid (*Aphis glycines*) populations were less than 20 aphids/plant at time of application. Post emerge weed control was applied as a blanket treatment across all plots.

On August 11, thirty-three days after treatment, soybean aphid populations were evaluated by counting the number of aphids on five soybean plants/plot. Brown spot was estimated by a visual rating of lower canopy in five locations in each plot on September 14. The following rating scale was used: 1) No identifiable disease observed, 2) Brown spot detected, 3) Brown spot pronounced in lower canopy, 4) Brown spot present in mid to upper canopy, 5) Brown spot pronounced in mid to upper canopy. Simultaneously, senescence (plant health or delayed maturity) was visual rated as % of canopy lost.

Plots were end trimmed to harvest length and harvested with a plot combine on October 3, 2006.

Table 1. Plot information

Site information	
Location:	University of Minnesota Southwest Research & Outreach Center
County:	Redwood Nearest Town: Lamberton, MN
Soil type:	Ves Clay Loam
Fertility:	P(Bray): 17 ppm K: 199 ppm pH: 5.6 O.M. % 4.0
Applied Fertilizer:	April 14, 2006 23-60-60 broadcast
Plot design:	Randomized Complete Block with 4 replications
Plot size:	10 foot x 30 foot
Plot Maintenance	
Previous crop:	Corn
Primary tillage:	Fall 2005 Mulch Till Soil saver
Secondary tillage:	5/18/2006 Field cultivator 2X
Planting date:	May 19, 2006 Row spacing: 30 inch
Seeding rate:	165,000 Seeding depth: 1.5 inches
Planting equipment:	John Deere MaxEmerge II
Cultivar:	Pioneer 91M91 Trait(s): Roundup Ready SCN resistant (Peking)
Weed control:	PPI May 18, 2006 2.5 pts/acre Prowl H2O POST June 20, 2006 1.5 pts/acre Touchdown Total + AMS
Disease control:	Part of study
Insect control:	Part of study

Table 2. Treatment application information

	A
Date:	7/18/2006
Wind:	4 mph
Temperature:	85 F
Relative humidity %	43
Crop stage:	R3
Crop height:	30"
Volume:	20 GPA
Pressure:	40PSI
Nozzle:	8003XR
Nozzle spacing:	18"
Boom height:	18 inches above canopy
Compressed air offset boom sprayer (R & D sprayers modified)	

Results and discussion

Significant fungal root rots were observed in all treatments early and mid-season but root systems had recovered by late season. SCN females were observed on root systems at low numbers and plant symptoms were not observed within the trial.

No visible crop injury was observed with any of the treatments in this trial.

Soybean yields and one time soybean aphid population assessment, plant health and disease assessment are shown in Table 3.

Yield differences among treatments were not observed.

Soybean aphid populations persisted to the end of the season but populations remained low. Aphids were assumed to be controlled well in advance of yield loss and populations remained very low for the remainder of the growing season.

In part due to the hypothesis tested in this trial, intensive aphid or disease assessments were not made. However, in two adjacent trials, plots in which aphids were not controlled accumulated 2500 aphid-days (CAD) and peaked at slightly more than 100 to 300 soybean aphids/plant in late August. Thirty-three days after application those treatments with Warrior and the Domark + Orthene treatment had fewer aphids than the untreated and other insecticide fungicide combinations. After application few new aphids colonized this trial and aphid populations reflect initial control.

The Domark + Quadris + Orthene, Headline + Warrior and Quadris + Warrior treatments had lower brown spot severity than the untreated check. The untreated, Domark alone and Orthene alone treatments had lower canopy loss than other treatments.

These data hint at possible synergy between products but not in a strong way. This trial is similar to many others that show reduced disease and likely related delayed senescence with fungicide applications, in particular strobilurins and strobilurin + triazole mixes. However, like many other trials disease and insects populations are not necessarily yield limiting.

These data reinforce the economic uncertainty of insect and disease control with knowledge of yield risk.

Acknowledgments:

The information given in this publication is for educational purposes only. Reference to commercial products is made with the understanding that no discrimination is intended and no endorsement by the University of Minnesota any specific product(s) used in this implied.

		Fungicide Class
Domark 230 ME™ Valent U.S.A. Corporation	tetraconazole	triazole
Folicur® Bayer CropScience	tebuconazole	triazole
Headline® BASF Corporation	pyraclostrobin	strobilurin
Orthene 97 Valent U.S.A. Corporation	acephate	
Prowl H2O® BASF Corporation		
Touchdown Total® Syngenta Crop Protection	glyphosate	
Quadris ® Syngenta Crop Protection	azoxystrobin	stobilurin
Warrior® Syngenta Crop Protection	lambda-cyhalothrin	

Table 3. The effect of foliar applied fungicides and insecticides on senescence, brown spot and yield. University of Minnesota – Southwest Research and Outreach Center, Lamberton, MN. (2006) B. D. Potter

Treatment	Soybean aphid Aphids/ plant *	Canopy Defoliation %	Septoria Brown spot Severity 1-5 scale	Yield Bushels/ acre @ 13%
	8/11/2006 R7	9/14/2006 R7	9/14/2006 R7	10/3/2006 R8
1 check	77.3 ab	82.5 a	4.0 a	53.6 a
2 Domark 7.2 lb ai/a	108.4 a	75.0 a	3.8 a	51.4 a
3 Orthene 97 0.73 lb ai/a	72.5 ab	75.0 a	3.3 abc	55.4 a
4 Domark 7.2 lb ai/a Orthene 97 0.73 lb ai/a	28.7 bc	50.0 b	3.3 abc	55.0 a
5 Domark 7.2 lb ai/a Orthene 97 0.73 lb ai/a Quadris 0.065 lb ai/a	60.1 ab	55.0 b	2.9 bcd	56.5 a
6 Domark 7.2 lb ai/a Quadris 0.065 lb ai/a	74.5 ab	50.0 b	3.5 ab	54.8 a
7 Headine 0.098 lb ai/a Warrior 0.0156 lb ai/a NIS 0.25 % v/v	14.7 c	40.0 b	2.3 d	54.4 a
8 Quadris 0.0975 lb ai/a Warrior 0.0156 lb ai/a NIS 0.25 % v/v	13.4 c	40.0 b	2.5 cd	51.5 a
LSD (P=.05)	56.4	17.5	0.7	n.s.
CV	68.2	20.3	15.9	5.7
Grand Mean	56.2	58.4	3.2	54.0
Prob(F)	0.0013	0.0001	0.0009	0.2950
* mean separations based on log transformed data				
Means followed by same letter do not significantly differ (P=.05, Duncan's New MRT)				