



College of Food, Agricultural
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2006- Foliar fungicide effects on soybean aphid populations, soybean disease, senescence and yield.

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Summary

Several foliar fungicides and fungicide tank mixes were applied to soybean alone and sequentially to soybean. The following fungicide treatments were compared to an untreated control, an insecticide treated low aphid treatment and among themselves: 1) untreated, 2) Headline + Folicur (Headline SBR) @ R2 and R4, 3) Quilt @ R2 and R4, 4) Stratego @ R2 and R4, 5) Headline SBR @ R2 and R4 followed by Bravo @R5, 6) Warrior @ R2 and R4, 7) Headline @ R2, and 8) Cabrio @R2. No yield differences were observed. All fungicides reduced the severity of Brown spot and delayed senescence. The insecticide treatment accumulated fewer aphid days than other treatments. A Sequential application of Headline SBR, Headline SBR and Bravo accumulated more aphid days than all other treatments with the exception of a sequential Quilt application. There is some evidence that this higher cumulative aphid day (CAD) was related to delayed senescence. However, based on CADs a yield response to aphids was not expected. No yield differences were observed.

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. In addition, interest in the use of foliar fungicides to control leaf diseases other than soybean rust has been expressed.

Entomopathogenic fungi can be a significant source of mortality for soybean aphid. The fungicides which will be used for soybean rust suppression and perhaps more typically, prophylactic applications for plant health, have been shown to have a suppressive effect on several entomopathogenic fungi. Therefore, it is possible that fungicide applications to soybean could exacerbate soybean aphid populations. This trial was implemented to examine the effect of fungicide applications on soybean aphid populations.

Objective

This trial was designed to examine the effect of foliar applied fungicides on: 1) soybean aphid populations, 2) entomopathogenic fungi, 3) soybean disease incidence and severity under SW MN conditions 4) plant health and 5) yield. Objective 2 will be reported on elsewhere. Objectives 3-5 are secondary in importance but data was taken with the expectation that they may help more fully explain aphid populations.

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*), 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 lesser levels included Cercospora blight (*Cercospora kikuchii*) and downy mildew (*Peronospora manshurica*). Brown stem rot (*Phialophora gregata*) was rated at 50% incidence and higher in other experiments in the same field.

Soybean aphid populations were low to moderate in this trial with populations peaking in mid –August or later.

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 chemical 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 fungicide treatments. 8003 XR flat fan nozzles on 18-inch spacing were operated at 20 PSI and 20 GPA spray volume. On July 11, at the late R2 to early R3 (early pod set) soybean growth stage, fungicide and insecticide applications were made to rows 2 through 5 leaving a 2 row untreated border between individual plots for driving and minimization of drift. Sequential applications were made on July 27th to R4

stage soybeans. On August 15, a Bravo was applied to R5 stage soybeans using a C02 backpack sprayer.

Soybean aphid populations were assessed weekly based on examinations of 5 random plants /plot. Brown spot was estimated by a visual rating of lower canopy in five locations in each plot on September 5, and again 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 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. The percentage of plants showing symptoms of stem disease (incidence) was assessed based on ten randomly selected plants/plot (5 plants /plot at the 9/28/06 observation).

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 trial
Insect control:	Part of trial

Table 2. Treatment application information

	A	B	C
Date:	7/11/2006	7/27/2006	8/15/2006
Wind:	1.8mph	1.6 mph	4 mph
Temperature:	75 F	91 F	56F
Relative humidity %	75	66	
Crop stage:	V10/R2	R4	R5
Crop height:	23"	36"	40"
Volume:	20 GPA	20GPA	20GPA
Pressure:	40PSI	40PSI	38PSI
Nozzle:	8003XR	8003XR	8002XR
Nozzle spacing:	18"	18"	18"
Boom height:	18 inches above canopy		
A & B -Compressed air offset boom sprayer (R &D sprayers modified)			
C- CO2 Backpack sprayer (R &D sprayers modified)			

Results and discussion

Aphids were assumed to be controlled well in advance of yield loss where insecticide was applied. Bean leaf beetle, grasshopper and other pest insect populations remained low. Weed control was also acceptable.

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 although phytotoxicity from Folicur has been reported by others.

Soybean yields and plant health and disease assessment are shown in Table 3.

No yield differences were observed.

Septoria was pronounced in this trial. All treatments containing fungicide(s) had lower brown spot scores than the untreated and insecticide treated plots. The untreated control had greater defoliation than all other treatments including insecticide alone. This indicates that insects may have contributed to early senescence. A fungal epizootic was not observed. Soybean aphid populations were higher in several of the fungicide treatments. Headline SBR, Headline SBR, Bravo plots had greater CAD than all other treatments (Table 3, Table 4). However, when CADs were compared to degree of late season senescence, it appears that late season aphid populations were partially related to leaf retention (Table 3, Figure 5).

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
Bravo Weather stick® Syngenta Crop Protection	chlorothalonil	
Cabrio® BASF Corporation	pyraclostrobin	triazole
Folicur® Bayer CropScience	tebuconazole	triazole
Headline® BASF Corporation	pyraclostrobin	strobilurin
Prowl® H2O BASF Corporation	pendimethalin	
Quilt™, Syngenta Crop Protection, Inc.	azoxystrobin+propiconazole	strobilurin+triazole
Stratego® Bayer CropScience	trifloxystrobin + propiconazole	strobilurin + triazole
Touchdown Total® Syngenta Crop Protection	glyphosate	
Warrior® Syngenta Crop Protection	lambda-cyhalothrin	

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

Rating Unit Rating Date Trt-Eval Interval Treatment Product	SBA/PL 7/19/2006 8 DA-A V10/R3	SBA/PL 7/26/2006 15 DA-A /R4	SBA/PL 8/4/2006 24 DA-A V14/R4	SBA/PL 8/10/2006 30 DA-A V15/R5	SBA/PL 8/17/2006 37 DA-A R5	SBA/PL 8/21/2006 41 DA-A R5	SBA/PL 8/29/2006 49 DA-A R6	SBA/PL 9/4/2006 55 DA-A R6	SBA/PL 9/13/2006 64 DA-A R6-7	Cumulative Aphid days 7/10-9/13	Sept 1-5 9/13/2006 55 DA-A R6-7	%defolia 9/13/2006 55 DA-A R6-7	Yield 10/3/2006 @13% R8		
1 Untreated control	12 abc	47.6 a	23.9 ab	22.2 a	56.6 a	83.4 a	107.9 ab	40.7 b	0.2 c	2776.6 b	4 a	60 a	52.63 a		
2 Headline Folicur Headline Folicur	4.71 fl oz/a 3.16 fl oz/a 4.71 fl oz/a 3.16 fl oz/a	R2 R2 R4 R4	10.3 abc	27.2 a	19.7 ab	22.9 a	80.3 a	116.9 a	63.6 c	33.2 b	1.9 ab	2393.3 b	2 b	25 b	54.33 a
3 Quilt COC Quilt COC	14 fl oz/a 1 % v/v 14 fl oz/a 1 % v/v	R2 R2 R4 R4	9.2 abc	41.9 a	39.6 a	37.1 a	110 a	152.9 a	109.8 ab	45.2 b	1.3 bc	3556.3 ab	2.6 b	27.5 b	52.63 a
4 Stratego Stratego	7 fl oz/a 7 fl oz/a	R2 R4	5.8 bc	32.9 a	25.3 ab	26 a	78 a	144.2 a	136.8 ab	44.4 b	2 ab	3341.5 b	2 b	26.3 b	52.8 a
5 Headline Folicur Headline Folicur Bravo	4.71 fl oz/a 3.16 fl oz/a 4.71 fl oz/a 3.16 fl oz/a 2 pt/a	R2 R2 R4 R4 R5	18.3 ab	49.2 a	24.8 ab	37.4 a	66.9 a	116.7 a	180.9 a	262.1 a	8.3 a	4760.2 a	2.3 b	16.3 b	53.75 a
6 Warrior Warrior "Aphid free"	2 fl oz/a 2 fl oz/a	R2 R4	0.3 d	26.2 a	2.7 c	7.6 b	29.1 a	9.9 b	22.4 d	8.8 c	0.1 c	887.7 c	3.8 a	30 b	53.1 a
7 Headline	6.2 fl oz/a	R2	5 c	30.8 a	16.8 b	18.4 a	63.5 a	63.2 a	75.2 bc	68.7 ab	1 bc	2240.7 b	2.8 b	20 b	54.43 a
8 Cabrio	0.505 lb/a	R2	18.2 a	47.1 a	15.4 b	18.2 a	69.3 a	97.8 a	100.7 bc	53.3 b	0.2 c	2866.4 b	2.8 b	20 b	57 a
LSD (P=.05) CV Grand Mean Prob(F) P(Bartlett's X2)	* 40.52 9.86 0.0016 0.003	n.s. 58.61 37.83 0.239	* 15.66 20.99 0.0001 0.76	* 20.46 23.71 0.0058 0.087	* 19.45 69.18 0.0213 0.026	* 10.12 98.09 0.0001 0.643	* 8.58 99.64 0.0001 0.811	* 21.91 69.54 0.0004 0.789	* 80.11 1.84 0.0037 0.0037	1262.25 30.08 2852.82 0.0003 0.135	0.87 21.48 2.77 0.0004 0.753	19.12 46.23 28.13 0.0037 0.795	n.s. 4.23 53.83 0.17 0.767		
Means followed by same letter do not significantly differ (P=.05, Duncan's New MRT) * = Mean separations based on log transformation and not show. Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.															

Figure 2.

