



College of Food, Agricultural
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Foliar fungicide effects on soybean disease suppression, senescence and yield I.

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Summary

Foliar fungicides and mixes of fungicide were applied at 2 timings; singly and sequentially. Crop injury symptoms were not observed with any treatments. The Caramba alone at late R2 had lower yield than Untreated, Headline at late R2, Headline at late R2 followed by Headline + Caramba at R4.5, and Headline plus Folicur at late R2. At R6 the untreated control had greater leaf loss than all treatments except the following late R2 applications: Headline alone, Headline + Folicur and Caramba alone. At R6 the untreated check had greater Septoria (brown spot) severity than all treatments except Caramba alone at late R2. At R7, treatments with Headline and Caramba, combined or sequentially, had the lowest Septoria severity scores. Defoliation was greatest in untreated, Caramba alone and Headline alone treated plots. Brown stem rot, anthracnose, pod and stem blight, Sclerotinia stem rot or charcoal rot treatment differences were not 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. 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.

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) Effect of fungicides 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*), 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 less than rateable 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 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 applications were applied to rows 2 through 5 leaving a 2 row untreated border between individual plots for driving and minimization of drift. Two treatments (5 and 6) received a sequential fungicide application 22 days later to R4.5 stage soybeans.

After two assessments of soybean aphid (*Aphis glycines*) populations, 50 aphids/plant populations were controlled by applying Warrior insecticide at 3.2 fl. oz. /acre to all plots on July 31. Post emerge weed control was also applied as a blanket treatment across all plots.

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). Brown stem rot severity was rated on 9/28/06 on the following 1-5 scale: 1) pith clean, 2) slight discoloration confined to node(s), 3) pith discolored at single node, 4) pith discolored at more than 1 node, 5) pith discolored/chambered most of lower stem. This severity score was taken later than optimum.

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:	July 31, 2006 Warrior 3.2 oz./acre applied before soybean aphid ET

Table 2. Treatment application information

	A	B
Date:	7/11/2006	8/3/2006
Wind:	4 mph	Calm
Temperature:	89 F	69 F
Relative humidity %	56	68 w/dew
Crop stage:	R2/R3	R4.5
Crop height:	24"	38"
Volume:	20 GPA	20GPA
Pressure:	40PSI	40PSI
Nozzle:	8003XR	8003XR
Nozzle spacing:	18"	18"
Boom height:	18 inches above canopy	
Compressed air offset boom sprayer (R &D sprayers modified)		

Results and discussion

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

Plots were examined for crop injury weekly. No visible crop injury was observed with any of the treatments in this trial although phytotoxicity from both Folicur and Caramba has been reported by others.

Soybean yields and plant health and disease assessment are shown in Table 3. The untreated control, Headline followed by Headline + Caramba, Headline + Folicur, yielded higher than the Caramba alone treatment.

Septoria was pronounced in this trial. The Untreated control and Caramba alone treatment had greater disease ratings than other treatments @ R6 stage. BY R7 all R2-3 treatments with Headline alone, the high and low rates of Headline + Caramba, Sequential treatments with Headline followed by Caramba or Headline + Caramba had less disease than the Untreated, R2-3 rates of Caramba alone, and Headline + Folicur combinations. At R6, the untreated, Headline alone, Caramba alone, Headline in combination with Caramba or Folicur and the sequential applications had the least lower canopy defoliation. By late R7 difference followed the same pattern but were no longer significant.

No differences in stem diseases were observed. However, no pod and stem blight was observed in the two Headline + Caramba R2/3 treatments.

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
Headline® BASF Corporation	pyraclostrobin	strobilurin
Caramba ® BASF Corporation	metconazole	triazole
Folicur® Bayer CropScience	tebuconazole	triazole
Warrior® Syngenta Crop Protection	lambda-cyhalothrin	
Touchdown Total ® Syngenta Crop Protection	glyphosate	

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

Treatment	Appl Timing	Canopy Defoliation % 9/5/2006 R6	Canopy Defoliation % 9/14/2006 R7	Septoria Brown spot Severity 1-5 scale 9/5/2006 R6	Septoria Brown spot Severity 1-5 scale 9/14/2006 R7	Brown stem Rot Incidence % plants 9/14/2006 R7	White mold Incidence % plants 9/14/2006 R7	Brown stem Rot Incidence % plants 9/28/2006 R8	Brown stem Rot Severity 1-5 score 9/28/2006 R8	Anthraco- nose Incidence % plants 9/28/2006 R8	Pod & Stem blight Incidence % plants 9/28/2006 R8	Yield Bushels/ acre @ 13% 10/3/2006 R8	
1 UNTREATED CONTROL		10.0 a	55.0 a	2.8 a	3.8 a	45.0 a	0 a	80.0 a	3.4 a	95.0 a	10.0 a	61.1 abc	
2 HEADLINE CARAMBA	4.4 fl oz/a 7.7 fl oz/a	R2-3 R2-3	5.0 c	53.8 a	1.0 c	2.0 d	67.5 a	0 a	65.0 a	2.7 a	85.0 a	0.0 a	59.3 a-d
3 HEADLINE CARAMBA	3.56 fl oz/a 6.1 fl oz/a	R2-3 R2-3	6.3 bc	37.5 a	1.8 bc	2.5 cd	65.0 a	0 a	60.0 a	2.5 a	100.0 a	0.0 a	58.4 bcd
4 HEADLINE NIS	6 fl oz/a 0.25 % v/v	R2-3 R2-3	8.8 ab	55.0 a	1.3 c	2.8 bcd	55.0 a	0 a	60.0 a	1.8 a	80.0 a	5.0 a	57.6 cd
5 HEADLINE NIS CARAMBA	6 fl oz/a 0.25 % v/v 8 fl oz/a	R2-3 R2-3 R4.5	5.0 c	40.0 a	1.8 bc	2.0 d	45.0 a	0 a	50.0 a	1.8 a	90.0 a	15.0 a	58.3 bcd
6 HEADLINE NIS HEADLINE CARAMBA	6 fl oz/a 0.25 % v/v 3.6 fl oz/a 6.1 fl oz/a	R2-3 R2-3 R4.5 R4.5	6.3 bc	35.0 a	1.3 c	2.0 d	45.0 a	0.3 a	45.0 a	1.9 a	80.0 a	15.0 a	62.3 a
7 HEADLINE FOLICUR 3.6 F	4.71 fl oz/a 3.2 fl oz/a	R2-3 R2-3	7.5 abc	38.8 a	1.5 c	3.5 ab	47.5 a	0 a	60.0 a	1.8 a	95.0 a	25.0 a	61.3 ab
8 HEADLINE FOLICUR 3.6 F	3.6 fl oz/a 2.4 fl oz/a	R2-3 R2-3	6.3 bc	37.5 a	1.5 c	3.0 abc	57.5 a	0 a	60.0 a	2.4 a	80.0 a	10.0 a	60.2 a-d
9 CARAMBA	8.2 fl oz/a	R2-3	8.8 ab	57.5 a	2.3 ab	3.8 a	50.0 a	0 a	80.0 a	2.9 a	90.0 a	5.0 a	56.8 d
LSD (P=.05)		2.9	19.44	0.68	0.83	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	3.19	
CV		28.01	29.23	27.84	20.22	28.92	600	32.03	40.3	18.33	163.65	3.68	
Grand Mean		7.08	45.56	1.67	2.81	53.06	0.03	62.22	2.34	88.33	9.44	59.46	
Prob(F)		0.0133	0.0918	0.0005	0.0001	0.2925	0.4613	0.2501	0.2076	0.5631	0.4014	0.0204	
Means followed by same letter do not significantly differ (P=.05, Duncan's New MRT)													
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.													