PROPOSAL TO THE ARKANSAS WHEAT PROMOTION BOARD, 2007-2008

Title: Wheat Disease Management

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Objectives: Characterize the resistance to important diseases in commonly grown varieties and promising replacement varieties.

Determine the economic return of a foliar fungicide application on commonly grown varieties and promising replacement varieties.

Determine the relative efficacy of registered and advanced experimental foliar fungicides on stripe rust and other diseases.

Enhance the timely communication of pertinent information on wheat diseases and their management.

Abstract

Wheat diseases are a major constraint to profitable wheat production in Arkansas. Therefore, producers need to manage disease problems in the most effective and economical way possible. The development of an effective disease management strategy depends on several key components. Management of wheat diseases hinders on how well we understand the varietal resistance along with efficacy of commercially available fungicides. Fields in Arkansas, Chicot, and Lafayette Counties were selected for this research project. Each field location had a collection of 20 commonly grown varieties. At each location, a split plot experimental design with four replications was used to evaluate the resistance characteristic and fungicide response of each variety. Fungicide trials were conducted at multiple locations to evaluate the efficacy of select commercially available and experimental fungicides on stripe rust, leaf rust, and septoria leaf blotch. The results of the Disease Management Plots indicated that varietal resistance for stripe rust is available in a majority of the 20 varieties evaluated but resistance to other diseases like leaf rust and septoria leaf blotch are not as prevalent. The results also showed an addition of a fungicide increased the level of disease suppression and yield even in some of the more resistance varieties. To further understand the importance of fungicide, efficacy trials were conducted in key disease prone areas in the state on commercially available and experimental fungicides. Results showed that a majority of the fungicides utilized in wheat are very effective in managing the economically important diseases in Arkansas if used properly. With the wheat board's support, progress is being achieved in characterizing resistance levels of available varieties and efficacy of fungicides on the economically important wheat diseases. This will enable the development of a more effective and economical disease management strategy for producers.

Introduction

Wheat diseases are a major constraint to profitable wheat production in Arkansas. Growing adapted, high-yielding cultivars with resistance to important diseases and applying foliar fungicides when they are most likely to provide an economic return are the most cost-effective methods for managing diseases and for preventing yield and test weight losses caused by diseases. Arkansas growers can choose from a relatively large number of commercially available varieties. However, the marketing of one wheat genotype under multiple variety names has inflated the number of varieties and caused confusion among growers and researchers. It has been difficult to completely characterize the resistance in this large group of varieties. More detailed information on disease resistance can be generated by focusing on a small set of "recommended" varieties.

Yield and test weight response for applying a foliar fungicide has never been determined for contemporary varieties. Furthermore, the probability of a positive economic return from a fungicide application is higher now than in the past because of the higher price for wheat and some fungicides. Knowing which varieties are most likely to have positive or negative returns for a fungicide application will help growers decide whether to apply a fungicide and improve their profitability. New fungicides and combinations of fungicides have been registered recently for use on wheat. The relative efficacy of these products on stripe rust and other important diseases in Arkansas is largely unknown. Furthermore, differences in formulations, rates, and costs among the products add confusion to fungicide selection. This research will attempt to determine the relative efficacies and economic returns of these products when used against stripe rust and other diseases.

Characterizing Resistance to Foliar Diseases and Fungicide Response of Varieties

Materials and Methods

Fields in Arkansas, Chicot, and Lafayette Counties were selected for this research project. Each field location had a collection of 20 commonly grown varieties. At each location, a split plot experimental design with four replications was used to evaluate the resistance characteristic and fungicide response of each variety. The main plots consisted of the 20 wheat varieties and the subplot consisting of fungicide treatment: Trt 1.) Triazole Fungicide, Trt 2.) Untreated check. Plot dimensions were 5 feet wide (7 rows) by 20 feet long. Wheat was planted with a grain drill at 120 pounds per acre on 7 Nov, 8 Oct, and 25 Oct for Arkansas, Chicot, Lafayette counties, respectively. Weed control and fertility were according to current University of Arkansas recommendations. Each location received adequate rainfall during the growing season. The application of the triazole fungicide was applied at an average GS 9 growth stage, using a CO_2 plot sprayer delivering 10 gpa spray volume.

Plots were visually evaluated for stripe rust, leaf rust, and septoria based on percent leaf area affected in the upper canopy when plants were at Feekes growth stage 11.1. Plots were harvested 29 May, 4 June, and 12 June for Chicot, Lafayette, and Arkansas Counties, respectively, using a Hege 140 plot combine. Grain samples were taken and processed in the lab to obtain moisture, test weight, and plot weight. Yield data was adjusted to 13% grain moisture and analyzed using analysis of variance (SAS Statistical Software, SAS Institute Inc.).

Results and Discussion

Disease development of stripe rust and leaf rust was greatest at the Chicot and Lafayette County locations with only light levels of septoria leaf blotch observed. Leaf rust severity developed earlier in the growing season allowing for a greater level of disease development compared to stripe rust and septoria leaf blotch at Chicot and Lafayette County locations. Leaf rust ranged from 0 % to 48.8% (Tables 1 and 2) across the varieties at the Chicot and Lafayette County locations with stripe rust and septoria leaf blotch severity only ranging from 0 to 7% severity (data not presented). In examining the resistance characteristics among the varieties, Pioneer 26R22, Croplan Genetics 8302, and Terral TV8558 varieties had the highest level of Leaf Rust at both locations indicating their susceptibility to the disease compared to the other varieties in the untreated plots. Although other varieties like Pioneer 26R87, Dixie 989, and AGS 2050 had similar levels of disease, there were inconsistencies observed in the disease levels between the two locations. This is one reason it is important to evaluate varieties at multiple locations across multiple years under moderate to severe disease pressure in order to determine their level of resistance to the economically important diseases.

Differences in disease control between the treated and untreated plots among varieties ranged from 2 to 39.3% and 2.3 to 24.5% at the Lafayette and Chicot County locations, respectively. This is another potential indicator of the level of disease resistance of the 20 varieties evaluated. There were large numerical difference observed among the fungicide treatments and the untreated within many of the varieties in disease control even though not all were significant (Tables 1 and 2). This may be contributed to the high level of variability observed in some of the varieties. Yields ranged from 62.7 to 94.3 bu/ac at Chicot County (Table 1) and 62.1 to 94.0 bu/acre at Lafayette County (Table 2). Like with yield, there were some variations among the varieties and fungicide treatments regarding test weight. Test weight ranged anywhere from 52.2 to 60.6 lbs/bu at both locations. The top yielding variety in the untreated was Pioneer 26R15 with the lowest yield variety being Pioneer 26R22 at both locations (Tables 1 and 2). The varieties with the highest test weights recorded were Pioneer 26R87 and Coker 9553. Similar results were observed in the fungicide treated plots. In evaluating the yield response from the treated and untreated plots with each variety, the application of a fungicide to control Leaf Rust along with other diseases significantly increased yields in some of the varieties (Tables 1 and 2). The yield response ranged from 0 to 16.7 bu/ac.

For the Arkansas County location, septoria leaf blotch was the only important disease observed with disease severity ranging from 3.3 % to 63.7 % across the varieties (Table 3). Like the other two locations, septoria leaf blotch also developed late in the year in Arkansas County. However, the growth stage of the wheat at this location was 2 weeks later providing a great opportunity to evaluate the impact of septoria leaf blotch in the absence of leaf rust and stripe rust. Most of the 20 varieties evaluated showed a slight to moderate susceptibility to septoria leaf blotch. Hornbeck 3266, Terrral LA 841, Coker 9553, Croplan Genetics 554w, and Pioneer 26R22 had the highest level of disease with Pioneer 26R15 and Delta King 7710 having the lowest level of disease in the untreated plots (Table 3).

With little fungicide information available on fungicide response on septoria leaf blotch in Arkansas, the Arkansas County location proved to be very informative. Differences in disease control between the treated and untreated plots among varieties ranged from 2.6 to 28.7%, however not all responses were significant. Yields and test weights ranged from 82.5 to 106.4 bu/ac and 49.2 to 59.2 lbs/bushel, respectively (Table 3). The top yielding variety in the untreated was Dixie 989 with the lowest yield variety being Beretta (Table 3). The varieties with the highest test weights recorded were Beretta and Pioneer 26R87. In evaluating the yield response from the treated and untreated plots with

each variety, the application of a fungicide to control septoria leaf blotch significantly increased yields in a few of the varieties (Table 3). The yield response ranged from 0.9 to 15.6 bu/ac. Varieties with the highest numerical yield response were Beretta and Croplan Genetics 554w.

The overall results of the Disease Management Plots showed that disease resistance varied for leaf rust and septoria leaf blotch among the 20 commonly grown varieties. Like with variation in disease resistance, fungicide response also varied among the 20 varieties. There is a need to evaluate the varieties over multiple years and location to ensure the validity of the results observed. Results from the Disease Management Plots at multiple locations over multiple years will be used to develop the most effective control recommendations for disease management in Arkansas.

Determining the Relative Efficacy of Fungicides

Materials and Methods

Chicot County Fungicide Trials

Wheat was drill-seeded at 120 lb/A on 8 Oct 07 in a producer field in the southeast part of Arkansas near Lake Village. The cultivar was Hornbeck 3266, currently rated as susceptible to stripe rust, the most important foliar disease on wheat in Arkansas in recent years. Plots received 58 lb/A N (as urea) on 28 Feb and 58 lb/A N (as urea) on 14 Mar. Fungicide treatments consisted of various fungicides and fungicide combinations commercially available along with a few select experimental fungicides that may become registered in Arkansas. Fungicides were applied 24 Mar when plants were at Feekes growth stage 8-9 and when plants were at Feekes growth stage 10.5 on 31 Mar, using a self-propelled CO_2 plot sprayer delivering 10 gpa spray volume. Treatments were applied using a randomized complete block design with 3 replications. Plots were visually evaluated for stripe rust and other diseases based on percent leaf area affected in the upper canopy (10 DAA) on 3 Apr and when plants were at Feekes growth stage 11.1 on 16 Apr. Plots were harvested 29 May using a Hege 140 plot combine equipped with the HarvestMaster 1000 GrainGage measurement system. Yield data was adjusted to 13% grain moisture and analyzed using analysis of variance (ARM software, Gylling Corp).

Lonoke County Fungicide Trials

Wheat was drill-seeded in a producer field in the central part of Arkansas near Lonoke. The cultivar was Delta King 9577, currently rated as moderately resistant to stripe rust, the most important foliar disease on wheat in Arkansas in recent years. Plots were maintained and fertilized according to current University of Arkansas recommendations. Fungicide treatments consisted of various fungicides and fungicide combinations commercially available along with a few select experimental fungicides that may become registered in Arkansas. Fungicides were applied 6 Apr when plants were at Feekes growth stage 8-9 and when plants were at Feekes growth stage 10.5 on 16 Apr, using a CO_2 backpack sprayer delivering 10 gpa spray volume. Treatments were applied using a randomized block design with 4 replications. Plots were visually evaluated for stripe rust, leaf rust, and Septoria Leaf Blotch based on percent leaf area affected in the upper canopy when plants were at Feekes growth stage 11.1 on 5 May. Plots (four center rows) were harvested 13 June using a Yanmar plot research combine. Grain samples were taken and processed in the lab to obtain moisture, test weight, and plot weight. Yield data was adjusted to 13% grain moisture and analyzed using analysis of variance (ARM software, Gylling Corp).

Results and Discussion

Disease at both locations developed late into the growing season. Stripe rust was observed at the Chicot County location and a mixture of stripe rust and septoria leaf blotch was observed at the Lonoke County Location. Stripe rust incidence and % severity on were both significantly reduced in all fungicide treatments when compared to the untreated check at the Chicot Co. location (Data not shown). Unfortunately, differences observed among the treatments in disease control did not translate into significantly higher yields. The lack of differences in yield among the treatments was likely due to the late infection of diseases.

Although disease came in relatively late and at low levels at the Lonoke location, fungicide applications significantly lowered leaf rust, and septoria leaf blotch levels when compared to the untreated check. Fungicides didn't have a significant impact on test weight when compared to the untreated check at this location. Fungicides applications of Experimental 1 (6.5 oz/A), Experimental 2 (4 oz/A), Experimental 3 (14 oz/A), Headline (6 oz/A), and Quilt (10.5 and 12 oz/A) applied at Feekes 8-9 and Experimental 1 (6.5 oz/A) applied at Feekes 10.5 significantly increased yield when compared to the untreated check (Table 4). Other applications followed the same trend but were not significant when compared to the untreated check. Yield response from controlling the diseases ranged from 5.4 to 15.8 bu/ac. With fungicides plus application costs averaging $12.00/acre and wheat prices averaging $5.00/bu, it would take an estimated 2+ bushels to cover the costs related to managing diseases in wheat. This does not take in account other production expenses.

Enhancing Communication on Diseases and Their Management

The investigators will summarize and interpret these observations for communication to clientele via the Wheat Newsletter. At least one field day will be hosted at each location to convey our findings to local growers, county agents, consultants, and suppliers.

Results of these Disease Management Plots were used to determine the level of varietal resistance available in today's marketplace for the economically important diseases commonly found in Arkansas. The differences observed among the varieties evaluated were included in the 2008 wheat/variety update. Disease updates based on the disease levels observed in the Disease Management Plots were also posted several times in the Arkansas Wheat Newsletter. The Disease management plots also provided an education opportunity to have a wheat field day in Lafayette and Arkansas Counties for producers and wheat board members and an industry field day in Chicot County.

Conclusion

Wheat diseases are a major constraint to profitable wheat production in Arkansas. Therefore, producers need to manage disease problems in the most effective and economical way possible. The development of an effective disease management strategy depends on several key components. Management of wheat diseases hinders on how well we understand the varietal resistance along with efficacy of commercially available fungicides. The first step to this goal of an effective management strategy has been the initiation of the Disease Management Plots in key areas of the state. The Disease Management Plots provided the needed information on disease development and varietal resistance in 2007 to begin to ensure the representation of varietal resistance is accurate thus allowing producers to

make best management decision possible. Thus far, the Disease Management Plots have indicated that varietal resistance for stripe rust is available in a majority of the 20 varieties evaluated but resistance to other diseases like leaf rust and septoria leaf blotch are not as prevalent. Another key component of this program was to determine the additive affects of fungicides along with varietal resistance. The addition of a fungicide showed a trend of increased disease suppression and yield response even in more resistance varieties.

The positive effects observed from the Disease Management Plots also showed the importance of fungicides in disease management. Fungicide efficacy trials on commercially available and experimental fungicides showed that a majority of the fungicides utilized in wheat are very effective in managing the economically important diseases in Arkansas if used properly. With the wheat board's support, progress is being achieved in characterizing resistance levels of available varieties and efficacy of fungicides on the economically important wheat diseases. This will enable the development of a more effective and economical disease management strategy for producers.

Table 1. 2008 Disease Management Plot in Lafayette County -- Evaluation of Disease Resistance and Fungicide Response for the 20 Most Widely Grown Wheat Varieties in Arkansas

Lafayette County		% Leaf Rust[b]		Fungicide Response by Variety[c]	Test Weight (lbs/bu)		Fungicide Response by Variety[c]	Yield bu/acre		Fungicide Response by Variety[c]
Variety	Relative[a] Maturity	Treated	Untreated		Treated	Untreated		Treated	Untreated	
Horn Beck 3266	E	0.5	2.8	NS	55.7	55.9	NS	81.1	80.6	NS
Pioneer 26R87	E	0.0	2.0	NS	59.4	59.0	NS	84.7	84.3	NS
Terral LA841	E	0.0	2.3	NS	54.3	54.7	NS	85.3	82.4	NS
AGS 2000	E	2.3	2.0	NS	56.7	56.5	NS	83.1	80.8	NS
AGS 2050	M	1.5	27.3	NS	57.9	56.6	1.3	82.9	76.7	6.2
Coker 9553	M	2.0	22.5	20.5	58.2	56.9	NS	83.9	78.7	NS
Magnolia	M	2.8	14.8	NS	57.3	56.6	NS	77.4	73.2	NS
Croplan Genetics 554w	M	1.0	9.3	NS	53.7	53.1	NS	77.5	67.4	10.1
Croplan Genetics 8302	M	3.3	22.5	19.3	55.6	55.1	NS	84.2	75.7	8.5
Delta Grow 4500	M	2.3	11.5	NS	56.6	56.1	NS	84.5	76.1	8.4
Delta Grow 1600	M	2.8	9.8	NS	54.7	52.2	2.5	82.7	73.1	9.6
Delta King 7710	M	1.8	5.8	NS	56.9	56.2	NS	83.9	79.3	4.6
Pioneer 26R15	M	0.0	1.0	NS	57.6	56.2	NS	94.0	87.5	NS
Pioneer 26R22	M	11.0	48.8	37.8	55.1	55.0	NS	78.8	62.1	16.7
Progeny 166	M	0.0	3.3	NS	55.7	55.8	NS	85.6	82.2	NS
Terral TV8558	M	5.8	45.0	39.3	54.1	53.4	NS	82.6	70.4	12.2
Beretta	L	1.0	3.3	NS	54.6	54.0	NS	87.8	83.3	NS
Armor 5110	L	1.0	4.5	NS	55.6	56.5	NS	82.1	80.8	NS
Dixie 989	L	4.0	20.5	NS	54.6	52.7	1.9	82.9	72.6	10.3
Pat	L	3.3	8.8	5.5	57.2	55.5	NS	78.1	71.7	NS
LSD (P=0.05)		**2.9**	**12.7**		**1.6**	**1.6**		**6.5**	**6.4**	

[a] Relative Maturity: E = Early, M= Medium, and L=Late and is based on average heading date of variety.
[b] % leaf Rust **=** percent leaf area affected of the top 3 leaves of the canopy.
[c]Represents fungicide response within each variety at P=0.05.

Table 2. 2008 Disease Management Plot in Chicot County -- Evaluation of Disease Resistance and Fungicide Response for the 20 Most Widely Grown Wheat Varieties in Arkansas

Chicot County		% Leaf Rust[b]		Fungicide Response by Variety[c]	Test Weight		Fungicide Response by Variety[c]	Yield Bu/acre		Fungicide Response by Variety[c]
Variety	Maturity[a]	Treated	Untreated		Treated	Untreated		Treated	Untreated	
Horn Beck 3266	E	0	2.3	NS	56.3	57.3	NS	82.3	86.1	3.8
Pioneer 26R87	E	3.3	16.8	NS	59.8	60.2	NS	78.5	76.9	NS
Terral 841	E	0.5	1.5	NS	56.6	56.7	NS	86.6	86.9	NS
AGS 2000	E	1.0	4.0	NS	58.6	58.4	NS	83.0	79.0	NS
AGS 2050	M	1.5	4.5	NS	57.4	57.6	NS	80.4	81.4	NS
Coker 9553	M	2.0	7.8	NS	59.7	60.1	NS	79.9	77.3	NS
Magnolia	M	2.0	9.0	7	59.8	60.6	NS	82.6	80.9	NS
Croplan Genetics 554w	M	2.0	14.8	NS	58	57.9	NS	73.6	65.2	NS
Croplan Genetics 8302	M	4.5	29.0	NS	58.5	59.0	NS	75.1	73.6	NS
Delta Grow 4500	M	4.5	9.8	NS	56.6	58.2	NS	82.3	82.4	NS
Delta Grow 1600	M	1.5	5.8	4.3	57.1	56.3	NS	76.4	77	NS
Delta King 7710	M	4.5	16.8	NS	58.7	59	NS	71.6	72.3	NS
Pioneer 26R15	M	1.5	5.5	NS	57.5	56.8	NS	91.1	90.5	NS
Pioneer 26R22	M	7.8	29.3	NS	58.8	58.6	NS	68.6	62.7	NS
Progeny 166	M	3.3	15	11.7	58.7	59.1	NS	79.4	82.1	NS
Terral 8558	M	4.5	18.8	14.3	56.6	56.3	NS	94.3	83.9	NS
Beretta	L	2	1.5	NS	58.7	58.3	NS	85.2	86.8	NS
Armor 5110	L	2.8	3.3	NS	58.5	58.6	NS	75.8	73.5	NS
Dixie 989	L	2.0	7.0	5	56.9	56.7	NS	87.3	81.9	NS
Pat	L	2.0	5.8	NS	58.7	59.6	NS	69.4	65.4	4
LSD (P=0.05)		**3.0**	**10.7**		**2.0**	**1.4**		**8.2**	**7.7**	

[a] Relative Maturity: E = Early, M= Medium, and L=Late and is based on average heading date of variety.
[b] % leaf Rust = percent leaf area affected of the top 3 leaves of the canopy.
[c] Represents fungicide response within each variety at P=0.05.

Table 3. 2008 Disease Management Plot in Arkansas County -- Evaluation of Disease Resistance and Fungicide Response for the 20 Most Widely Grown Wheat Varieties in Arkansas

Arkansas County		% Septoria[b]		Fungicide Response by Variety[c]	Test Weight		Fungicide Response by Variety[c]	Yield Bu/acre		Fungicide Response by Variety[c]
Variety	Maturity[a]	Treated	Untreated		Treated	Untreated		Treated	Untreated	
Horn Beck 3266	E	14.7	31.3	16.6	58.4	58.4	NS	95.1	93.2	NS
Pioneer 26R87	E	7	14.8	NS	58.8	58.9	NS	99.8	96.6	NS
Terral 841	E	35	63.7	NS	57	57.1	NS	93.1	86.3	6.8
AGS 2000	E	11.0	18.8	NS	53.8	53.6	NS	91.5	84.9	6.6
AGS 2050	M	7.8	16.8	NS	55.8	56.5	NS	97.1	92.5	NS
Coker 9553	M	11	31.3	20.3	57.9	58.7	NS	100.4	93.3	7.1
Magnolia	M	16.8	40	23.2	59.2	58.6	NS	99.7	96.2	3.5
Croplan Genetics 554w	M	9.0	23.8	NS	54.4	54.1	NS	104.1	93.9	10.2
Croplan Genetics 8302	M	5.7	11	NS	56.7	55.2	NS	99.1	98.2	NS
Delta Grow 4500	M	7.7	16.8	9.1	56.7	56.6	NS	99.1	93.7	NS
Delta Grow 1600	M	7.0	13	NS	53.3	51.8	NS	99.5	97.5	NS
Delta King 7710	M	3.3	7	NS	54.6	56.2	NS	98.8	97.7	NS
Pioneer 26R15	M	3.3	5.8	NS	54.2	54.3	NS	98.5	89.9	NS
Pioneer 26R22	M	11	31.3	20.3	53.5	53.2	NS	97.7	93.1	NS
Progeny 166	M	5.7	9.8	NS	54.6	54.5	NS	99.8	94.8	NS
Terral 8558	M	11	16.8	NS	56.9	55.4	1.5	106.4	99.9	6.5
Beretta	L	5.3	7.8	NS	53.7	49.2	4.5	82.5	98.1	NS
Armor 5110	L	5.8	15.0	9.3	57.4	56.2	NS	102.8	96.4	NS
Dixie 989	L	5.8	11.0	NS	54.4	54.3	NS	103.7	102.6	NS
Pat	L	5.3	11.0	NS	55	55.3	NS	92.9	94.3	NS
LSD (P=0.05)		**7.0**	**10.9**		**2.8**	**2.4**		**8.1**	**8.0**	

[a] Relative Maturity: E = Early, M= Medium, and L=Late and is based on average heading date of variety.
[b] % Septoria = percent leaf area affected of the top 3 leaves of the canopy.
[c] Represents fungicide response within each variety at P=0.05.

Table 4. Fungicide Evaluations for Control of Important Wheat Diseases in Lonoke County, Arkansas

Trt. #	Treatment	Product Rate		Growth Stage	Stripe Rust %LAA[1] (5-5-08)		Septoria %LAA[1] (5-5-08)		Leaf Rust %LAA[1] (5-5-08)		Test Weight Lb/Bu		Yield Bu/A[2]	
1	STRATEGO	7.0	OZ/A	FK's 8-9	1.00	a	1.50	b	7.80	bc	57.88	a	73.78	ab
2	STRATEGO	8.0	OZ/A	FK's 8-9	1.00	a	2.00	b	9.00	b	57.03	a	70.56	ab
3	STRATEGO	10.0	OZ/A	FK's 8-9	0.50	a	1.00	b	5.80	bcd	58.53	a	70.24	ab
4	Experimental 1	6.5	OZ/A	FK's 8-9	1.00	a	2.00	b	5.80	bcd	58.93	a	76.07	a
	INDUCE	0.125	% V/V											
5	Propimax	4.0	OZ/A	FK's 8-9	1.00	a	2.00	b	5.30	bcd	58.55	a	74.09	ab
6	Experimental 2	4.0	OZ/A	FK's 8-9	1.00	a	1.50	b	7.00	bc	59.43	a	75.77	a
7	Experimental 3	14.0	OZ/A	FK's 8-9	0.00	a	2.80	b	7.00	bc	58.80	a	76.43	a
8	Headline	6.0	OZ/A	FK's 8-9	0.50	a	1.50	b	4.50	bcd	59.23	a	79.29	a
9	Quilt	10.5	OZ/A	FK's 8-9	0.50	a	2.00	b	3.30	bcd	58.73	a	77.18	a
10	Quilt	12.0	OZ/A	FK's 8-9	0.50	a	1.50	b	2.00	cd	59.15	a	79.62	a
11	Quilt	14.0	OZ/A	FK's 8-9	1.50	a	3.30	b	3.30	bcd	58.80	a	70.99	ab
12	BAS 556 01	7.0	OZ/A	FK's 8-9	1.50	a	1.00	b	4.50	bcd	59.18	a	78.80	a
13	BAS 556 01	9.0	OZ/A	FK's 8-9	2.80	a	1.00	b	4.50	bcd	59.73	a	80.62	a
14	Experimental 1	6.5	OZ/A	Fk's10.5	0.00	a	3.30	b	0.00	d	59.63	a	76.21	a
	INDUCE	0.125	% V/V											
15	Experimental 2	4.0	OZ/A	Fk's10.5	0.00	a	3.30	b	1.50	cd	58.88	a	70.58	ab
16	Untreated				2.00	a	11.00	a	15.00	a	57.70	a	64.81	b
LSD (P=.05)					1.61		2.66		3.98		1.54		6.33	

Means followed by same letter do not significantly differ (P=.05)

1 %LAA = percent leaf area affected of the top 3 leaves of the canopy.

2 %Incidence = percent plot area affected by stripe rust.