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# Foliar Fungicide Treatments for Control of Diseases of Wheat

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# CONTENTS

	page
Introduction and Methods .....	3
General Results and Interpretation.....	3
Fungicide Tests, 2007-2008 .....	4
Tennessee Valley Research and Extension Center Tests, 2007-2008 .....	4
Prattville Agricultural Research Unit Tests, 2007-2008 .....	6
Gulf Coast Research and Extension Center Tests, 2007-2008 .....	6
Fungicide Tests, 2008-2009 .....	7
Tennessee Valley Research and Extension Center Tests, 2008-2009 .....	7
Prattville Agricultural Research Unit Tests, 2008-2009 .....	8
Gulf Coast Research and Extension Center Tests, 2007-2008 .....	8
Fungicide Tests, 2009-2010 .....	10
Sand Mountain Research and Extension Center Tests, 2009-2010 .....	10
Prattville Agricultural Research Unit Tests, 2009-2010 .....	10
Gulf Coast Research and Extension Center Tests, 2009-2010 .....	12

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# FOLIAR FUNGICIDE TREATMENTS FOR CONTROL OF DISEASES OF WHEAT

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## INTRODUCTION AND METHODS

Winter wheat is grown throughout the state of Alabama, with planting done in fall and harvest in spring. Over the past three years, the value of the crop has ranged from \$17 to \$84.5 million dollars across the state. Wherever wheat is grown, disease problems can limit grain yields, and rust diseases are particularly limiting to yield. While cultivar resistance plays a major role in the amount of disease seen on wheat and on the level of grain loss due to disease, fungicides remain an option for fungal disease control when cultivar resistance to diseases proves inadequate. Consequently, fungicide trials on winter wheat in Alabama were conducted for three growing seasons (2007-2008, 2008-2009, and 2009-2010) to determine the effect of foliar fungicide treatments on winter wheat in different regions of the state. This report summarizes these results.

Tests were conducted in North Alabama at the Tennessee Valley Research and Extension Center near Belle Mina (Limestone Co.), in Central Alabama at the Prattville Agricultural Research Unit (Autauga Co.), in South Alabama at the Gulf Coast Research and Extension Center near Fairhope (Baldwin Co.), and in North Alabama at the Sand Mountain Research and Extension Center in Crossville (DeKalb Co.).

Cultivars included in these tests were Pioneer 26R61, Red Ruby, and AGS 2026; these were used primarily because of seed availability.

Commercially available fungicides were applied at label rates and application timings in all trials. Products and the year and site of evaluations are provided in Table 1. All of these fungicides are systemic; that is, these chemistries are absorbed into plant tissue to some degree and so have some rain resistance and may have kick-back activity.

Generally, standard production practices were followed, with fungicides applied to foliage as noted in each test. Growth stages used for fungicide application timing are referring to the Feekes' scale and are usually limited to GS 8 (flag leaf just visible) and GS 10 (flag leaf whole, sheath swollen by ear) except where delayed due to weather conditions. Each test consisted of a randomized complete block of treatment combinations with four replications. None of the tests were irrigated.

Diseases were rated at each location during the spring of each year and included leaf rust, caused by *Puccinia recondita* (also known as *P. triticina*); stripe rust, caused by *P.*

*striiformis*; Septoria leaf blotch, caused by *Septoria tritici*, and Fusarium head blight (also known as scab).

Diseases were rated on a scale from 0 (no disease) to 10 (leaves are dead apparently to infection or high incidence of affected heads). Disease ratings for leaf rust, stripe rust, and Septoria leaf blotch were made on the flag leaf while scab was rated on incidence across each plot. Diseases were rated prior to the soft dough stage (GS 11.2). Yields for each plot were measured at harvest and 1000 kernel weights were obtained. Data were subjected to analysis of variance, and statistical differences between treatment means were distinguished using Fisher's protected least significant difference using  $P \leq 0.05$ .

## GENERAL RESULTS AND INTERPRETATION

Plant hardiness zones across Alabama vary from zone 7a in the north to 8b in the south. These zones reflect the average minimum temperatures—0 to 5 degrees F for the northern counties in the state to 15 to 20 degrees F for the southernmost counties. Actual temperatures and rainfall amounts recorded for test locations during the wheat growing seasons are presented in tables. In general, temperatures are 5 to 10 degrees (Fahrenheit) cooler in northern counties than in southern counties.

Since the wheat plant is adapted to relatively dry and cool climates, one would expect lower grain yields from trials in southern locations than from trials in northern locations. However, this was not a clear trend in every year of these trials. In 2009, yields in the test at Belle Mina were between 55 and 68 bushels per acre while at Fairhope, yields were closer to 80 bushels per acre. In 2010, yields at all three sites were similar, averaging 67 bushels per acre.

In the three years of tests presented in this report, rust diseases, which are commonly found on winter wheat in Alabama, were more limiting to yield in the south than in the north. Septoria leaf blotch occurrence was lower, as were prevailing temperatures, in 2010 than in the two preceding growing seasons included in the study. In addition, the disease called scab or Fusarium head blight, also affected the wheat crop in North Alabama in two of the past three years. Scab is important not only because of yield decreases it can cause, but also because of mycotoxins that infect the grain with disease.

Rust diseases prevailed in 2008 on Red Ruby; without fungicide treatment, leaf rust intensity developed to high lev-

**Table 1. Fungicide Products Included in Tests with Chemical Name, Percent Active Ingredient and Label Rates of Use on Wheat**

Fungicide	Generic	% Active	Manufacturer	Label rate of product use (per acre)
Folicur 3.6 F	tebuconazole	38.7	Bayer	4 fl oz
Headline	pyraclostrobin	23.6	Bayer	9 to 19 fl oz
Orbit	Propiconazole	41.8	Syngenta	Orbit not labeled for wheat; see Tilt
Proline 480 SC	prothioconazole	41	Bayer	4.3 to 5.0 fl oz for foliar and stem diseases, 5.0 to 5.7 fl oz for suppression of Fusarium head blight
Prosaro	Prothioconazole	19	Bayer	6.5 to 8.2 fl oz
	+ tebuconazole	19		
Punch	carbendazim	11.8	Dupont	Discontinued
	+flusilazole	23.6		
Quilt	propiconazole	11.7	Syngenta	7 to 14 fl. oz
	+ azoxystrobin	7		
Quilt Xcel	Azoxystrobin	13.5	Syngenta	10.5-14 fl oz
	+ propiconazole	11.7		
Stratego	propiconazole	11.4	Bayer	10 fl oz
	+ trifloxystrobin	11.4		
Stratego YLD	Prothioconazole	10.8	Bayer	Not currently labeled for wheat
	+ trifloxystrobin	32.3		
Tilt	propiconazole	41.8	Syngenta	4 fl oz
Topguard	flutriafol	11.8	Chemnova	Not currently labeled for wheat
Twinline	pyraclostrobin	12	BASF	7 to 9 fl oz, twice
	+ metaconazole	7.4		

els throughout the state. Prevailing weather played an important role in the occurrence of rust diseases and the intensity to which they develop. Most of the fungicides tested provided some decrease in rust levels and improved 1000 kernel weight. The best treatments included two applications of a Topguard formulation or Stratego.

In 2009, leaf rust developed to moderate levels in South Alabama while Septoria leaf blotch intensity occurred at moderate and moderately high levels in Central and North Alabama, respectively. Scab, or Fusarium head blight, was also seen in North Alabama. Most of the fungicide treatments provided some reduction in disease levels in Central and South Alabama. However, yield quantity and, even more so, yield quality (1000 kernel weight) were improved with fungicide treatment in North and South Alabama. Where included, treatments with Proline at Feekes' stage 8, Twinline or Stratego, provided the greatest yield increase.

In 2010, Septoria leaf blotch was seen throughout the state at low to moderate intensity. Fusarium head blight was observed only in North Alabama where this disease occurred at moderate-to-low levels. Disease levels were reduced slightly in North Alabama with fungicide, but this trend was not seen in Central and South Alabama, probably because disease levels stayed low even on nontreated plots. Yield and 1000 kernel weight were improved slightly with most fungicide treatments in North and Central Alabama.

Fungicide application costs start at \$15 per acre, which includes product plus equipment costs. With wheat prices hovering above \$5 per bushel, fungicide application is justified if it increases yield by 3 bushels per acre bump in yield. Most of the fungicide treatments evaluated in these tests did provide

such a yield increase, especially when any of the diseases were observed at moderate or greater intensities. Grade may also be improved with fungicide use.

### FUNGICIDE TESTS, 2007-2008

All tests were planted with Red Ruby and conventional tillage practices were used. No tests were irrigated. Each test consisted of a randomized complete block of foliar treatments replicated four times. Additional details on agronomic practices can be found in Table 2.

Tennessee Valley had fairly dry conditions early in the season during seedling growth; otherwise rainfall was plentiful at all test locations in the 2007 to 2008 wheat growing season. Temperatures at Prattville and in Fairhope (Gulf Coast) were similar during these months. Weather observations can be found in Table 3.

#### Tennessee Valley Research and Extension Center Tests, 2007-2008

Leaf rust developed to moderately high levels on nontreated control plots; no other diseases were observed in this test with Red Ruby. All fungicides reduced leaf rust, but only those applied at Feekes' stage 10 provided a significant reduction in disease at the last rating date. Yield quantity was good (overall average was 77 bushels per acre) and was similar to that of other varieties grown in other tests at this location. While yield quantity was unaffected by fungicide treatment, test weight (1000 kernel weight.) was significantly improved by all treatments. See Table 4.

**Table 2. Agronomic Practices Followed in Fungicide Tests, 2007-2008**

Location	Tennessee Valley REC Belle Mina	Prattville Agricultural Research Unit, Prattville	Gulf Coast REC Fairhope
Planting date	11/2/2007	11/8/2007	12/3/2007
Seeding rate	90 lb/A	120 lb/A	120 lb/A
Preceding crop	corn	Summer fallow	Summer fallow
Row width	7 inches	7 inches	7 inches
Soil analysis	P - high K - high	P - medium K - high	P - medium K - medium
Soil pH	6.0	6.0	5.9
Soil organic matter	< 1%	< 1%	< 1%
Starter fertilizer	20 lbs N/A (34-0-0) 11/19/07	20 lbs N/A (34-0-0) 11/8/07 Sulfur(20-100-60-10S), 10/9/07	363 lb/A (5-27-16) + 10 lb/A
Post-plant fertilizer	80 lbs N/A (34-0-0) 2/19/08	60 lbs N/A (34-0-0) 2/15/08	235 lb/A Ammonium Sulfate and Urea (80-0-0), 2/11/08
Plot size:	treated 10 x 20 ft harvested 5 x 20 ft	treated 5 x 20 ft harvested 5 x 20 ft	treated 10 x 15 ft harvested 5 x 15 ft
Insecticide application	Mustang Max (2.5 oz/A) 5/23/08	none	none
Application of experimental products			
Feekes' stage 8	3/31/08	3/29/08	
Feekes' stage 9			4/9/08*
Feekes' stage 10	4/18/08	4/7/08	
Feekes' stage 10.2			4/16/08*
Harvest date	6/9/08	6/9/08	6/2/08

\*Request for application at FS 8; due to weather conditions, these applications were delayed.

**Table 3. Weather Observations in Alabama, December 2007–May 2008**

	—Tennessee Valley—			—Prattville—			—Gulf Coast—		
	Average Daily Temp (F)		Total Rainfall	Average Daily Temp (F)		Total Rainfall	Average Daily Temp (F)		Total Rainfall
	Min	Max	in.	Min	Max	in.	Min	Max	in.
December	36.9	58.1	1.25	63.8	42.9	2.68	68.4	48.7	5.39
January	26.7	48.5	1.79	56.3	33.8	3.55	59.4	39.4	7.15
February	32.3	55.2	5.15	64.1	37.4	4.34	67.3	43.1	5.06
March	40.0	63.3	3.47	71.3	44	5.54	70.7	48.4	4.26
April	48.9	41.1	3.62	76.9	54.9	5.02	76.8	57.5	4.72
May	57.3	78.4	4.04	85.1	63	4.35	83.5	66.5	8.79

**Table 4. Tennessee Valley Research and Extension Center Tests, Belle Mina, Limestone County, 2007-2008**

Foliar treatment <i>fl. oz./A</i>	Application stage	—Leaf Rust <sup>1</sup> —			Bushels per acre	1000 Kernel wt. (g)
		April 30	May 7	May 13		
Nontreated control		0.45 ab <sup>2</sup>	2.55 ab	6.05 a	71.51 a	32.06 e
Tilt 3.6 EC (4)	8 <sup>3</sup>	0.55 a	2.90 a	5.73 ab	74.80 a	33.65 d
Stratego 250EC (10)	8	0.28 abc	2.10 a-d	5.24 ab	77.07 a	33.93 cd
Headline (9)	8	0.38 ab	1.88 a-e	5.18 ab	77.71 a	34.39 a-d
Topguard 1.04 SC (14)	8	0.53 a	1.90 a-e	5.38 ab	77.60 a	33.78 cd
Punch 3.3 EC (4)	8	0.43 ab	2.28 abc	5.45 ab	76.45 a	34.39 a-d
Topguard 1.04 SC (14)	10	0.15 c	1.75 b-e	4.56 bc	77.53 a	35.36 a
Topguard 1.04 SC (7) FB <sup>4</sup>	8 FB	0.38 ab	2.11 a-e	5.05 ab	76.71 a	34.23 bcd
Topguard 1.04 SC (7)	10					
Topguard 1.04 SC (10)	8 FB	0.18 bc	1.43 cde	4.40 bc	79.05 a	34.87 abc
FB Topguard 1.04 SC (10)	10					
Topguard 1.04 SC (14)	8 FB	0.08 c	1.20 de	3.56 cd	80.35 a	35.27 ab
FB Topguard 1.04 SC (14)	10					
Punch 3.3 EC (3) FB	8 FB	0.03 c	0.93 e	2.19 d	83.01 a	35.31 ab
Punch 3.3 EC (3)	10					
Stratego 250EC (5) FB	8 FB	0.08 c	0.98 e	3.25 cd	77.13 a	35.35 a
Stratego 250EC (5)	10					
<b>FLSD (P = 0.05)</b>		<b>0.27</b>	<b>1.10</b>	<b>1.39</b>	<b>7.59</b>	<b>1.10</b>

<sup>1</sup> Leaf rust was rated on flag leaves on a scale of 0-10, where 0 = no disease, 5 = moderate disease intensity, and 10 = severe disease or all leaves showing premature senescence due to disease.

<sup>2</sup> Data are averages of four replicated plots. Letters following means, when different, indicate significant differences according to Fisher's Protected Least Significant Difference Test at P = 0.05.

<sup>3</sup> Application stages: Feekes' stage 8 = appearance of flag leaf; stage 10 = sheath of flag leaf completely grown out; ear swollen but not yet visible. <sup>4</sup> FB = followed by.

**Prattville Agricultural Research Unit Tests, 2007-2008**

Leaf rust and stripe rust were observed in this test with Red Ruby. Leaf rust developed to high levels on nontreated control plots while stripe rust remained at low levels. All fungicides reduced disease levels except for Punch at 4 fluid ounces per acre applied at Feekes' stage 8, and most of those disease reductions were statistically significant reductions. Yields of plots in this test were good and were better than those of varieties in other tests at this same location. All fungicide treatments significantly improved yield quantity and most improved yield quality as measured by test weight. See Table 5.

**Gulf Coast Research and Extension Center Tests, 2007-2008**

Leaf rust was the only disease observed in this test with Red Ruby and it developed to high levels on nontreated control plots. All fungicides reduced disease levels and all but one treatment significantly reduced rust in this test. However, yield quantity was not affected by fungicide treatment. In addition, yields (bushels per acre) were very low, averaging about half of wheat varieties in other tests at this location. Yield quality, as 1000 kernel weight, was significantly improved with every fungicide treatment in this test. See Table 6.

**Table 5. Prattville Agricultural Research Unit Tests, Prattville, Autauga County, 2007-2008**

Foliar treatment <i>fl. oz./A</i>	Application stage	—Leaf Rust <sup>1</sup> —		Stripe Rust <sup>1</sup> May 5	Bushels per acre	1000 Kernel wt. (g)
		April 30	May 5			
Nontreated control		2.33 a <sup>2</sup>	6.68 a	1.63 ab	76.91 c	28.01 d
Tilt 3.6 EC (4)	8 <sup>3</sup>	0.83 b	4.50 bc	1.50 ab	98.72 ab	30.27 cd
Topguard 1.04 SC (14)	8	0.55 b	3.55 cd	0.55 b	98.45 ab	32.46 bc
Punch 3.3 EC (4)	8	1.01 ab	5.23 ab	2.15 a	94.34 b	33.53 ab
Topguard 1.04 SC (14)	10	0.33 b	1.78 e	0.05 c	99.68 ab	33.36 ab
Topguard 1.04 SC (7) FB <sup>4</sup>	8 FB	0.13 b	1.90 e	0.20 c	104.19 ab	35.22 ab
Topguard 1.04 SC (7)	10					
Topguard 1.04 SC (10) FB	8 FB	0.20 b	2.27 de	0.13 c	106.65a	33.90 ab
Topguard 1.04 SC (10)	10					
Topguard 1.04 SC (14) FB	8 FB	0.00 b	1.63 e	0.10 c	107.06 a	34.31 ab
Topguard 1.04 SC (14)	10					
Punch 3.3 EC (3) FB	8 FB	0.15 b	0.85 e	0.00 c	101.45 ab	33.79 ab
Punch 3.3 EC (3)	10					
Stratego 250EC (5) FB	8 FB	0.18 b	1.56 e	0.23 c	108.29 a	35.65 a
Stratego 250EC (5)	10					
<b>FLSD (P = 0.05)</b>		<b>1.45</b>	<b>1.54</b>	<b>1.10</b>	<b>11.06</b>	<b>3.00</b>

<sup>1</sup> Rust diseases were rated on flag leaves on a scale of 0-10, where 0 = no disease, 5 = moderate disease intensity, and 10 = severe disease or all leaves showing premature senescence due to disease.

<sup>2</sup> Data are averages of four replicated plots. Letters following means, when different, indicate significant differences according to Fisher's Protected Least Significant Difference Test at P = 0.05.

<sup>3</sup> Application stages: Feekes' stage 8 = appearance of flag leaf; stage 10 = sheath of flag leaf completely grown out; ear swollen but not yet visible. <sup>4</sup> FB = followed by.

**Table 6. Gulf Coast Research and Extension Center Tests, Fairhope, Baldwin County, 2007-2008**

Foliar treatment <i>fl. oz./A</i>	Application stage	—Leaf Rust <sup>1</sup> —		Bushels per acre	1000 Kernel wt. (g)
		April 18	April 23		
Nontreated control		2.43 a <sup>2</sup>	6.98 a	15.25 a	32.06 e
Tilt 3.6 EC (4)	8 <sup>3</sup>	0.65 d	0.53 f	25.14 a	33.65 d
Stratego 250EC (10)	8	1.00 bcd	2.76 cde	28.13 a	33.93 cd
Headline (9)	8	1.85 abc	3.75 cd	19.68 a	34.39 a-d
Topguard 1.04 SC (14)	8	0.50 d	0.80 f	25.13 a	33.78 cd
Punch 3.3 EC (4)	8	0.70 d	1.08 e	21.45 a	34.39 a-d
Topguard 1.04 SC (14)	10	2.70 a	4.13 bc	19.75 a	35.36 a
Topguard 1.04 SC (7) FB <sup>4</sup>	8 FB	0.75 cd	0.68 f	22.84 a	34.23 bcd
Topguard 1.04 SC (10)	10				
Topguard 1.04 SC (10) FB	8 FB	0.98 cd	0.28 f	27.52 a	34.87 abc
Topguard 1.04 SC (7)	10				
Topguard 1.04 SC (14) FB	8 FB	2.60 a	5.55 ab	23.25 a	35.27 ab
Punch 3.3 EC (3)	10				
Punch 3.3 EC (3) FB	8 FB	1.00 bcd	0.65 f	24.16 a	35.31 ab
Topguard 1.04 SC (14)	10				
Stratego 250EC (5) FB	8 FB	0.87 cd	1.20 ef	27.18 a	35.35 a
Stratego 250EC (5)	10				
<b>FLSD (P = 0.05)</b>		<b>1.11</b>	<b>1.72</b>	<b>5.39</b>	<b>1.10</b>

<sup>1</sup> Leaf rust was rated on flag leaves on a scale of 0-10, where 0 = no disease, 5 = moderate disease intensity, and 10 = severe disease or all leaves showing premature senescence due to disease.

<sup>2</sup> Data are averages of four replicated plots. Letters following means, when different, indicate significant differences according to Fisher's Protected Least Significant Difference Test at P = 0.05.

<sup>3</sup> Application stages: Feekes' stage 8 = appearance of flag leaf; stage 10 = sheath of flag leaf completely grown out; ear swollen but not yet visible. <sup>4</sup> FB = followed by.

**FUNGICIDE TESTS, 2008-2009**

All tests were planted to Pioneer 26R61 and conventional tillage practices were used. No tests were irrigated and no insecticide applications were needed. Each test consisted of a randomized complete block of foliar treatments replicated four times. See Table 7.

Rainfall was plentiful at all test locations during the 2008-2009 wheat growing season. Temperatures in April and May, at Prattville and at Belle Mina (Tennessee Valley), were cooler than 30-year normal temperatures, while at Fairhope, temperatures were warmer than normal. See Table 8.

**Tennessee Valley Research and Extension Center Tests, 2008-2009**

Septoria leaf blotch and Fusarium head blight (scab) were the only diseases noted in tests on Pioneer 26R61 at Belle Mina in 2009. Leaf blotch was observed at high levels on all plots, regardless of fungicide treatment. Scab levels were moderate throughout the test. Yield quantities were improved slightly with all treatments compared to the nontreated control; however, only Proline applied at Feekes' stage 8 and Twinline applied at Feekes' stage 10 significantly improved yield. Yield quality, in terms of 1000 kernel weight, was improved by most fungicide treatments compared to the nontreated control. Significant

**Table 7. Agronomic Practices Followed in Fungicide Tests, 2008-2009**

Location	Tennessee Valley REC Belle Mina	Prattville Agricultural Research Unit, Prattville	Gulf Coast REC Fairhope
Planting date	11/4/08	11/10/08	11/21/08
Seeding rate	90 lb/A	120 lb/A	120 lb/A
Preceding crop	corn	Summer fallow	Summer fallow
Row width	7 inches	7 inches	7 inches
Soil analysis	P - high K - high	P - medium K - high	P - medium K - medium
Soil pH	6.0	6.0	5.9
Soil organic matter	< 1%	< 1%	< 1%
Starter fertilizer	200 lbs/A (0-20-20) 10/22/08; 20 lbs N/A (34-0-0) 11/5/08 363 lb/A (5-27-26) + 10 lb/A Sulfur (20-100-60-10S), 9/19/08		20 lbs N/A (34-0-0) 11/14/08
Post-plant fertilizer Urea (80-0-0), 2/9/09	80 lbs N/A (34-0-0) 2/13/09	60 lbs N/A (34-0-0) 2/24/09	235 lb/A Ammonium Sulfate and
Plot size	treated 10 x 20 ft harvested 5 x 20 ft	treated 5 x 20 ft harvested 5 x 20 ft	treated 10 x 15 ft harvested 5 x 15 ft
Application of experimental products			
Feekes' stage 8	3/30/09	3/30/09	
Feekes' stage 10	4/10/09	4/9/09	3/30/09*
Feekes' stage 10.5			4/3/09* (actually FS 10.3)
Harvest date	6/10/09	6/8/09	5/20/09

\*Treatment planned for Feekes' stage 8 , but delayed due to weather conditions.

**Table 8. Weather Observations in Alabama, December 2008 –May 2009**

	—Tennessee Valley—			—Prattville—			—Gulf Coast—		
	Average Daily Temp (F)		Total Rainfall <i>in.</i>	Average Daily Temp (F)		Total Rainfall <i>in.</i>	Average Daily Temp (F)		Total Rainfall <i>in.</i>
	Min	Max		Min	Max		Min	Max	
December	53.7	33.3	9.95	62.7	42	4.48	66.7	47.1	2.89
January	48.8	27.6	3.54	59.8	35.8	2.16	63.8	41	2.03
February	56.7	31.1	2.59	64.1	35.8	4.82	66.3	41.7	4.57
March	63.7	43	5.02	71.2	48.8	9.38	73.8	52.4	12.35
April	70.1	47.8	4.94	75.8	52.2	3.65	75.5	56.5	1.99
May	76.8	61.2	9.53	82.5	66.3	10.6	82	67	2.72

improvement in 1000 kernel weight was seen with Twinline (applied at Feekes' stage 8 or 10), Topguard at 14 fluid ounces applied at Feekes' stage 8 or at 10 fluid ounces applied Feekes' stage 10, and Tilt at 4 fluid ounces applied at Feekes' stage 10. See Table 9.

#### Prattville Agricultural Research Unit Tests, 2008-2009

Septoria leaf blotch was the only disease observed at the Prattville location, and the disease developed to moderately low levels on the nontreated control plots. While most fungicides provided a slight reduction in leaf blotch levels, only Twinline (applied at Feekes' stage 8 or 10), and Topguard at 7 fluid ounces, Tilt and Stratego applied at Feekes' stage 10 provided statistically significant reductions in disease levels compared to the nontreated control. Yield quantity was excellent, averaging 96 bushels per acre across all plots and this quantity was greater than yields of other varieties in other tests at this location. No differences were observed in yield quality as measured by 1000 kernel weights. See Table 10.

#### Gulf Coast Research and Extension Center Tests, 2008-2009

Leaf rust and Septoria leaf blotch were both observed in this test and each of these diseases developed to moderate levels on nontreated plots. Most of the tested products reduced leaf rust, but only Tilt at Feekes' stage 8, Twinline at Feekes' stage 8 or 10, Folicur at Feekes' stage 8 or 10, Topguard at 14 fluid ounces at Feekes' stage 10, Stratego at Feekes' stage 10 significantly reduced leaf rust compared to the control. Almost all tested products provided significant reductions in Septoria leaf blotch compared to the nontreated control plots. Yield quantities were good, averaging 78 bushels per acre across all plots. Most of these fungicide treatments provided a slight increase in yield quantity, but only Twinline applied at Feekes' stage 8 significantly improved yield compared to the nontreated control plots. Yield quality as measured by 1000 kernel weight was significantly improved by almost all fungicide treatments. See Table 11.

**Table 9. Tennessee Valley Research and Extension Center Tests, Belle Mina, Limestone County, 2008-2009**

Foliar treatment <i>fl. oz./A</i>	Application stage	—Septoria Leaf Blotch <sup>1</sup> —			Scab <sup>2</sup>	Bushels per acre	1000 Kernel wt. (g)
		May 20	May 26				
Nontreated control		3.12 b-e <sup>3</sup>	5.80 ab	2.38 a	59.12 bc	41.92 de	
Tilt 3.6 EC (4)	8 <sup>4</sup>	3.36 a-d	6.22 a	2.25 a	63.32 abc	42.64 b-e	
Stratego 250EC (10)	8	3.90 a	6.49 a	1.88 a	60.08 abc	42.78 b-e	
Headline (9)	8	2.97 cde	5.75 ab	2.13 a	63.48 abc	42.80 b-e	
Twinline (11)	8	3.33 abc	5.73 ab	1.75 a	62.20 abc	44.17 a	
Folicur 3.6F (4)	8	3.85 ab	5.98 a	3.00 a	57.52 c	42.52 b-e	
Proline 480 (5)	8	2.98 cde	5.98 a	2.75 a	66.33 a	42.41 cde	
Topguard 1.04 SC (7)	8	3.70 abc	5.98 a	2.25 a	62.81 abc	41.69 e	
Topguard 1.04 SC (10)	8	3.63 abc	6.38 a	2.00 a	63.13 abc	42.79 b-e	
Topguard 1.04 SC (14)	8	3.18 a-e	5.83 ab	2.88 a	62.93 abc	42.87 bcd	
Topguard 1.04 SC (7)	10	3.52 a-d	5.80 ab	1.63 a	62.50 abc	42.74 b-e	
Topguard 1.04 SC (10)	10	2.85 def	5.78 ab	1.25 a	62.09 abc	43.59 ab	
Topguard 1.04 SC (14)	10	3.19 a-e	5.67 ab	2.63 a	62.23 abc	42.61 b-e	
Tilt 3.6 EC (4)	10	2.20 f	5.00 b	2.00 a	62.45 abc	43.25 abc	
Stratego 250EC (10)	10	2.52 ef	6.35 a	2.25 a	61.69 abc	42.79 b-e	
Twinline (11)	10	0.98 g	3.63 c	1.75 a	66.45 a	44.13 a	
Proline 480 SC (5)	10	3.40 a-d	6.48 a	3.25 a	65.14 ab	42.41 cde	
Topguard 1.04 SC (7) FB <sup>5</sup>	8 FB	3.38 ad	5.68 ab	1.75 a	60.46 abc	42.57 b-e	
Topguard 1.04 SC (7)	10						
<b>FLSD (P = 0.05)</b>		<b>0.73</b>	<b>0.94</b>	<b>1.36</b>	<b>6.60</b>	<b>1.17</b>	

<sup>1</sup> Septoria leaf blotch was rated on flag leaves on a scale of 0-10, where 0 = no disease, 5 = moderate disease intensity, and 10 = severe disease or all leaves showing premature senescence due to disease.

<sup>2</sup> Scab or Fusarium head blight was rated on a scale of 0 to 5, where 0 = no disease and 5 = 90 to 100% of plants in plots showing symptoms of scab.

<sup>3</sup> Data are averages of four replicated plots. Letters following means, when different, indicate significant differences according to Fisher's Protected Least Significant Difference Test at P = 0.05.

<sup>4</sup> Application stages: Feekes' stage 8 = appearance of flag leaf; stage 10 = sheath of flag leaf completely grown out; ear swollen but not yet visible.

<sup>5</sup> FB = followed by.



**Table 10. Prattville Agricultural Research Unit Tests, Prattville, Autauga County, 2008-2009**

Foliar treatment <i>fl. oz./A</i>	Appl. stage	Septoria Leaf		1000 Kernel wt. (g)
		Blotch <sup>1</sup> May 12	Bushels per acre	
Nontreated control		2.43 a <sup>2</sup>	97.45 ab	45.34 a
Stratego 250EC (10)	8 <sup>3</sup>	1.89 ab	97.45 ab	44.03 a
Twinline (11)	8	1.12 c	95.80 ab	44.01 a
Topguard 1.04 SC (7)	8	2.50 a	96.01 ab	45.86 a
Topguard 1.04 SC (10)	8	2.00 ab	91.45 b	44.18 a
Topguard 1.04 SC (14)	8	2.13 ab	94.97 ab	44.83 a
Topguard 1.04 SC (7)	10	1.40 b	92.49 b	45.02 a
Topguard 1.04 SC (10)	10	1.69 ab	98.28 ab	45.66 a
Topguard 1.04 SC (14)	10	1.81 abc	97.04 ab	45.36 a
Tilt 3.6 EC (4)	10	1.40 bc	92.28 b	44.76 a
Stratego 250EC (10)	10	0.89 c	102.42 a	44.89 a
Twinline (11)	10	1.38 bc	99.32 ab	46.04 a
<b>FLSD (P = 0.05)</b>		<b>0.99</b>	<b>8.68</b>	<b>1.82</b>

<sup>1</sup> Septoria leaf blotch was rated on flag leaves on a scale of 0-10, where 0 = no disease, 5 = moderate disease intensity, and 10 = severe disease or all leaves showing premature senescence due to disease.

<sup>2</sup> Data are averages of four replicated plots. Letters following means, when different, indicate significant differences according to Fisher's Protected Least Significant Difference Test at P = 0.05.

<sup>3</sup> Application stages: Feekes' stage 8 = appearance of flag leaf; stage 10 = sheath of flag leaf completely grown out; ear swollen but not yet visible.

**Table 11. Gulf Coast Research and Extension Center Tests, Fairhope, Baldwin County, 2008-2009**

Foliar treatment <i>fl. oz./A</i>	Application stage	—Leaf Rust <sup>1</sup> —		Septoria	Bushels per acre	Septoria
		April 28	May 4	Leaf Blotch <sup>1</sup> May 4		1000 Kernel wt. (g)
Nontreated control		3.25 a <sup>2</sup>	2.79 abc	2.98 a	73.87 b	43.49 d
Tilt 3.6 EC (4)	8 <sup>3</sup>	0.45 fgh	1.45 fgh	1.66 b-f	79.64 ab	45.64 bc
Stratego 250EC (10)	8	1.53 cde	1.85 b-f	2.03 bcd	80.66 ab	46.06 abc
Headline (9)	8	0.65 e-h	2.03 a-f	1.65 b-f	78.65 ab	46.53 abc
Twinline (11)	8	0.08 gh	0.43 hi	1.15 efg	81.51 a	47.75 a
Folicur 3.6F (4)	8	0.00 h	1.15 f-i	1.58 c-g	76.85 ab	46.59 abc
Proline 480 (5)	8	0.88 e-h	2.06 a-f	1.72 b-f	80.88 ab	46.69 abc
Topguard 1.04 SC (7)	8	2.58 ab	2.87 ab	2.23 bc	78.08 ab	46.49 abc
Topguard 1.04 SC (10)	8	2.11 bcd	2.65 a-d	2.35 ab	78.77 ab	46.47 abc
Topguard 1.04 SC (14)	8	2.43 abc	2.95 a	1.98 bcd	77.63 ab	46.75 abc
Topguard 1.04 SC (7)	10	1.50 cde	1.93 a-f	1.90 b-e	78.48 ab	46.14 abc
Topguard 1.04 SC (10)	10	0.93 e-h	1.98 a-f	1.60 c-g	78.80 ab	46.18 abc
Topguard 1.04 SC (14)	10	1.05 efg	1.58 d-g	1.58 c-g	74.47 b	46.05 abc
Tilt 3.6 EC (4)	10	0.93 e-h	1.75 c-f	1.14 efg	78.79 ab	45.12 cd
Stratego 250EC (10)	10	0.70 e-h	1.55 efg	1.45 d-g	79.70 ab	47.46 ab
Twinline (11)	10	0.05 h	0.53 ghi	0.90 g	76.14 ab	46.99 abc
Folicur 3.6F (4)	10	0.23 gh	0.13 i	1.20 efg	74.59 ab	46.68 abc
Topguard 1.04 SC (7) FB <sup>4</sup>	8 FB	1.23 def	2.63 a-e	2.05 bcd	77.16ab	47.04 abc
Topguard 1.04 SC (7)	10					
<b>FLSD (P = 0.05)</b>		<b>0.99</b>	<b>1.05</b>	<b>0.73</b>	<b>7.02</b>	<b>1.95</b>

<sup>1</sup> Leaf rust and Septoria leaf blotch were rated on flag leaves on a scale of 0-10, where 0 = no disease, 5 = moderate disease intensity, and 10 = severe disease or all leaves showing premature senescence due to disease.

<sup>2</sup> Data are averages of four replicated plots. Letters following means, when different, indicate significant differences according to Fisher's Protected Least Significant Difference Test at P = 0.05.

<sup>3</sup> Application stages: Feekes' stage 8 = appearance of flag leaf; stage 10 = sheath of flag leaf completely grown out; ear swollen but not yet visible.

<sup>4</sup> FB = followed by.

## FUNGICIDE TESTS 2009-2010

All tests were planted to AGS 2026 and conventional tillage practices were used. No tests were irrigated. Each test consisted of a randomized complete block of foliar treatments replicated four times. See Table 12.

Temperatures at all locations were slightly cooler than 30-year normal temperatures. Rainfall was generally adequate except during April at both the Prattville and Fairhope (Gulf Coast) sites. See Table 13.

### Sand Mountain Research and Extension Center Tests, 2009-2010

Septoria leaf blotch and Fusarium head blight (scab) developed to moderate levels in plots on AGS 2026. All of the fungicide products tested reduced leaf blotch, but only formulations of Quilt and two applications of 7 fluid ounces of Topguard provided significant reductions in this disease compared to the nontreated control plots. Most of these products also reduced scab, but none provided a statistical reduction compared

to the nontreated plots. Yield quantities were slightly greater from fungicide treated plots compared to the nontreated plots, but only Topguard at 14 fluid ounces applied at Feekes' stage 8 significantly improved yield quantity compared to the nontreated control. Yield quality, in terms of 1000 kernel weight, was generally improved with fungicide treatment; however, only Orbit and Twinline applied at Feekes' stage 8, and Prosaro applied at Feekes' stage 10 provided statistical improvements in 1000 kernel weight. See Table 14.

### Prattville Agricultural Research Unit Tests, 2009-2010

Septoria leaf blotch was observed in this test at low levels. None of the tested fungicides significantly reduced leaf blotch compared to the nontreated control. Yields averaged 68 bushels per acre, which was slightly better than yields of wheat in a variety trial at the same location. All of the fungicides tested improved yield quality (1000 kernel weight), but only Stratego YLD applied as Feekes' stage 8, Topguard at 14 fluid ounces applied Feekes' stage 8 or 10 significantly improved quality compared to the nontreated plots. See Table 15.

**Table 12. Agronomic Practices Followed in Fungicide Tests, 2009-2010**

Location	Sand Mountain REC Crossville	Prattville Agricultural Research Unit, Prattville	Gulf Coast REC Fairhope
Planting date	11/9/09	11/16/09	11/19/09
Seeding rate	90 lb/A	90 lb/A	120 lb/A
Preceding crop	soybean	Summer fallow	Summer fallow
Row width	7 inches	7 inches	7 inches
Soil analysis	P - high K - high	P - high K - high	P - medium K - medium
Soil pH	5.9	6.0	5.9
Soil organic matter	< 2%	< 1%	< 1%
Starter fertilizer (20-60-40-10S), 10/1/09	20 lbs N/A 34-0-0, 11/6/09	20 lbs N/A, 11/19/09	210 lb/A 11-28-19 + 10 lb/A Sulfur
Post-plant fertilizer	70 lbs N/A 34-0-0, 3/1/10 225 lb/A 34-0-34 (70-0-0), 2/19/10	70 lbs N/A, 2/28/10	
Plot size	Treated 20 × 20 ft harvested 5 × 20 ft	treated 5 × 20 ft harvested 5 × 20 ft	treated 10 × 15 ft harvested 5 × 15 ft
Insecticide application	Mustang Max 4 oz/A on 3/5 and 3/16/10; Harmony Extra 0.9 oz/A + Aguidex 1 qt/100 gal, Warrior 2.5 fl oz/A on 4/15/10	none	none
Application of experimental products			
Feekes' stage 8	4/9/10	4/12/10	3/31/10
Feekes' stage 10	4/23/10	4/15/10	4/9/10
Harvest date	6/9/10	6/8/10	6/4/10

**Table 13. Weather Observations in Alabama, December 2008–May 2009**

	—Sand Mountain—			—Prattville—			—Gulf Coast—		
	Average Daily Temp (F)		Total Rainfall <i>in.</i>	Average Daily Temp (F)		Total Rainfall <i>in.</i>	Average Daily Temp (F)		Total Rainfall <i>in.</i>
	Min	Max		Min	Max		Min	Max	
December	46.7	30.2	8.13	52.3	34.5	9.16	60.7	42.1	12.26
January	42.5	24.1	4.24	51.1	28.8	5.90	57.1	34.9	5.87
February	42.2	25.6	2.91	50.9	29.6	4.04	55.7	35.6	4.83
March	55.0	36.7	4.85	62.0	40.3	4.14	65.5	45.5	4.76
April	73.1	48.3	4.86	78.0	50.1	1.48	78.5	55.8	1.87
May	78.1	58.3	5.65	84.9	63.2	3.93	85.5	69.2	7.17

**Table 14. Sand Mountain Research and Extension Center Tests, Crossville, DeKalb County, 2009-2010**

Foliar treatment <i>fl. oz./A</i>	Application stage	Septoria Leaf Blotch <sup>1</sup>		Scab <sup>2</sup> May 25	Bushels per acre	1000 Kernel wt. (g)
		May 25	May 25			
Nontreated control		2.40 a <sup>3</sup>	2.50 a	64.31 c	28.14 de	
*Stratego YLD (4)	8 <sup>4</sup>	1.90 abc	1.75 a	70.97 abc	29.16 a-d	
*Prosaro (8.2)	8	1.74 abc	2.00 a	68.69 abc	28.58 cde	
Orbit 3.6EC (4)	8	1.95 abc	2.00 a	64.51 c	29.61 abc	
Quilt (10.5)	8	1.67 bc	1.75 a	73.32 ab	28.56 cde	
Quilt (14)	8	1.67 bc	2.00 a	71.13 abc	29.40 a-d	
Quilt Xcel (10.5)	8	1.58 bc	2.50 a	72.55 abc	28.99 a-d	
Twinline (11)	8	1.78 abc	1.75 a	65.47 bc	30.09 ab	
Topguard 1.04 SC (7)	8	1.93 abc	2.25 a	70.11 abc	28.72 b-e	
Topguard 1.04 SC (10)	8	2.12 ab	2.25 a	65.60 bc	28.77 b-e	
Topguard 1.04 SC (14)	8	1.85 abc	1.50 a	74.37 a	29.11 a-d	
Topguard 1.04 SC (7)	10	1.97 abc	2.50 a	65.80bc	27.55 e	
Topguard 1.04 SC (10)	10	2.11 ab	2.50 a	67.57 abc	28.87 a-e	
Topguard 1.04 SC (14)	10	1.83 abc	1.75 a	71.52 abc	29.18 a-d	
*Stratego YLD (4)	10	1.75 abc	2.50 a	71.96 abc	28.82 b-e	
*Prosaro (8.2)	10	2.10 ab	1.75 a	71.38 abc	30.20 a	
Topguard 1.04 SC (7) FB <sup>5</sup>	8 FB	1.32 c	2.00 a	71.32 abc	28.94 a-d	
Topguard 1.04 SC (7)	10					
**Topguard 1.04 SC (7) FB	8 FB	1.92 abc	2.50 a	66.01 bc	27.52 e	
Topguard 1.04 SC (7)	10					
<b>FLSD (P = 0.05)</b>		<b>0.66</b>	<b>1.03</b>	<b>8.24</b>	<b>1.37</b>	

\* Indicates that treatment included Induce at (0.125% v/v).

\*\*plus Nimble 75% AW/W (0.6 oz).

<sup>1</sup> Septoria leaf blotch was rated on flag leaves on a scale of 0-10, where 0 = no disease, 5 = moderate disease intensity, and 10 = severe disease or all leaves showing premature senescence due to disease.

<sup>2</sup> Scab or Fusarium head blight was rated on a scale of 0 to 10, where 0 = no disease and 10 = 90 to 100% of plants in plots showing symptoms of scab.

<sup>3</sup> Data are averages of four replicated plots. Letters following means, when different, indicate significant differences according to Fisher's Protected Least Significant Difference Test at P = 0.05.

<sup>4</sup> Application stages: Feekes' stage 8 = appearance of flag leaf; stage 10 = sheath of flag leaf completely grown out; ear swollen but not yet visible.

<sup>5</sup> FB = followed by.

**Table 15. Prattville Agricultural Research Unit Tests, Prattville, Autauga County, 2009-2010**

Foliar treatment <i>fl. oz./A</i>	Application stage	Septoria Leaf Blotch <sup>1</sup>		Bushels per acre	1000 Kernel wt. (g)
		April 20	May 10		
Nontreated control		0.08 a <sup>2</sup>	1.15 ab	66.47 a	29.57 d
*Stratego YLD (4)	8 <sup>3</sup>	0.08 a	1.48 a	68.52 a	30.43 a
*Prosaro (8.2)	8	0.13 a	1.15 ab	67.38 a	29.74 bcd
Topguard 1.04 SC (7)	8	0.08 a	0.98 b	67.15 a	29.75 bcd
Topguard 1.04 SC (10)	8	0.10 a	1.35 ab	64.87 a	29.63 cd
Topguard 1.04 SC (14)	8	0.08 a	1.23 ab	66.70 a	30.29 ab
Topguard 1.04 SC (7)	10	0.11 a	1.33 ab	67.95 a	29.65 cd
Topguard 1.04 SC (10)	10	0.13 a	1.18 ab	67.61 a	29.90 a-d
Topguard 1.04 SC (14)	10	0.15 a	1.48 a	69.66 a	30.16 abc
*Stratego YLD (4)	10	0.08 a	1.03 b	71.70 a	29.91 a-d
*Prosaro (8.2)	10	0.08 a	1.18 ab	70.34 a	30.08 a-d
<b>FLSD (P = 0.05)</b>		<b>0.13</b>	<b>0.37</b>	<b>9.30</b>	<b>0.55</b>

\*Indicates that treatment included Induce at (0.125% v/v).

<sup>1</sup> Septoria leaf blotch was rated on flag leaves on a scale of 0-10, where 0 = no disease, 5 = moderate disease intensity, and 10 = severe disease or all leaves showing premature senescence due to disease.

<sup>2</sup> Data are averages of four replicated plots. Letters following means, when different, indicate significant differences according to Fisher's Protected Least Significant Difference Test at P = 0.05.

<sup>3</sup> Application stages: Feekes' stage 8 = appearance of flag leaf; stage 10 = sheath of flag leaf completely grown out; ear swollen but not yet visible.

**Gulf Coast Research and Extension Center Tests, 2009-2010**

The only disease noted on AGS 2026 at this location was Septoria leaf blotch and this disease remained at low levels. Fungicide treatments did not have much of an effect on leaf blotch levels or on yields. Yields averaged 65 bushels per acre,

which was slightly lower than yields observed in variety trials at the same location. Grain weights generally did not show differences due to fungicide treatment; however, Topguard applied twice with Nimble included in the first application, significantly improved 1000 kernel weight compared to that from nontreated control plots. See Table 16.

**Table 16. Gulf Coast Research and Extension Center Tests, Fairhope, Baldwin, County, 2009-2010**

Foliar treatment <i>fl. oz./A</i>	Application stage	Septoria Leaf Blotch <sup>1</sup>		Bushels per acre	1000 Kernel wt. (g)
		April 14	May 19		
Nontreated control		0.18 bc <sup>2</sup>	0.88 a-e	64.26 ab	28.84 bc
*Stratego YLD (4)	8 <sup>3</sup>	0.43 ab	0.79 b-e	66.98 ab	28.05 bc
*Prosaro (8.2)	8	0.65 a	0.72 cde	64.64 ab	28.67 bc
Orbit 3.6EC (4)	8	0.20 bc	0.98 a-e	66.03 ab	28.17 bc
Quilt (10.5)	8	0.28 bc	0.63 de	64.72 ab	28.12 bc
Quilt (14)	8	0.28 bc	0.63 de	66.22 ab	28.51 bc
Quilt Xcel (10.5)	8	0.20 bc	0.67 de	64.06 ab	28.25 bc
Twinline (11)	8	0.10 c	0.68 de	64.87 ab	28.39 bc
Topguard 1.04 SC (7)	8	0.23 bc	0.77 cde	62.44 ab	28.56 bc
Topguard 1.04 SC (10)	8	0.23 bc	0.80 a-e	63.37 ab	28.50 bc
Topguard 1.04 SC (14)	8	0.18 bc	1.17 a	67.18 a	27.89 bc
Topguard 1.04 SC (7)	10	0.18 bc	1.00 a-d	65.25 ab	28.07 bc
Topguard 1.04 SC (10)	10	0.25 bc	0.97 a-e	65.74 ab	28.81 bc
Topguard 1.04 SC (14)	10	0.23 bc	1.07 abc	62.82 ab	29.42 ab
*Stratego YLD (4)	10	0.04 c	0.78 b-e	66.38 ab	28.45 bc
*Prosaro (8.2)	10	0.20 bc	0.61 e	63.15 ab	27.74 c
Topguard 1.04 SC (7) FB <sup>4</sup>	8 FB	0.10 c	1.15 ab	66.93 ab	28.34 bc
Topguard 1.04 SC (7)	10				
**Topguard 1.04 SC (7) FB	8 FB	0.08 c	0.80 a-e	61.08 b	30.61 a
Topguard 1.04 SC (7)	10				
<b>FLSD (P = 0.05)</b>		<b>0.30</b>	<b>0.37</b>	<b>6.04</b>	<b>1.57</b>

\*Indicates that treatment included Induce at (0.125% v/v).

\*\* plus Nimble 75% AW/W (0.6 oz).

<sup>1</sup> Septoria leaf blotch was rated on flag leaves on a scale of 0-10, where 0 = no disease, 5 = moderate disease intensity, and 10 = severe disease or all leaves showing premature senescence due to disease.

<sup>2</sup> Data are averages of four replicated plots. Letters following means, when different, indicate significant differences according to Fisher's Protected Least Significant Difference Test at P = 0.05.

<sup>3</sup> Application stages: Feekes' stage 8 = appearance of flag leaf; stage 10 = sheath of flag leaf completely grown out; ear swollen but not yet visible.

<sup>4</sup> FB = followed by.