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Soybean Foliar Fungicides
Yield Benefit or an Extra Expense?

Economic Return of Strobilurin Fungicide on Soybean
Results of 2006 NY On-Farm Research

Foliar Plant Health Strobilurin Fungicides on Soybean?

- There is limited information on occurrence and severity of foliar soybean diseases in New York State.
- There is periodic occurrence and development of Septoria brown spot and other foliar soybean diseases in NYS such as downy mildew and frogeye leafspot.
- Strobilurin fungicides are protectant only and may serve a limited use against Asian Soybean Rust once rust has been confirmed in an area of the state.
- There is limited economic analysis to show the value of fungicide application as a preventative in either the absence or presence of foliar soybean disease.

The National Scene

- Industry generated data shows yield increase to be common in the absence of disease and is attributed to “plant health” effects of strobilurin fungicides.
- University generated data shows variable results. An economic yield advantage has been seen in approximately 28% of total fungicide research trials, (*Marty Draper, SDSU; Trials in IA, IL, IN, KS, MO, MN, NE, OH, SD, WI).*

Experiment Background Site 1 and 2

- Pioneer 93B36, Round Up Ready Soybeans
- Untreated Check (UTC) vs. Headline vs. Quadris vs. Wheel track only treatments
- Rule of thumb: assumed 3-4 bu/acre yield loss due to equipment traffic (wheel track) during soybean reproductive stages
- Chemical application done with John Deere 4710 at 8 mph; 20 gpa carrier; 35 – 40 psi; TeeJet 60 nozzles; Headline and Quadris each applied at 6 oz/acre
- Chemical application on August 9, 2006 at growth stage R3 (beginning pod)

Site 1

- Soil type: Dunkirk and Odessa silt loams (Odessa somewhat poorly drained); Schoharie silty clay loam; field variability was similar across treatments
- Treatments replicated four times
- Field size 32 acres, 0.9 acre plot size
- Planting date: May 10, 2006
- No till 15 inch row spacing
- Harvest: November 7, 2006
  - John Deere 9560 combine with 25’ flex head
  - Combine yield monitor used to measure yield and calibrated with state certified truck scale

Site 2

- Soil type: Honeoye and Collamer silt loams (Collamer moderately well drained)
- Treatments replicated five times
- Field size 20 acres, 0.5 acre plot size
- Planting date: May 9, 2006
- No till 7 inch row spacing

Site 2 continued

- Harvest: October 30, 2006

- John Deere 9560 combine with 18' flex head
- State certified truck scale used to measure yield

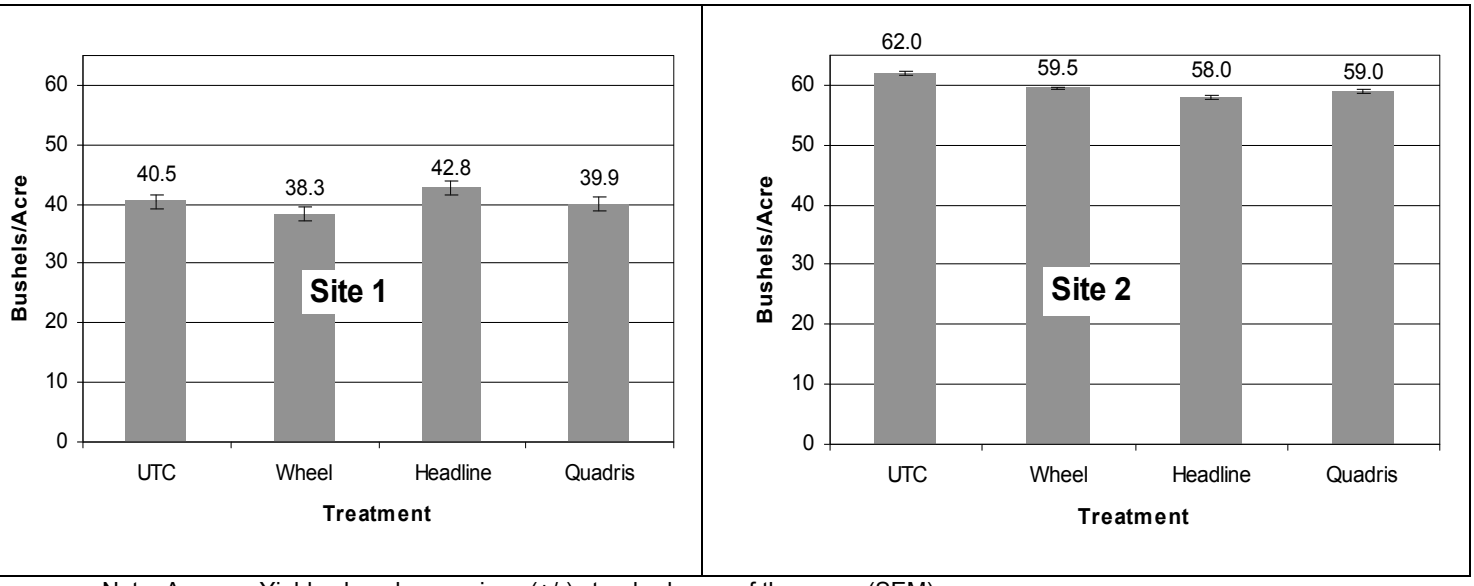
Measurements Taken

- Initial plant stand assessment (plant population)
- Disease assessment included incidence, the percentage of leaflets with any amount of Septoria brown spot and downy mildew, and severity, the percentage of leaf area affected with each disease, and other notable disease presence
    - Assessment prior to fungicide application at growth stage R2 (full flower)
    - Assessment following fungicide application two weeks post spray at growth stage R5 (beginning seed)
- Soybean aphid assessment conducted prior to and after fungicide application
- Final plant stand assessment and pod count
- Yield measured in bushels per acre corrected to 15% moisture
- Visual seed quality analysis
- Partial budget analysis was utilized to calculate the expected change in profit, and gain threshold, the economic breakeven yield that covers increased costs, and the economic viability of fungicide application at R3

Results

- **Initial Plant Population:**
    - Site1: 67,000 plants/acre (population was uniformly low across all plots)
    - Site 2: 141,650 plants/acre
- **Pre-fungicide Disease Assessment:** Septoria brown spot and downy mildew were present but not severe at either site.
    - Average Incidence Site 1: 21% brown spot; 37% downy mildew
    - Average Incidence Site 2: 18% brown spot: 24% downy mildew
- **Post-fungicide Disease Assessment:**
    - Septoria brown spot was not significantly affected by fungicide treatment at either site (average incidence Site 1: 12.4%; Site 2: 17.4%).
    - Downy mildew was not significantly affected by fungicide treatment (average incidence Site 1: 16.3%). At Site 2, significantly less downy mildew was observed in the Quadris treatment (UTC incidence: 9.8%; Quadris incidence: 5.3%).
- **Soybean aphid** populations are often kept in check by insect - killing fungal diseases. Did strobilurin fungicide impact aphid populations?
    - Pre-fungicide: Fewer than 2 aphids/plant; Post-fungicide: 18-29 aphids/plant
    - Populations were well below economic threshold of 250 aphids/plant
    - Changes in aphid numbers could not be attributed to fungicide application
- **Final Plant Stand Assessment and Pod Count:**
    - Site 1: Significantly more plants per acre in the untreated check plots. Headline treatments had significantly more pods per plant than other treatments.
    - Site 2: No significant differences in plant populations. Headline treatments had significantly more pods per plant than other treatments.
- There were no notable seed quality differences among treatments.
- **Yield:**
    - Site 1: There were no statistically significant yield differences among treatments.
    - Site 2: There was a significant yield advantage in the untreated check. There were no significant yield differences among Headline, Quadris, or Wheel track treatments.
    - Disease occurrence could not account for differences in yield.
    - Wheel traffic effects were not as great as the expected 3 to 4 bushels per acre yield loss "rule of thumb" (Sit 1: no statistically significant difference in yield; Site 2: 2.5 bushels/acre less than UTC).

Yield Results



Note: Average Yield value plus or minus (+/-) standard error of the mean (SEM)

The Partial Budget Analysis

- Used to compare a new farm practice with the current practice for economic viability in an average future year
- The following partial budgets examine Headline application or Quadris application versus no strobilurin fungicide application

Partial Budget Components: What to look at

- Items that "Increase Profit" are on the left and items that "Decrease Profit" are on the right
    - Increase in Profit: Items that increase income and items that decrease costs
    - Decrease in Profit: Items that decrease income and items that increase costs
- The difference between "Items that Increase Profit" and "Items that Decrease Profit" is the expected change in profit. A negative number (denoted with parenthesis) or a positive number show the expected dollar affect on potential farm profit.

Partial Budgets:

Site 1 Scenario 1: Headline Fungicide

Items that Increase Profit (A)				**Items that Decrease Profit (B)**	
Increased Income				*Decreased Income*	
	Headline	42.77	bu/ac		
	Check	40.49	bu/ac		
	Difference	2.27	bu/ac		
Expected Market Price	$6.00/bu	$13.62			
	Subtotal	$13.62		Subtotal	$0
Decreased Costs				*Increased Costs*	
				Headline cost/ac	$11.52
				Application cost/ac	$5.25
	Subtotal	$0		Subtotal	$16.77
	Total (A)	$13.62		**Total (B)**	$16.77
			Expected Change in Profit (A-B)		($3.15)

Partial Budgets continued:

Site 1 Scenario 2: Quadris Fungicide

Items that Increase Profit (A)		**Items that Decrease Profit (B)**		
Increased Income		*Decreased Income*		
		Check	40.49	bu/ac
		Quadris	39.88	bu/ac
		Difference	0.62	bu/ac
		Expected Market Price		
		$6.00/bu	$3.72	
Subtotal	$0	Subtotal	$3.72	
Decreased Costs		*Increased Costs*		
		Quadris cost/ac	$12.06	
		Application cost/ac	$5.25	
Subtotal	$0	Subtotal	$17.31	
Total (A)	$0	**Total (B)**	$21.03	
	Expected Change in Profit (A-B)		($21.03)	

Site 2 Scenario 1: Headline Fungicide

Items that Increase Profit (A)		**Items that Decrease Profit (B)**		
Increased Income		*Decreased Income*		
		Check	62.00	bu/ac
		Headline	58.01	bu/ac
		Difference	3.99	bu/ac
		Expected Market Price		
		$6.00/bu	$23.94	
Subtotal	$0	Subtotal	$23.94	
Decreased Costs		*Increased Costs*		
		Headline cost/ac	$11.52	
		Application cost/ac	$8.75	
Subtotal	$0	Subtotal	$20.27	
Total (A)	$0	**Total (B)**	$44.21	
	Expected Change in Profit (A-B)		($44.21)	

Site 2 Scenario 2: Quadris Fungicide

Items that Increase Profit (A)		**Items that Decrease Profit (B)**		
Increased Income		*Decreased Income*		
		Check	62.00	bu/ac
		Quadris	58.97	bu/ac
		Difference	3.03	bu/ac
		Expected Market Price		
		$6.00/bu	$18.18	
Subtotal	$0	Subtotal	$18.18	
Decreased Costs		*Increased Costs*		
		Quadris cost/ac	$12.06	
		Application cost/ac	$8.75	
Subtotal	$0	Subtotal	$20.81	
Total (A)	$0	**Total (B)**	$38.99	
	Expected Change in Profit (A-B)		($38.99)	

What If?

- Site 1: A gain threshold for Headline (2.8 bu/acre) and Quadris (2.9 bu/acre) is needed to cover increased costs and break even. ***What if*** the grain price goes up?

The table below shows expected gain thresholds needed at Site 1 with varying grain price

Research Site	Price per bushel	Average Gain Threshold (bu/acre)
Site 1	$6.00	2.85
	$8.50	2.00
	$10.00	1.70
	$11.50	1.50

- Site 2: Yield was lost when Headline (4 bu/acre) and Quadris (3 bu/acre) were applied. There was a statistically significant increase in yield in the untreated check. ***What if*** the grain price goes up? No rise in grain price can pay back for a yield depression.
- ***What If*** application equipment is owned vs. hired: Ownership and hire account for the difference in application costs between Site 1 and Site 2. Ownership reduces the gain threshold by approximately 0.6 bu/acre, or $3.50 at $6.00 per bushel soybeans.
- Are there Opportunity Costs? Can the farmer's time be better spent on another job at the farm operation? Does the timeliness of this new practice interfere with other current farming practices?

Project Conclusions

- Based on this one year study in 2006, in which May, June, and July were slightly above average in temperature and June and July were above average for precipitation, there is no economic yield advantage to applying strobilurin foliar fungicides to soybean in the absence of significant disease pressure.
- While the Headline treatment showed a yield increase above other treatments at Site 1, the increase was not statistically significant, meaning all treatments yielded the same. This yield does not exceed the gain threshold.
- Grain price will influence the gain threshold. Significant yield depression cannot be compensated for with elevated grain price.
- Use a partial budget analysis to evaluate new farming techniques or practices.
- Producers should be encouraged to always leave an untreated test strip when a new practice, such as fungicide application, is implemented on their farm so that they are able to determine the value of the new practice under their own farm conditions.
- Further studies looking at a range of soybean varieties in more locations will further enhance the validity of these results. Environmental influences, including temperature and rainfall, can greatly affect disease pressure and overall plant health.

A special note of thanks to our farm cooperators located in the Finger Lakes region of New York State. We are grateful for their dedicated commitment to the project and their willingness to make and keep the project a priority during critical times of the growing and harvest seasons.

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For a copy of the detailed report including all graphs and charts please contact either Mike Dennis, CCE Seneca County, 308 Main St Shop Center, Waterloo, NY 13165, (315) 539-9251 or Julianne Dennis, NYS IPM Program, 1581 Rte 88 North, Newark, NY 14513 (315) 331-8415.