Early and late fungicide applications in corn: What have we learned?

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Fungicide world is changing!

- More fungicides on market now
  - 17 tested in 2013!
- Changing trade names but ingredients stay the same
  - Different rates
- Repackaging products
  - Similar to herbicide market
- No longer a simple product decision

Fungicide questions abound…

- QoI (strobilurin), triazole, and now SDHI fungicides promoted heavily in corn
  - V4-V6 applications in corn new emphasis
- Targeting physiological benefits for yield enhancement
- Where and when will fungicide increase yield?

Fungicide applications to corn

- Compiled regional corn fungicide data over several years
- Compare observations of early (V4-V6) applications to standard VT-R2 applications
- Usually calculate a break-even response based on application costs and average market price of corn for each year

Break-even scenarios for corn

Corn price ($/bu)	Application cost ($/A)				
	$20	**$24**	**$28**	**$32**	**$36**
$3.00	6.7	8.0	9.3	10.7	12.0
$4.00	5.0	6.0	7.0	8.0	9.0
$5.00	4.0	4.8	5.6	6.4	7.2
$6.00	3.3	4.0	4.7	5.3	6.0
$7.00	2.9	3.4	4.0	4.6	5.1
$8.00	2.5	3.0	3.5	4.0	4.5
$9.00	2.2	2.7	3.1	3.6	4.0
$10.00	2.0	2.4	2.8	3.2	3.6

2010 Regional Response of Early Fungicide Applications to Corn

Growth stage of application	Number of comparisons	Mean yield response in bu/A (compared to untreated control)
V6	22	3.4
R1	102	5.8
R2	15	3.2
V6+R1	21	7.4

Data contributed by IA, IL, IN, KS, MD, MN, MS, ND, OH, SD, WI
Data summarized by Greg Shaner and Kiersten Wise

2011 Regional Response of Early Fungicide Applications to Corn

Growth stage of application	Number of comparisons	Yield response (bu/A)
V5-V6	25	2.1
VT-R1	17	0.4
V6 + R1	15	4.5

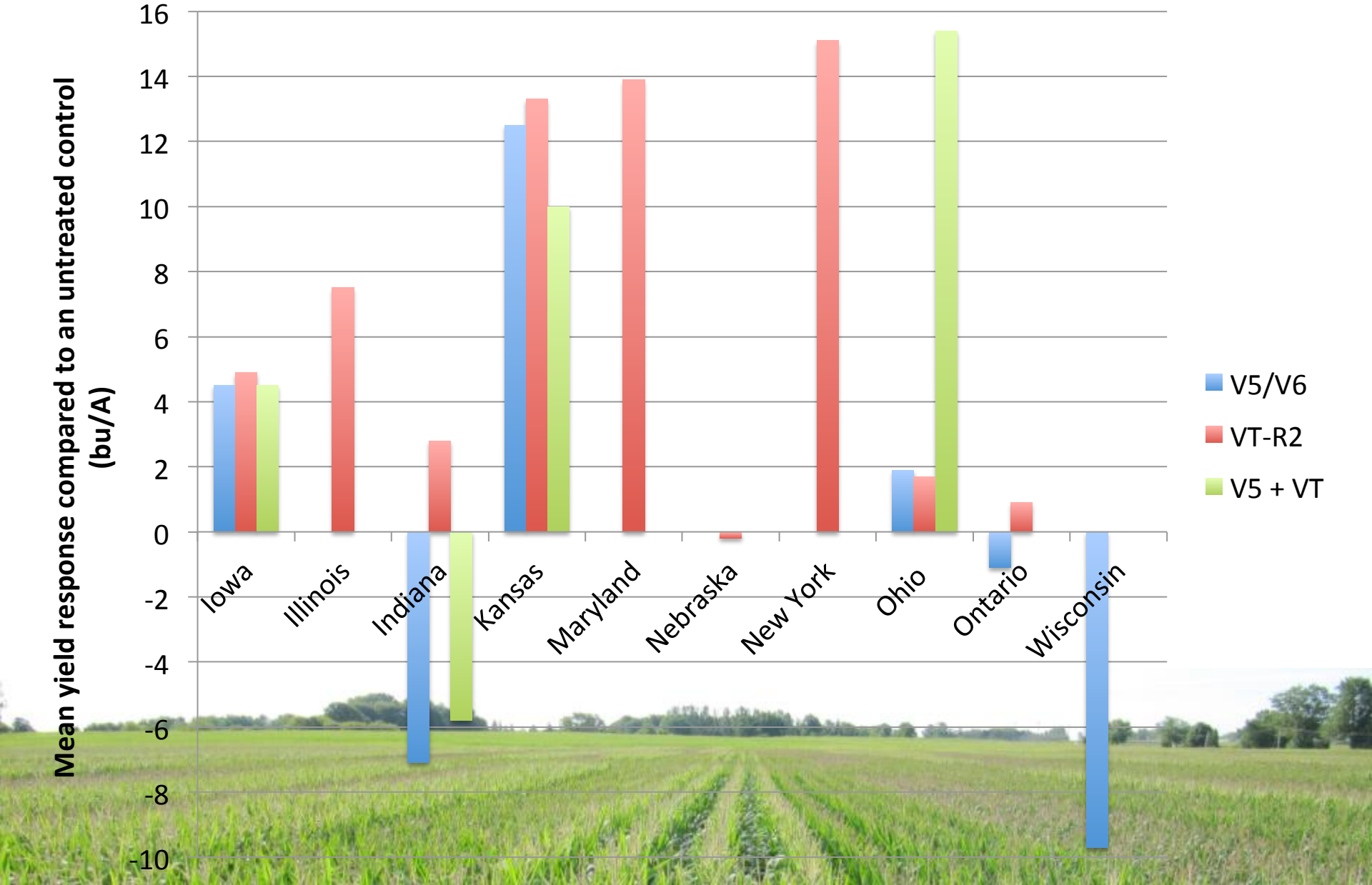
Data contributed by IN, MD, ND, WI
Data summarized by Greg Shaner and Kiersten Wise

2012 Regional Corn Fungicide Summary
Data from 10 states and Ontario, Canada

Timing of application	# of fungicides tested	# of observations	Mean yield response compared to non-treated control (bu/A)*
V5/V6	10	65	-1.1
VT-R2	14	243	4.9
V5 + VT/R1	7	35	3.0

*Mean calculated over all fungicides compared in individual state trials

Effect of fungicide applications on yield by location 2012

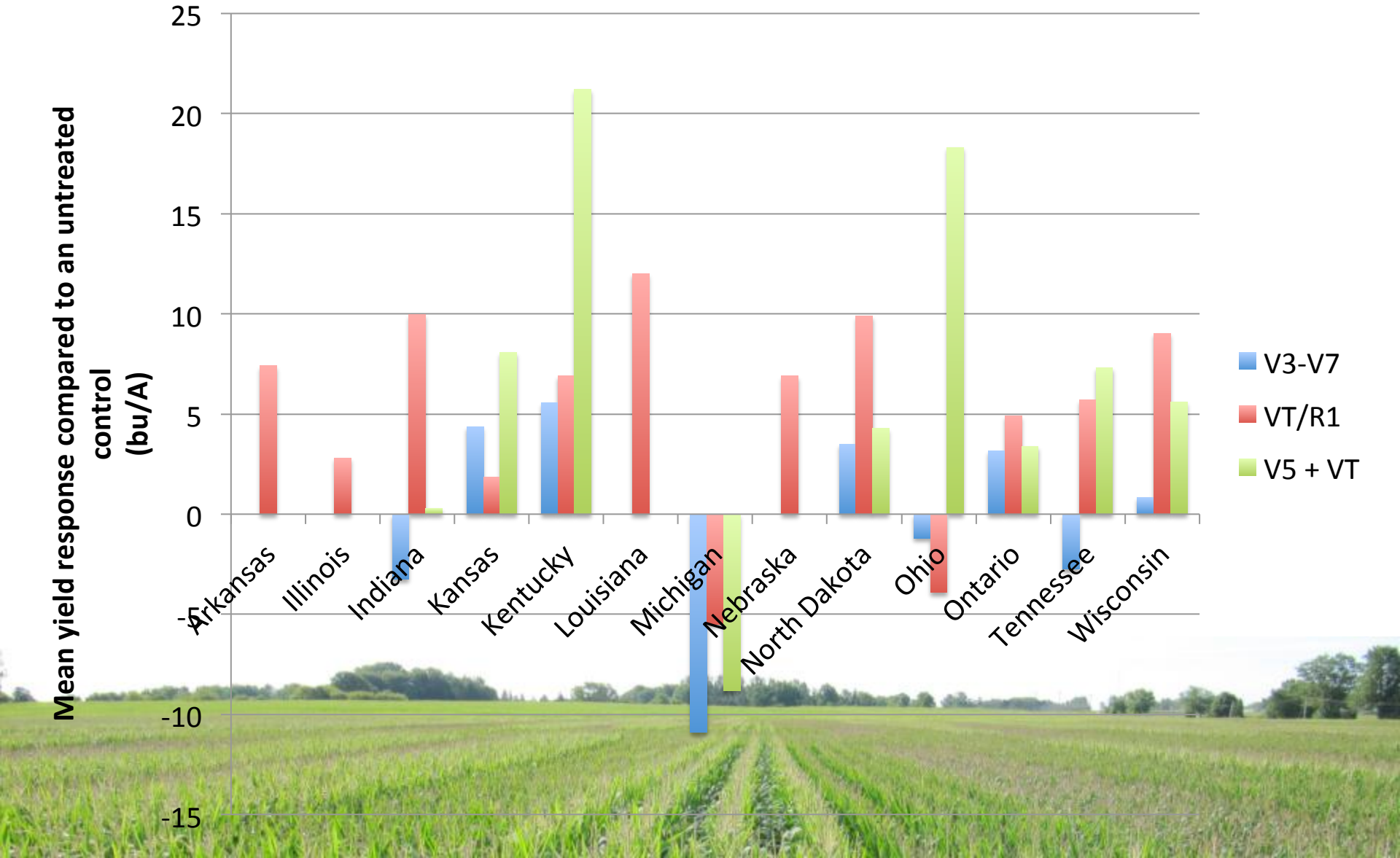


2013 Regional Corn Fungicide Summary
Data from 13 states and Ontario, Canada

Timing of application	# of fungicides tested	# of observations	Mean yield response compared to non-treated control (bu/A)*
V3-V7	17	97	0.1
VT/R1	14	286	4.5
V5 + VT/R1	11	42	3.7

*Mean calculated over all fungicides compared in individual state trials

Effect of fungicide applications on yield by location 2013



Mean yield response compared to non-treated control in bu/A over time

	2010 N = 160	2011 N = 57	2012 N = 343	2013 N = 425
V5	3.4	2.1	-1.1	0.1
VT-R2	4.5	0.4	4.9	4.5
V5 + VT/R1	7.4	4.5	3.0	3.7

Corn fungicide conclusions

- Variability in data sets and fields:
  - Some environment related, but yearly variability exists

- Continue to see best economic response from fungicides when used in response to disease pressure
  - VT application

What about influence of final disease levels?

- Compared 2013 VT/R1 observations of states that submitted rating data
  - Across all fungicides

- Less than 5% disease rated on non-treated control:

  +4.28 bu/A

- More than 5% disease rated on non-treated control:

  +6.15 bu/A

Step-by-step decision process: Stack the deck for a positive response

- Pre-season factors to consider

- Fields with these production practices are more likely to respond to a fungicide application:
  - Hybrids susceptible to foliar disease
  - Continuous corn
  - No-till or reduced tillage systems
  - Irrigation

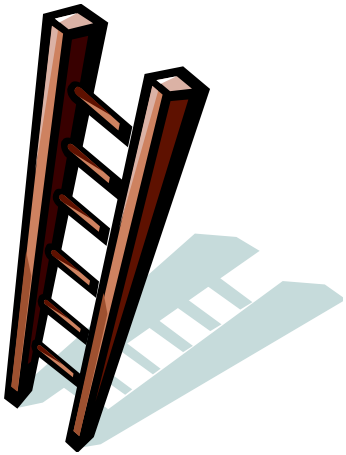
Step-by-step decision process: Stack the deck for a positive response

- In-season factors to consider

- Fields experiencing these conditions are more likely to respond to a VT/R1 application:
  - Late-planted corn
  - Weather conditions are favorable for disease development just prior to tassel, and through pollination

How do we get a more consistent yield benefit from a fungicide?

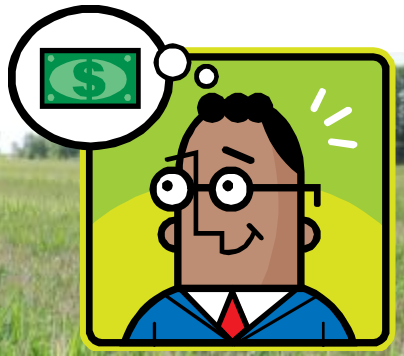
- University trials indicate fungicides are most profitable in corn when a combination of factors are present:
  - Hybrids susceptible to foliar disease
  - Continuous corn
  - No-till or reduced tillage systems
  - Late-planted corn
  - Irrigation
  - Weather conditions are favorable for disease development
  - Disease develops



Preparation is profitable

- Selecting fungicides based on field history, hybrid, and potential for disease development will increase the likelihood of a positive response from a fungicide application

- Fungicides do vary in ability to control disease
  - Check CDWG Fungicide Efficacy table for recommendations
  - www.ag.purdue.edu/agcomm/Pages/EducationStore.aspx



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BP-160-W

DISEASES OF CORN

Fungicide Efficacy for Control of Corn Diseases

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The Corn Disease Working Group (CDWG) developed ratings for how well several fungicides control major corn diseases in the United States. The CDWG determined the efficacy ratings for each fungicide by field-testing the materials over multiple years and locations. Each rating is based on the product's level of disease control and does not necessarily reflect yield increases obtained from applying the product.

A product's efficacy depends on proper application timing, rate, and application method as determined by the product label and overall level of disease in the field. Members of the CDWG determined differences in efficacy among each fungicide product by directly comparing products in field tests using a single application of the labeled rate.

The table includes the most widely marketed products available — it is not intended to be a list of all labeled products. Additional fungicides labeled for use on corn include contact fungicides such as chlorothalonil; other fungicides may be

ear rot. Applying Proline 480SC® for ear rots requires a FIFRA Section 2(ee) and is only approved for use in Illinois, Indiana, Iowa, Louisiana, Maryland, Michigan, Mississippi, North Dakota, Ohio, Pennsylvania, and Virginia.

Many products have specific use restrictions. Restrictions may be present on the amount of active ingredient that can be applied within a period of time or on the number of sequential applications that can occur. Read and follow all use restrictions before applying any fungicide.

This information is provided only as a guide. It is the applicator's legal responsibility to read and follow all current label directions. Reference in this publication to any specific commercial product, process, or service, or the use of any trade, firm, or corporation name is for general informational purposes only and does not constitute an endorsement, recommendation, or certification of any kind by Purdue Extension or the CDWG. Individuals using such products assume

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Fungicide Efficacy for Control of Corn Diseases

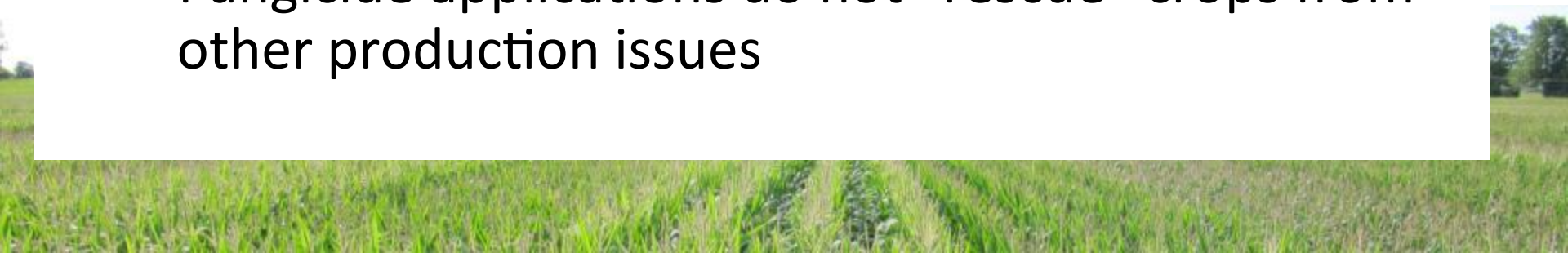
Fungicide(s)				Anthracnose Leaf Blight	Common Rust	Eyespot	Gray Leaf Spot	Northern Leaf Blight	Southern Rust	Harvest Restriction[1]
Class	Active Ingredient (%)	Trade Name	Rate/A (fl oz)							
QoI Strobilurins Group 11	azoxystrobin 22.9%	Quadris 2.08 SC®	6.0-15.5	VG	E	VG	E	G	G	7 days
	fluoxastrobin 40.3%	Evito 480 SC®	2.0 – 5.7	—	—	—	—	—	—	R4 (dough)
	pyraclostrobin 23.6%	Headline 2.09 EC/SC®	6.0-12.0	—	E	E	E	VG	E	7 days
	picoxystrobin	Aproach 2.08 SC®	3.0-12.0	—	—	VG	—	—	—	7 days
DMI Triazoles Group 3	propiconazole 41.8%	Tilt 3.6 EC® multiple generics	2.0-4.0	NL	VG	E	G	G	G	30 days
	prothioconazole 41.0%	Proline 480 SC®	5.7	—	—	—	—	VG	G	14 days
	tebuconazole 38.7%	Folicur 3.6 F® multiple generics	4.0-6.0	NL	—	NL	—	VG	—	36 days
	tetraconazole 20.5%	Domark 230 ME®	4.0 – 6.0	—	—	—	—	—	G	R3 (milk)
Mixed Modes of Action	azoxystrobin 7.0% propiconazole 11.7%	Quilt 200 SC®	7.0-14.0	NL	VG-E	E	E	VG	VG	30 days
	azoxystrobin 13.5% propiconazole 11.7%	Quilt Xcel 2.2 SE®	10.5-14.0	VG	VG-E	VG-E	E	VG	VG	30 days
	pyraclostrobin 13.6% metconazole 5.1%	Headline AMP 1.68 SC®	10.0-14.4	—	E	E	E	VG	VG	20 days
	pyraclostrobin 28.58% fluxapyroxad 14.33%	Priaxor 4.17 SC®	4.0-8.0	—	—	—	—	—	G	21 days
	trifloxystrobin 11.4% propiconazole 11.4%	Stratego 250 EC®	10.0-12.0	—	VG	E	VG	G	G	14 days
	trifloxystrobin 32.3% prothioconazole 10.8%	Stratego YLD 4.18 SC®	4.0-5.0	VG	E	VG	E	VG	VG	30 days

Efficacy ratings: G=good, VG=very good, E=excellent, NL=not labeled for use against this disease, —=insufficient data.

[1]Harvest restrictions are for field corn harvested for grain. Restrictions may vary for other types of corn (such as sweet, seed, popcorn), and corn for other uses (such as forage or fodder).

Bottom line

- Yield increases can occur in the absence of disease, but consistency and predictability is difficult to achieve
  - Use field production practices to help determine which fields might benefit from fungicides
- Understand limitations of fungicides and manage expectations
  - Fungicide applications do not “rescue” crops from other production issues



Acknowledgements

- Corn Disease Working Group members

INDIANA CORN Marketing Council