Impact of Fungicide and Tillage on Disease Incidence in Continuous Corn Production Systems

By Aaron Saeugling

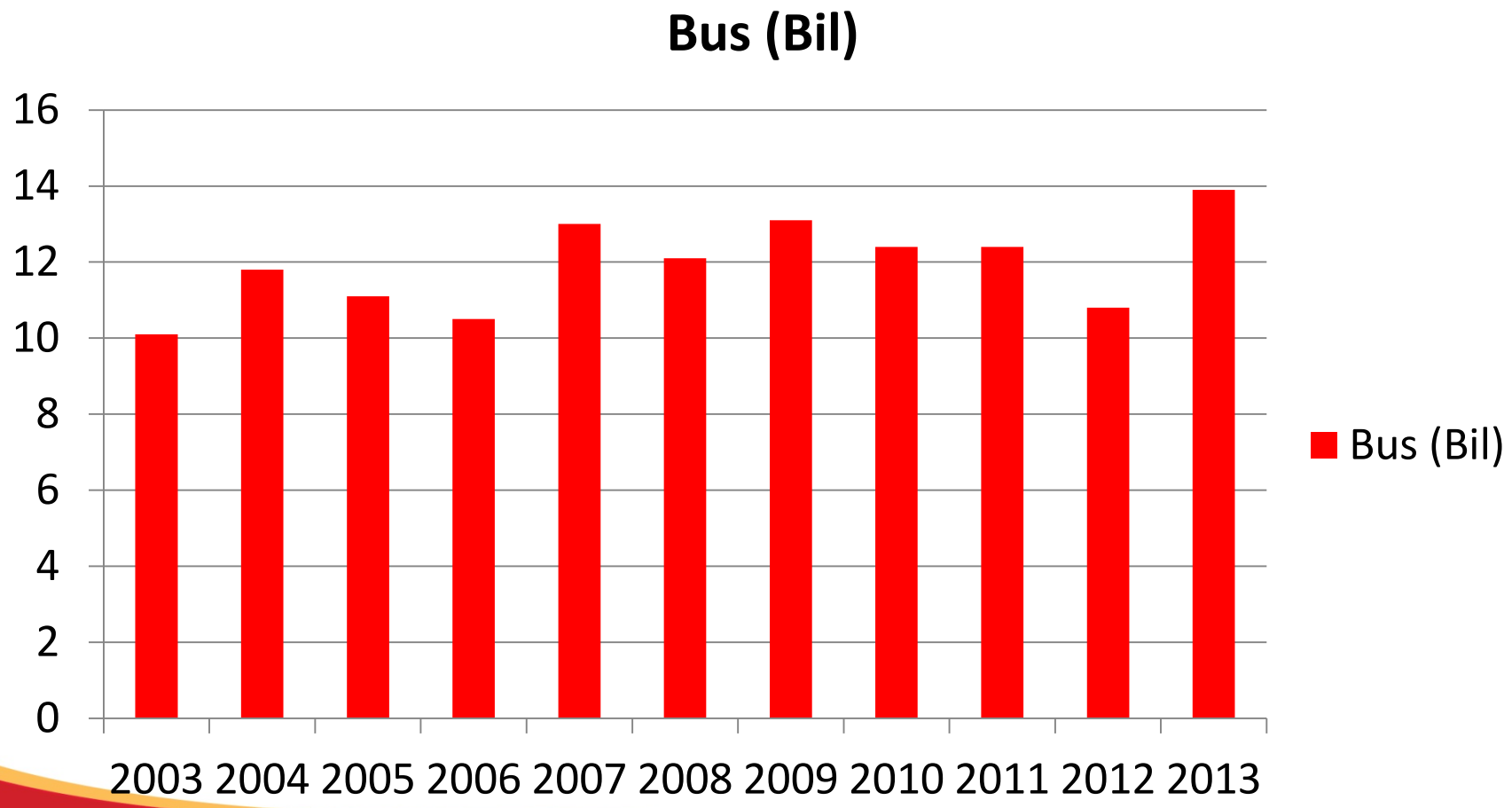
Background

- Spent my youth not involved in agriculture
- Junior high and High school Garner, IA
- Junior College then Iowa State BS 1991 Agronomy
- Professional career; Ag chemical sales, Agronomy manager, Seed sales, agronomist, and Extension agronomist

Introduction

- Increase in corn production 2.5 Million (1932) to 13.9 Billion (2013)
- Increase in continuous corn
- More no-till acres in Iowa
- Residue removal for stover and ethanol production
- More residue=more pathogens
- Increased fungicide usage

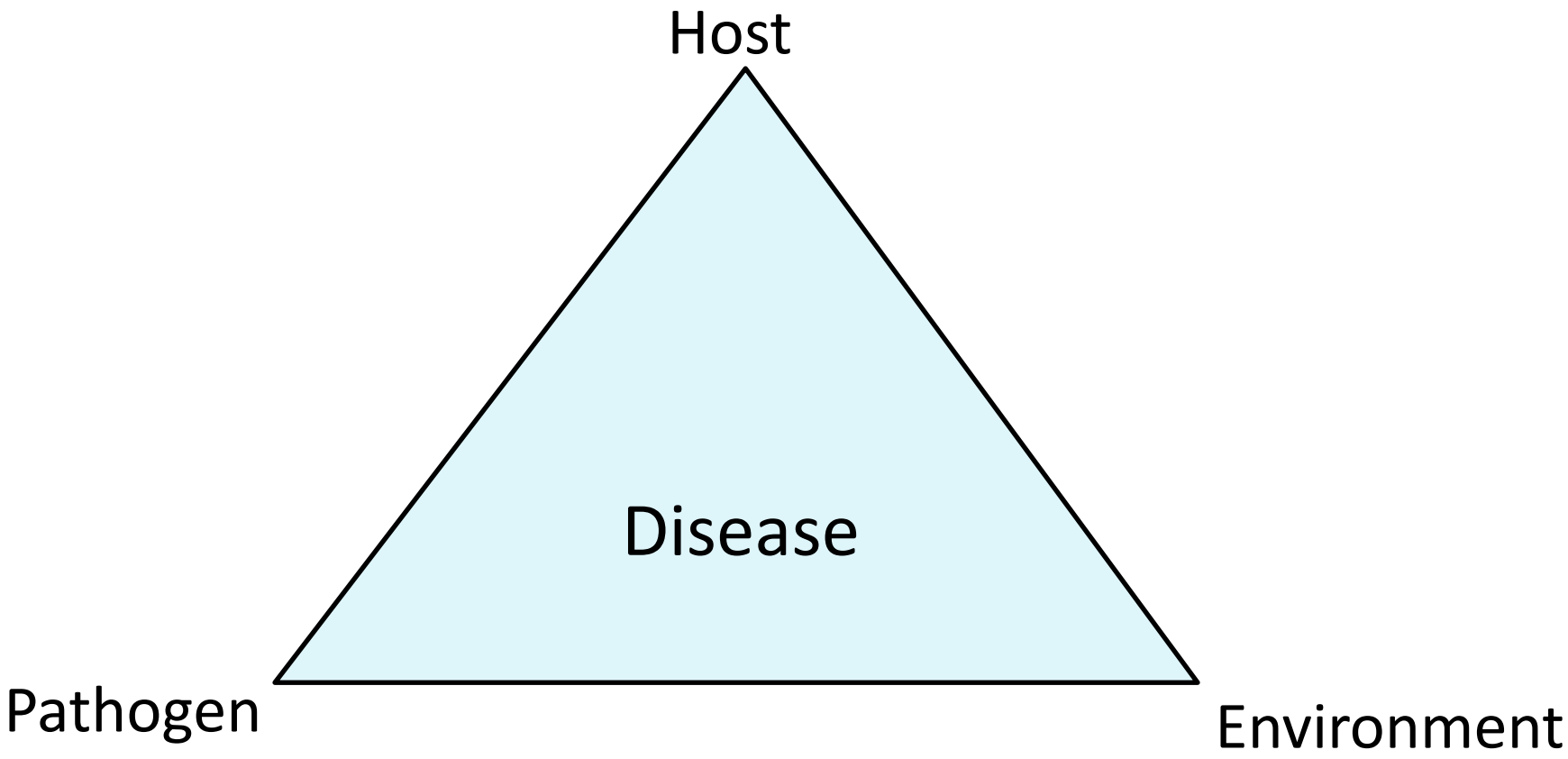
10 year US Corn production



Production challenges for continuous corn

- Increased residue
- Increased pathogens
- Allopathic affect
- Tillage affect on erosion
- Erosion destroys soil structure, increases bulk density and lowers water infiltration

Disease Triangle



Hypothesis

- Removal of residue would have similar affect on corn yield and disease severity as tillage

- Fungicide application would be effective at reducing disease in a no-till system compared to a tillage or residue removal system.

Objective

- Evaluate the effect of no-till, tillage, and residue removal in continuous corn on disease, grain moisture and grain yield

- Measure the interaction of fungicide application on tillage method, disease, grain moisture and yield

Treatment list

- **Tillage System (3)**
  - No-till
  - Residue removed
  - Chisel Plow
- **Fungicide application (2)**
  - No
  - Yes

Materials and Methods

- A 3 x 2 factorial in RCBD plot with four replications was established in the fall of 2011
- All sites were on continuous corn since 2010
- Plots were 8 rows wide (30”) by 100’ long

Materials and Methods

- Site 1 occurred in 2012
- Site 2 and 3 occurred in 2013
- Residue was removed in the fall after harvest at the rate of 50% removal
- Corn was planted 4-25-12 and 5-15-13 at 34K
- Susceptible hybrids chosen

Materials and Methods

- Headline AMP @ 10.5 oz./a applied at R1 with 20 GPA with 10’ hand boom to middle 4 rows
- Early season anthracnose ratings taken @ V-2 on 20 random plants
- Foliar leaf symptoms for grey leaf spot, eyespot, and common rust were taken on five plants above and below the ear leaf prior to fungicide application and 14 DAT
- Prior to harvest plants were assessed using the pinch method on 10 plants

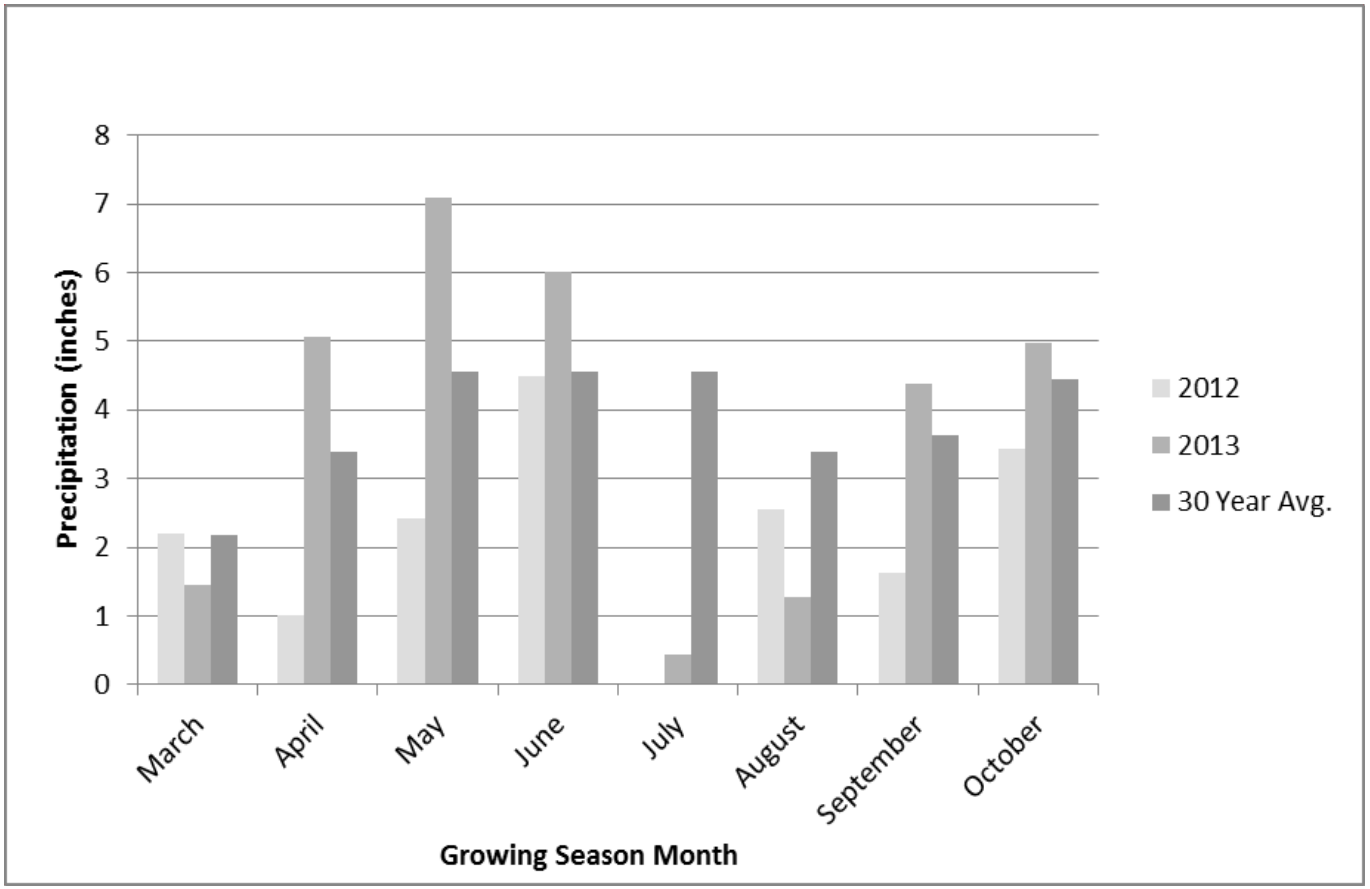
Materials and Methods

- Plots were harvested for yield and moisture
- Only the center 4 rows were harvested
- Analysis of disease and yield data was done with PROC GLM in SAS with a significance set to 5%
- Fisher's LSD test was used to separate means (alpha=0.05)

Weather influence

- 2012 drought year
- 2012 April, May, June and July ***below*** average
- 2013 April, May and June ***above*** average
- July 2012 and 2013 almost zero rainfall

Figure 2. Mean monthly rainfall for March through October 2012 and 2013 compared to the 30 year average at Iowa State University Armstrong Research Farm near Lewis, IA.



Anthracnose results

- Impact of weather on disease development
- 2012 had higher incidence of anthracnose not significant just not typical
- May have assessed disease too early wait until V-5 more time to develop
- Ranged from 12% to 20% 2012
- Ranged from 8% to 18% 2013

Stalk Rot Results

- Stalk rot incidence was reduced with an application of fungicide in the no-till treatment in 2012 (site 1)
- No differences were observed in 2013 (site 2 and 3)
- Fungicide claims to reduce plant stress were non conclusive

Table 1. Effect of chisel plow, residue removal and no till with and without a fungicide application at R1 on the mean incidence of anthracnose leaf blight and stalk rot incidence of corn at the ISU Armstrong Research Station, near Lewis in 2012 and 2013.

Treatment	**Fungicide applied**	**Mean incidence of anthracnose leaf blight (%)**			**Mean stalk rot incidence (%)**		
		Site 1	**Site 2**	**Site 3**	**Site 1**	**Site 2**	**Site 3**
Chisel plow	No	13	15	10	13 b	15	40
Chisel plow	Yes	12	8	10	8 b	8	22
Residue removed	No	13	9	8	10 b	15	28
Residue removed	Yes	14	15	18	10 b	8	32
No till	No	20	14	8	28 a[z]	13	28
No till	Yes	14	13	13	8 b	5	22

[z]Means with the same letter are not different (P<0.05) using Fisher's LSD

Grain moisture results

- Economic factor for farmers to consider
- No fungicide affect was observed
- Tillage treatment affect grain moisture
- No-till system had higher grain moisture content

Table 2. Effect of chisel plow, residue removal and no-till on grain moisture of corn at harvest at the ISU Armstrong Research Station, near Lewis Iowa in 2012 and 2013.

Tillage treatment	Site year 1[z]	Site year 2	Site year 3
No till	17.46 a[y]	17.91 a	20.13 a
Residue removal	16.75 ab	15.59 b	15.14 b
Chisel plow	16.12 b	15.43 b	15.04 b

[z] Site year 1 2012 experiment, site year 2, 2013 and site year 3, respectively

[y] Means with the same letter are not different ($P<0.05$) using Fisher's LSD

Corn grain yield results

- Site 1 - fungicide negatively affect no-till treatment
- Site 1 - drought conditions all season

- Site 2 and 3 - no-till was negatively affected compared to tillage and residue removal
- Site 2 and 3 - cold wet spring

Corn grain yield results

- Data suggests that farmers wanting to remove residue can expect similar results as tillage treatments
- Fungicide did not improve stress tolerance during drought relating to yield

Corn grain yield results

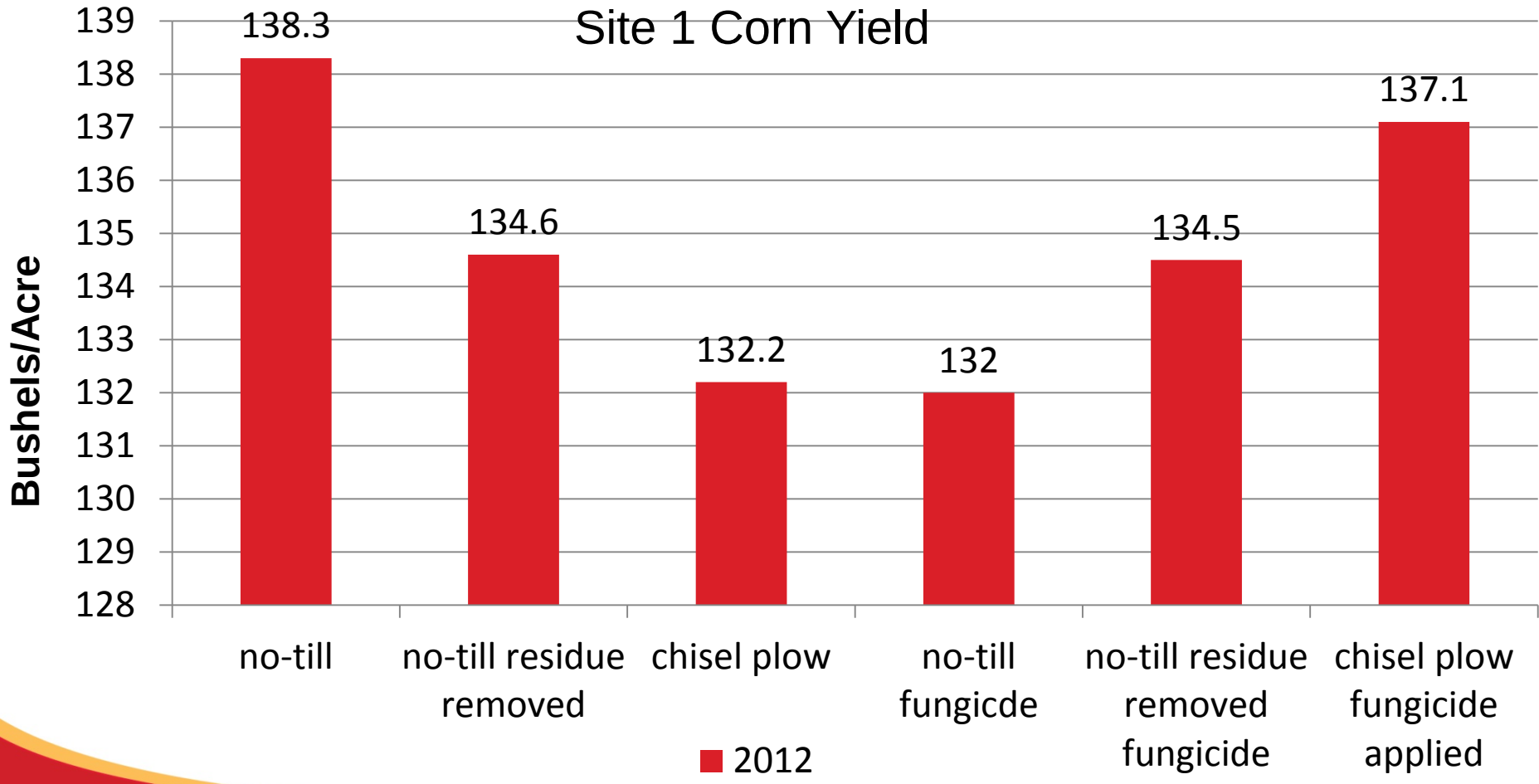


Table 3. Effect of chisel plow, residue removal and no-till on yield of corn at the ISU Armstrong Research Farm near Lewis, IA in 2013

Treatment	Mean Yield (bu/A)	
	Site 2	Site 3
No till	176.29 b [z]	167.73 b
Chisel plow	199.90 a	196.05 a
Residue removed	201.34 a	196.6 a

[z]Means comparison using Fisher's LSD at P=0.05

Summary

- World demand for corn has increased
- More continuous corn is being planted
- Dry conditions during disease development cause little disease incidence
- No-till caused wetter grain moisture
- Removing residue was as effective as tillage on grain yield

Summary

- Tillage was a greater factor than fungicide application
- Fungicide can impact stalk rot incidence
- Dry conditions impact disease development
- In the absence of disease fungicides have little affect on yield

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Thank you

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