Can Agronomic Practices Reduce DON?

Carrie Knott, Ph.D.
University of Kentucky
Grain Crops Extension Agronomist
carrie.knott@uky.edu
Kygrains.info
@kygrains

Map created at mapchart.net

Kentucky Grain Crop Production

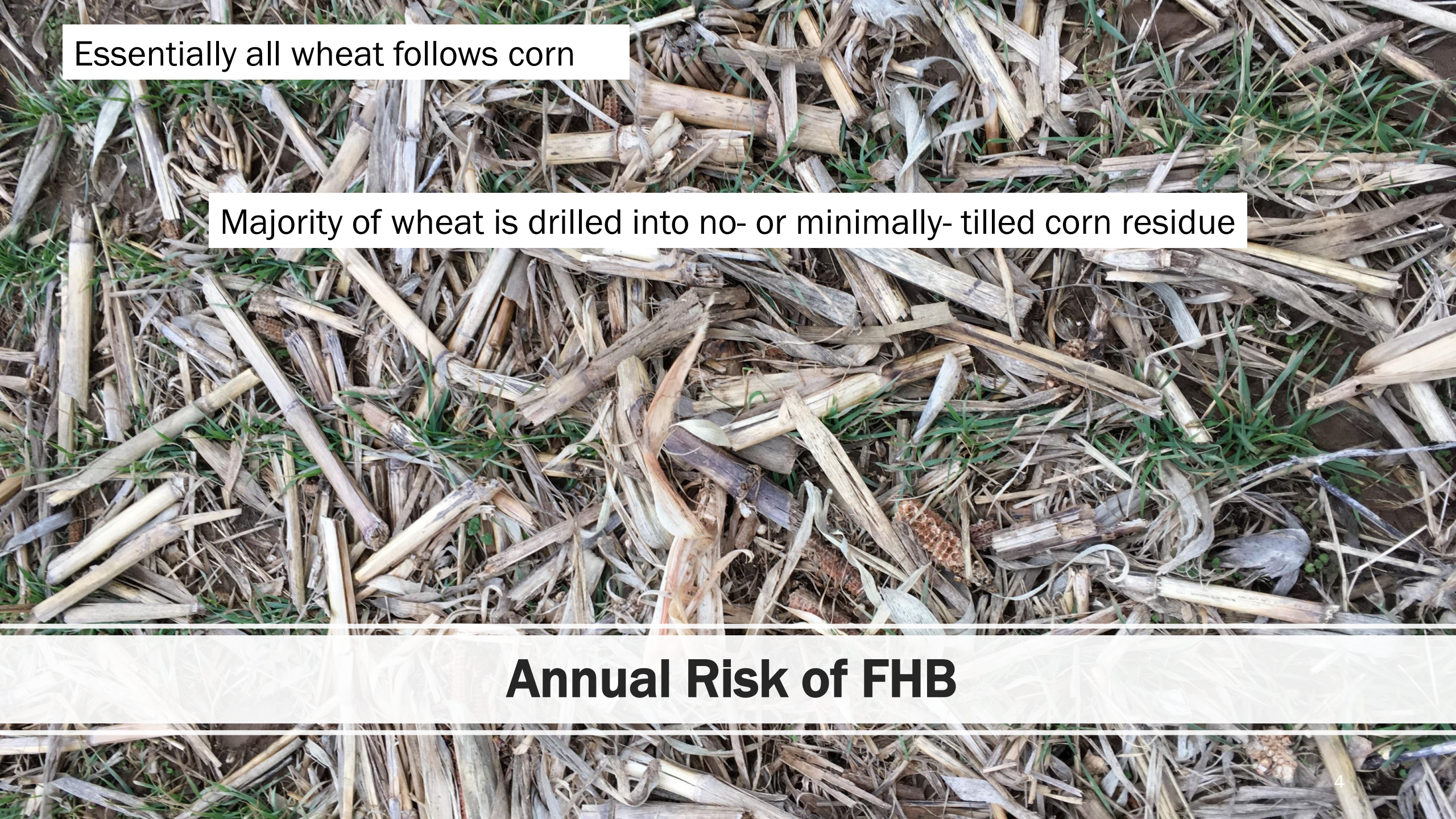
Full-Season 90%

Double-Crop 10%

Year 1

Year 2

Kentucky Grain Crop Rotations



Annual Risk of FHB

State	5-Yr Mean Soft Red Winter Wheat Harvested ha†	5-Yr Mean Soft Red Winter Wheat Yield kg ha^{-1} (bu acre^{-1}) †
Illinois	208,000	
Kentucky	147,700	
Michigan	195,900	
Missouri	212,900	
North Carolina	153,400	
Ohio	189,000	
Tennessee	121,800	

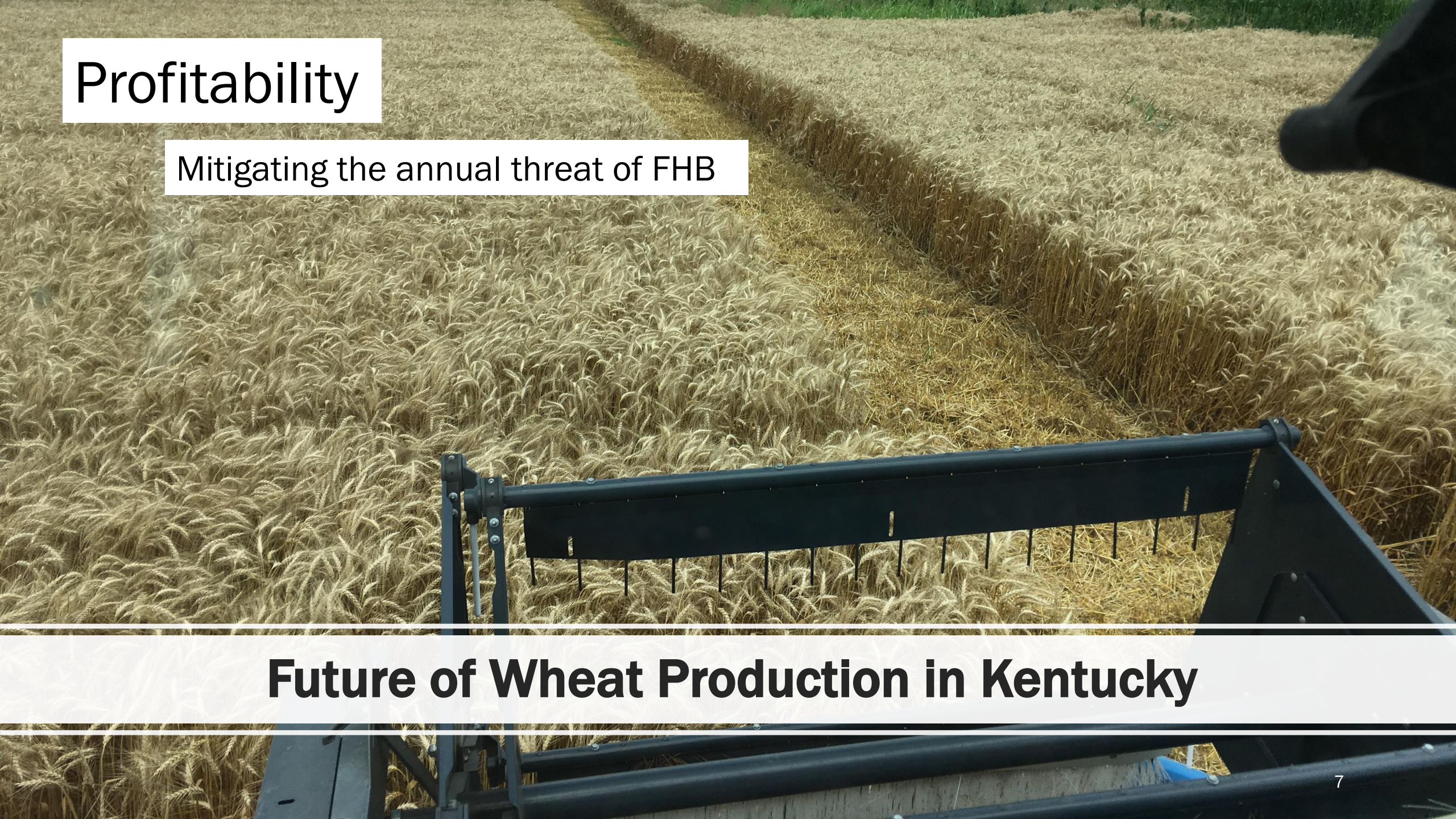
†Data obtained from USDA-NASS (https://quickstats.nass.usda.gov/).

State	5-Yr Mean Soft Red Winter Wheat Harvested ha†	5-Yr Mean Soft Red Winter Wheat Yield kg ha^{-1} (bu acre^{-1}) †
Illinois	208,000	4708 (70)
Kentucky	147,700	4977 (74)
Michigan	195,900	5447 (81)
Missouri	212,900	4237 (63)
North Carolina	153,400	3497 (52)
Ohio	189,000	4708 (70)
Tennessee	121,800	4640 (69)

†Data obtained from USDA-NASS (https://quickstats.nass.usda.gov/).

Profitability

Mitigating the annual threat of FHB



Future of Wheat Production in Kentucky

Recommendations to Manage FHB

Moderately Resistant Cultivars

Fungicide at Feekes 10.5.1 (Zadoks 60)

Variability in the Growth Stage of the Wheat Field

Variability in the Growth Stage of the Wheat Field

Goal: Identify Management Practices that could Mitigate FHB

Objectives

To determine if management practices can:

- Reduce variability in flowering (duration)
- Deoxynivalenol (DON)

Management Practices

1. In-Furrow Phosphorus Application
2. Increased Seeding Rate
3. Harvest Timing

Materials and Methods

Fall 2016, 2017, and 2018

- Planting Date
  - October
  - November
- In-Furrow Phosphorus
  - 0 kg P_2O_5 ha^{-1}
  - 47 kg P_2O_5 ha^{-1}

  all fields had adequate P
- Harvest Timing
  - 20 to 22% grain moisture
  - 13 to 15% grain moisture

Fall 2017 and 2018

- Seeding Rate
  - 377 pure live seed m^{-2}
  - 603 pure live seed m^{-2}

Materials and Methods

<u>Fall 2016, 2017, and 2018</u>

- Environments
  - Mist-irrigated FHB nursery inoculated with *F. graminearum*-infested corn
  - "Ambient"
- Cultivar
  - Moderately-Resistant to *Fusarium graminearum* (Pembroke 2016)
  - Moderately-Susceptible to *F. graminearum* (Pioneer 26R53)

Photo: Katherine Rod

Materials and Methods

Experimental Design

Randomized Complete Block

5 replications

PROC GLIMMIX SAS 9.4

-means adjusted with the Tukey method

Data Collected

Date of:

- Feekes 10.5 (Zadoks 58)
- Feekes 10.5.1 (Zadoks 60)
- Feekes 10.5.3 (Zadoks 68)

Fusarium Head Blight Index

Fusarium Damaged Kernels (FDK)

Deoxynivalenol (DON)

Grain Yield

2018 Heading and Flowering Duration

2018 Heading and Flowering Duration

2019 Heading and Flowering Duration

2019 Heading and Flowering Duration

Heading and Flowering

Treatment	Feekes 10.5	Feekes 10.5.1	Feekes 10.5.3
	Days from first plant of plot until 50% of the plot		
0 kg P_2O_5 ha^{-1}			
47 kg P_2O_5 ha^{-1}			
P – value			
377 pure live seed m^{-2}			
603 pure live seed m^{-2}			
P – value			

Heading and Flowering

Treatment	Feekes 10.5	Feekes 10.5.1	Feekes 10.5.3
	Days from first plant of plot until 50% of the plot		
0 kg P_2O_5 ha^{-1}	3		
47 kg P_2O_5 ha^{-1}	3		
P – value	0.7390		
377 pure live seed m^{-2}			
603 pure live seed m^{-2}			
P – value			

Heading and Flowering

Treatment	Feekes 10.5	Feekes 10.5.1	Feekes 10.5.3
	Days from first plant of plot until 50% of the plot		
0 kg P_2O_5 ha^{-1}	3	3	
47 kg P_2O_5 ha^{-1}	3	2	
P – value	0.7390	0.1260	
377 pure live seed m^{-2}			
603 pure live seed m^{-2}			
P – value			

Heading and Flowering

Treatment	Feekes 10.5	Feekes 10.5.1	Feekes 10.5.3
	Days from first plant of plot until 50% of the plot		
0 kg P_2O_5 ha^{-1}	3	3	2
47 kg P_2O_5 ha^{-1}	3	2	2
P – value	0.7390	0.1260	0.3497
377 pure live seed m^{-2}			
603 pure live seed m^{-2}			
P – value			

Heading and Flowering

Treatment	Feekes 10.5	Feekes 10.5.1	Feekes 10.5.3
	Days from first plant of plot until 50% of the plot		
0 kg P_2O_5 ha^{-1}	3	3	2
47 kg P_2O_5 ha^{-1}	3	2	2
P – value	0.7390	0.1260	0.3497
377 pure live seed m^{-2}	3		
603 pure live seed m^{-2}	3		
P – value	0.8024		

Heading and Flowering

Treatment	Feekes 10.5	Feekes 10.5.1	Feekes 10.5.3
	Days from first plant of plot until 50% of the plot		
0 kg P_2O_5 ha^{-1}	3	3	2
47 kg P_2O_5 ha^{-1}	3	2	2
P – value	0.7390	0.1260	0.3497
377 pure live seed m^{-2}	3	3	
603 pure live seed m^{-2}	3	2	
P – value	0.8024	0.0011	

Heading and Flowering

Treatment	Feekes 10.5	Feekes 10.5.1	Feekes 10.5.3
	Days from first plant of plot until 50% of the plot		
0 kg P_2O_5 ha^{-1}	3	3	2
47 kg P_2O_5 ha^{-1}	3	2	2
P – value	0.7390	0.1260	0.3497
377 pure live seed m^{-2}	3	3	2
603 pure live seed m^{-2}	3	2	2
P – value	0.8024	0.0011	0.3329

DON and Grain Yield

Treatment	FHB Index	FDK (%)	DON (ppm)	Grain Yield (kg ha^{-1})
0 kg P_2O_5 ha^{-1}				
47 kg P_2O_5 ha^{-1}				
P – value				
377 pure live seed m^{-2}				
603 pure live seed m^{-2}				
P – value				

DON and Grain Yield

Treatment	FHB Index	FDK (%)	DON (ppm)	Grain Yield (kg ha^{-1})
0 kg P_2O_5 ha^{-1}	4			
47 kg P_2O_5 ha^{-1}	4			
P – value	0.9500			
377 pure live seed m^{-2}	6			
603 pure live seed m^{-2}	6			
P – value	0.2294			

DON and Grain Yield

Treatment	FHB Index	FDK (%)	DON (ppm)	Grain Yield (kg ha^{-1})
0 kg P_2O_5 ha^{-1}	4	11		
47 kg P_2O_5 ha^{-1}	4	10		
P – value	0.9500	0.5073		
377 pure live seed m^{-2}	6	12		
603 pure live seed m^{-2}	6	12		
P – value	0.2294	0.1019		

DON and Grain Yield

Treatment	FHB Index	FDK (%)	DON (ppm)	Grain Yield (kg ha^{-1})
0 kg P_2O_5 ha^{-1}	4	11	2.1	
47 kg P_2O_5 ha^{-1}	4	10	2.0	
P – value	0.9500	0.5073	0.5009	
377 pure live seed m^{-2}	6	12	2.4	
603 pure live seed m^{-2}	6	12	2.3	
P – value	0.2294	0.1019	0.0769	

DON and Grain Yield

Treatment	FHB Index	FDK (%)	DON (ppm)	Grain Yield (kg ha^{-1})
0 kg P_2O_5 ha^{-1}	4	11	2.1	4768
47 kg P_2O_5 ha^{-1}	4	10	2.0	4909
P – value	0.9500	0.5073	0.5009	0.0333
377 pure live seed m^{-2}	6	12	2.4	4247
603 pure live seed m^{-2}	6	12	2.3	4393
P – value	0.2294	0.1019	0.0769	0.0079

Harvest Timing

Treatment	FDK (%)	DON (ppm)	Grain Yield (kg ha^{-1})
13 to 15% Grain Moisture			
20 to 22% Grain Moisture			
P – value			

Harvest Timing

Treatment	FDK (%)	DON (ppm)	Grain Yield (kg ha^{-1})
13 to 15% Grain Moisture	11		
20 to 22% Grain Moisture	10		
P – value	<0.0001		

Harvest Timing

Treatment	FDK (%)	DON (ppm)	Grain Yield (kg ha^{-1})
13 to 15% Grain Moisture	11	1.7	
20 to 22% Grain Moisture	10	2.4	
P – value	<0.0001	<0.0001	

Harvest Timing

Treatment	FDK (%)	DON (ppm)	Grain Yield (kg ha^{-1})
13 to 15% Grain Moisture	11	1.7	4873
20 to 22% Grain Moisture	10	2.4	4823
P – value	<0.0001	<0.0001	0.4529

Summary

- Management practices investigated did not reduce time to heading, beginning flowering, or full flowering
  - STAY TUNED
  - We will investigate further by examining total duration of these growth stages
- In-furrow P and seeding rate did not reduce FHB Index, FDK, or DON

Summary

- Phosphorus and greater seeding rate increased yield

- Harvesting at 20 to 22%
  - Reduced FDK
  - Increased DON
  - Did not impact grain yield

Acknowledgments

- Katherine Rod

- Carl Bradley, David Van Sanford, Kiersten Wise

- John James, Conner Raymond, John Walsh, Kelsey Mehl, Nolan Anderson
- Hunter Adam, Curtis Bradley, Jacob Foote, Gracie Harper, Carrie Ann Followell, Mary Grace Jackson, Bradley James, Kelly Eicher, Bailey Webster, and Kirsten Banks

Thank You!

carrie.knott@uky.edu

www.Kygrains.info

 @kygrains