

# Controlling Wheat Diseases for Dollars

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# Strategies for Cereal Disease Management

- **Variety Selection**
- **Crop Rotation**
- **Tillage System**
- **Cultural**
  - Planting date**
  - Other**
- **Seed Trt and**
- **Foliar Fungicide Utilization**





**Focus of this presentation:**  
**Economics of Foliar Fungicides  
on Wheat for Controlling Leaf  
and Head Diseases**

- **With information also provided by:**
  - **Roger Ashley, Dickinson REC**
  - **Kent McKay, NCREC**
  - **Keith Brown, Divide Co. and LoAyne Voigt, Renville Co.**
  - **Blaine Schatz, Greg Endres, CREC**
  - **John Lukach, Langdon REC**



# **Disease Severity and Fungicide Economics Impacted by:**

- 1. Host susceptibility**
- 2. Rotations used**
- 3. Environmental conditions**
- 4. Stages of Growth Disease Occurs**
- 5. Timing of application**
- 6. Rate and method of application**

# Economics of Wheat Fungicides

- Yield ↑ (increases bushels/acre)
- Test weight ↑ (increases plump kernels which contribute to increased test weight)
- Damage ↓ (reduces scabby kernels which are part of damage)
- Vomitoxin ↓ (often reduced with fungicides)
- Market grade ↑ (grain no longer discounted because of low twt or high damage)
- No consistent effect on protein



# **Fungicides Are Not Cure-Alls**

- **Fungicides work best when disease pressure is high and fungicides are combined with other management strategies (IPM)**
- **Have realistic expectations**
  - **Typically don't see 100% control,**
  - **Commonly see 50-70% reductions**
- **Use Disease Forecasting Models to help predict risk and need for fungicides**

# Disease Forecasting Models for Leaf Diseases of Wheat

[www.ag.ndsu.nodak.edu/cropdisease/cropdisease.htm](http://www.ag.ndsu.nodak.edu/cropdisease/cropdisease.htm)

Leaf Disease forecasting for  
Carrington June 16, 2003

Disease	6/15	6/14	6/13	6/12	6/11	6/10	6/9	6/8	6/7
Tan spot	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
S. Blotch	No	No	No	Yes	No	Yes	No	Yes	No
Leaf rust	No	No	No	Yes	No	No	Yes	No	Yes



Tan spot



Septoria



Leaf  
rust

# Leaf Disease Forecasting Models for Wheat

[www.ag.ndsu.nodak.edu/cropdisease/cropdisease.htm](http://www.ag.ndsu.nodak.edu/cropdisease/cropdisease.htm)

**Baker, ND June 13, 2003**

Disease	6/12	6/11	6/10	6/9	6/8	6/7	6/6	6/5	6/4
Tan spot	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
S. Blotch	Yes	No	Yes	No	Yes	No	No	No	Yes
Leaf rust	No	No	No	No	No	No	No	No	No

**Yes = infection likely**, no = infection unlikely

Consider a fungicide when 6 infection periods (Yes) have accumulated

Rain (in)	0.94	0	0.49	0.08	0.09	0	0.32	0.02	0.14
RH (%)	87	77	88	70	86	86	73	69	85
Temp. (F)	59	59	56	59	53	55	60	61	56
Hrs wet	11	9	12	7	7	7	1	10	12

# Leaf Disease Forecasting Models for Wheat

[www.ag.ndsu.nodak.edu/cropdisease/cropdisease.htm](http://www.ag.ndsu.nodak.edu/cropdisease/cropdisease.htm)

**Edgeley, ND June 12, 2003**

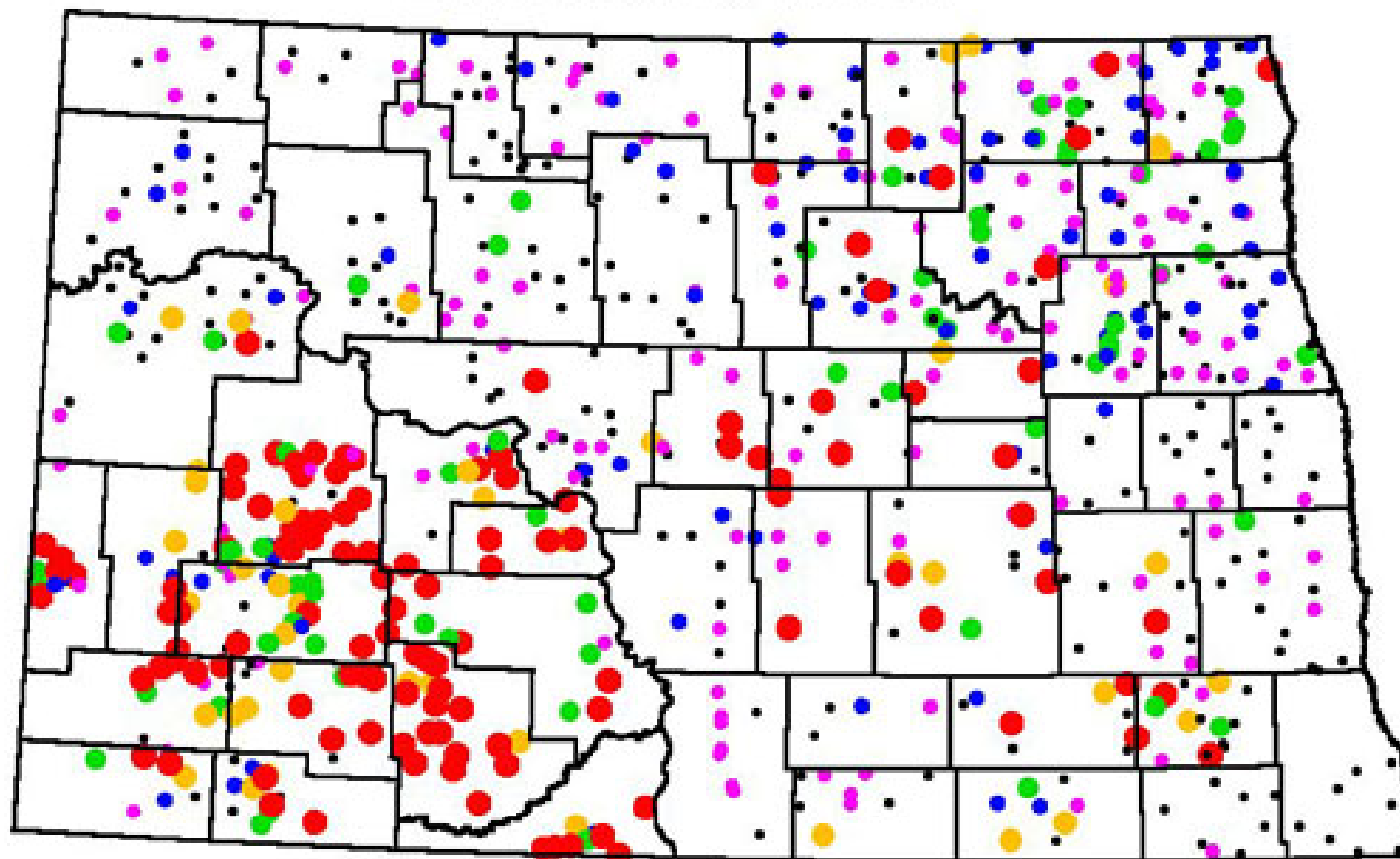
Disease	6/12	6/11	6/10	6/9	6/8	6/7	6/6	6/5	6/4
Tan spot	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
S. Blotch	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Leaf rust	Yes	No	No	No	No	No	No	No	No

**Yes = infection likely**, no = infection unlikely

Consider a fungicide when 6 infection periods (Yes) have accumulated

Rain (in)	0.81	0	0.58	0	0.21	0	0.46	0.05	0.04
RH (%)	86	90	88	79	87	84	84	80	90
Temp. (F)	62	58	60	58	57	55	59	60	54
Hrs wet	10	13	10	12	14	3	12	10	15

# ND IPM Survey - 2003 Wheat Tan Spot Incidence 2003 Scouting Season



Percentage of Main Tillers Infected

• 1 - 15	• 16 - 30	• 31 - 47	• 48 - 64	• 65 - 82	• 83 - 100
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## Early tan spot infection may result in use of fungicides for **Early Season Control**

Tilt  
Propimax  
Stratego  
Quadris  
Headline  
Quilt  
Mancozebs

- ALL very good on leaf spot diseases at 4-5 leaf stage;
- Generally applied at 1/2 full label
- Best response when wheat planted into field with some wheat stubble

**Folicur** also controls leaf diseases but Sec. 18 label specific for scab



# Examples of Wheat Fungicide Economics – Early season applic.

Application Cost of  
Fungicide =  
half full label rate or ~  
\$5.00/acre

No additional cost for  
application if apply with  
herbicide at 4-5 leaf  
stage

Generally don't apply  
additional adjuvant –  
only that required by  
herbicide; apply with  
straight down nozzles

- Yield increases of 2-6.9 bushels if environment favorable for disease and if have some wheat stubble present

# Early Season Fungicide Trial on RSW

– **SW ND, 2000** (R. O. Ashley, et al. Dickinson REC )

<u>Location</u>	<u>Prev. Crop</u>	<u>Precip.*</u>	<u>+Yield</u>	<u>\$ Return</u>
Beach	sunflower	7.6"	0.1 bu	-\$4.63
Mandan	wheat	15.5"	6.9 bu	\$20.53
Regent	wheat	6.5"	4.5 bu	\$11.65

**2 fl oz Tilt fungicide applied at 4-5 fleaf stage**

**\* Precipitation from May –August**

**\$ Return assumes \$3.70/bu and \$5.00/A cost of fungicide**

# Early Season Fungicide Trial on HRSW – Fargo, ND, 2001

<u>Treatment*</u>	<u>% tan spot</u>	<u>Yield</u>	<u>Twt</u>	<u>\$ return</u>
<b>Untreated</b>	<b>16.3</b>	<b>60.7</b>	<b>59.5</b>	
<b>Folicur 2 fl oz</b>	<b>4.0</b>	<b>65.0</b>	<b>60.3</b>	<b>\$10.90</b>
<b>Stratego 5 lf oz</b>	<b>5.0</b>	<b>66.5</b>	<b>60.0</b>	<b>\$16.46</b>
<b>Tilt 2 fl oz</b>	<b>6.8</b>	<b>62.4</b>	<b>60.0</b>	<b>\$ 1.29</b>

**Fungicides applied at 4-5 leaf stage;**  
**Wheat stubble present**

**Assuming \$3.70/bu wheat and \$5.00 for fungicide and application/A**

## Early season application to Oxen HRSW: Fargo Trials, 2003 (Syngenta sponsored trial)

Product	Rate/acre = ½ full label	% leaf spot	Yield Bu/a	Return* over investment Per acre
<b>Untreated</b>		<b>13</b>	<b>66</b>	<b>--</b>
<b>Tilt</b>	<b>2 fl oz</b>	<b>7</b>	<b>69</b>	<b>\$6.10</b>
<b>Stratego</b>	<b>5 fl oz</b>	<b>7</b>	<b>67</b>	<b>-\$1.25</b>
<b>Headline</b>	<b>3 fl oz</b>	<b>5</b>	<b>68</b>	<b>\$2.40</b>
<b>Quadris</b>	<b>3 fl oz</b>	<b>7</b>	<b>68</b>	<b>\$2.40</b>
<b>LSD 0.05</b>		<b>2</b>	<b>3</b>	

- Assuming \$3.70/bu; cost of fungicide application = \$5.00/A
- All fungicides applied only once at 4-5 lf stage. Wheat planted into wheat stubble

**Foliar diseases  
and fungicides applied  
for late season leaf  
disease control  
Pictures from the  
Carrington REC**

**Untreated**



**Treated**



**Pictures from Blaine Schatz  
Carrington REC**

# Later Season -Leaf Disease Forecasting

[www.ag.ndsu.nodak.edu/cropdisease/cropdisease.htm](http://www.ag.ndsu.nodak.edu/cropdisease/cropdisease.htm)

## Carrington, July 3, 2003

Disease	7/3	7/2	7/1	6/30	6/29	6/28	6/27	6/26	6/25
Tan spot	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
S. Blotch	No	No	No	No	No	Yes	Yes	Yes	Yes
Leaf rust	Yes	No	No	No	No	No	No	No	No

## Mohall, July 7, 2003

Disease	7/3	7/2	7/1	6/30	6/29	6/28	6/27	6/26	6/25
Tan spot	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes
S. Blotch	Yes	Yes	No	No	No	No	No	Yes	Yes
Leaf rust	No	Yes	No	No	No	No	No	No	No





## **Late Season Leaf Disease Control**

**Tilt**

**Propimax**

**Stratego**

**Have 24C**

**State labels that  
allow application  
to Feekes 10.5**

**Headline**

**Quadris**

**Mancozebs**

**Have Federal  
labels that allow  
application to  
Feekes 10.5**

**Folicur also controls leaf diseases: Sec. 18 label  
specific for scab**

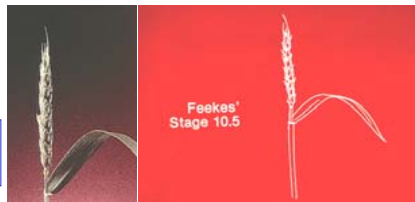
# Late Season Control of Leaf Diseases

## Wheat Growth Stages



STAGE 10.2  
1/4 of ear emerged

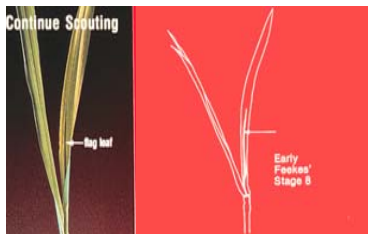
Feekes 10.2  
Zadoks 53  
1/4 head emerged



Feekes 10.5  
Zadoks 59  
Head emergence complete; no flowers

Feekes' Stage 10.5

Drawings from NDSU Ag. Communication; Pictures from Rohm and Haas



Flag leaf rolled and just visible

Feekes 8  
Zadoks 37



Feekes 10  
Zadoks 45

Boot swollen

Drawings from NDSU Ag. Communication; Pictures from Rohm and Haas

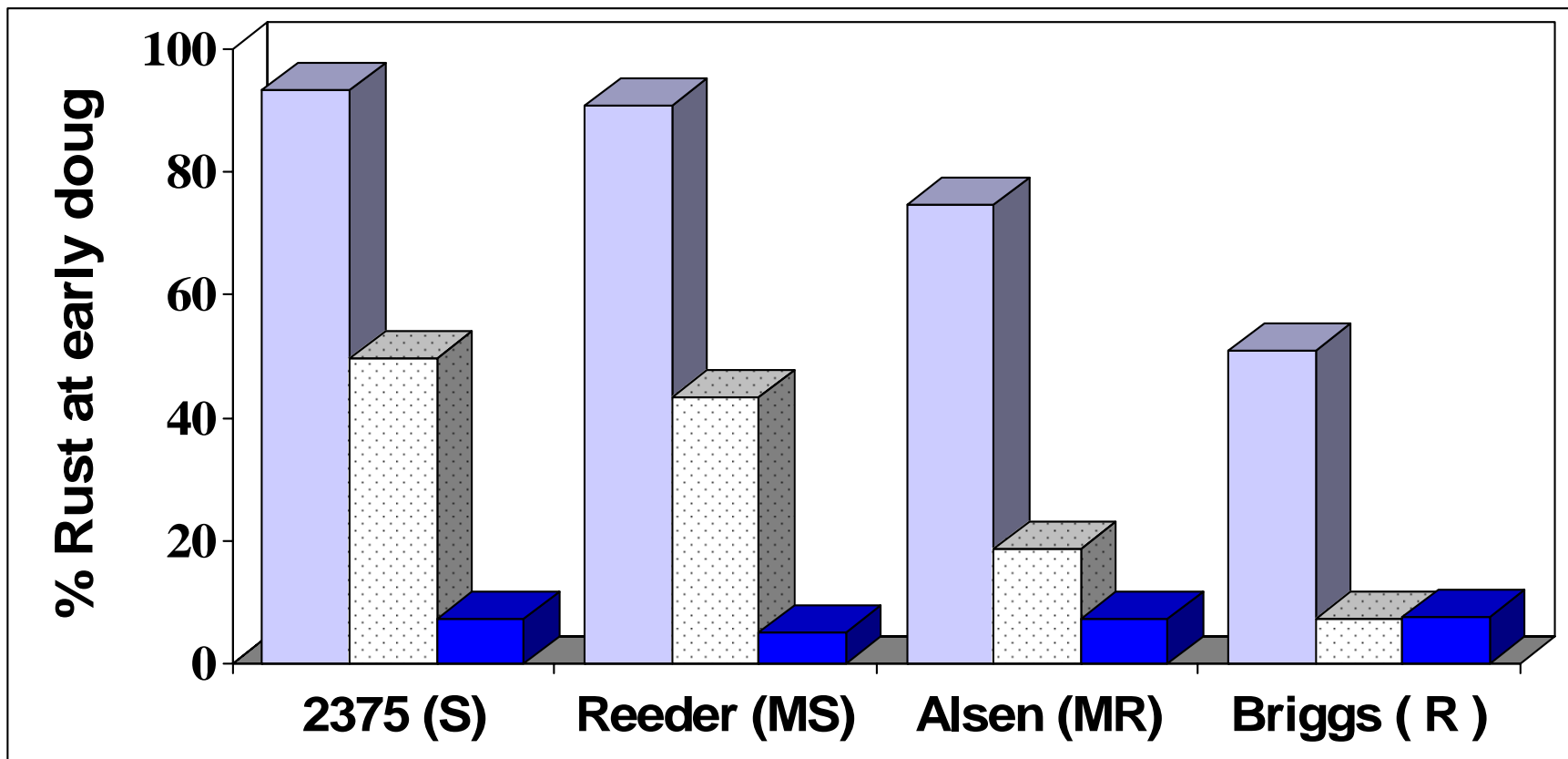
1. Application at Feekes 10.5-10.51 (full heading to early flowering) gives optimum control

2. Application of any product at Feekes 10 (boot) alone has not been adequate in NDSU trials

# Spring Wheat Leaf Rust Control

Impact of fungicide and timing of application on rust in varieties of different susceptibility. Folicur @ 4.0 fl oz/acre

Control Feekes 10.0 Feekes 10.51



NDSU Carrington Research Ext. Center

## Mid- and Late Season Application

### Oxen HRSW: Two Fargo Trials, **2003** (BASF trial)

<b>Product</b>	<b>Rate</b>	<b>Timing of Appl</b>	<b>% Lf Spt</b>	<b>Yield Bu/A</b>	<b>\$ return /A</b>
<b>Untrtd</b>	<b>---</b>	<b>---</b>	<b>27 a</b>	<b>65 d</b>	<b>----</b>
<b>Headline</b>	<b>6 fl oz</b>	<b>Feekes 10</b>	<b>6 de</b>	<b>71 ab</b>	<b>\$8.20</b>
<b>Headline</b>	<b>6 fl oz</b>	<b>Feekes 10.5</b>	<b>2 f</b>	<b>73 a</b>	<b>\$15.60</b>

**Assuming \$3.70/bu wheat price and \$14/acre fungicide cost for late season application (Feekes 10 and Feekes 10.5)**

## Mid- and Late Season Application

### Oxen HRSW: Two Fargo Trials, 2003 (Bayer trial)

Product	Rate	Timing of Appl	% Lf Spt	Yield Bu/A	\$ return /A
Untrt	---	---	35 a	64 c	---
Stratego	10 fl oz	Feekes 10	9 b	67 b	-\$2.90
Stratego	10 fl oz	Feekes 10.5	5 c	70 a	\$8.20

Assuming \$3.70/bu wheat price and \$14/acre fungicide cost

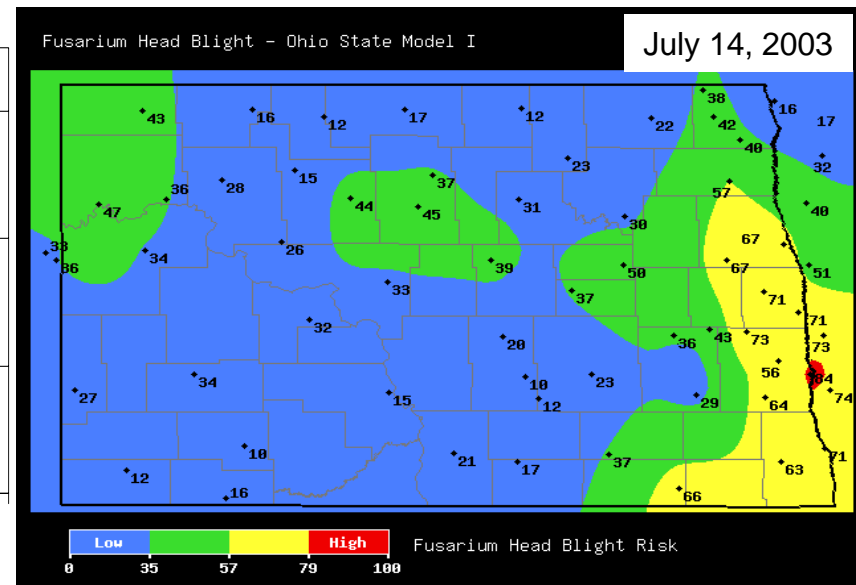
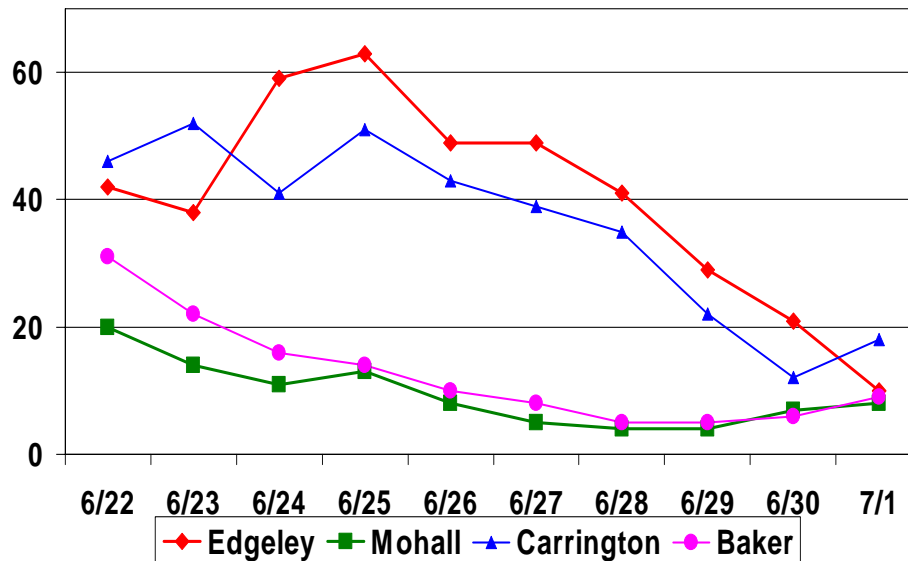
# FHB (scab) Forecasting and Fungicides

Fungicides should be applied to wheat at early flowering (Feekes 10.51)

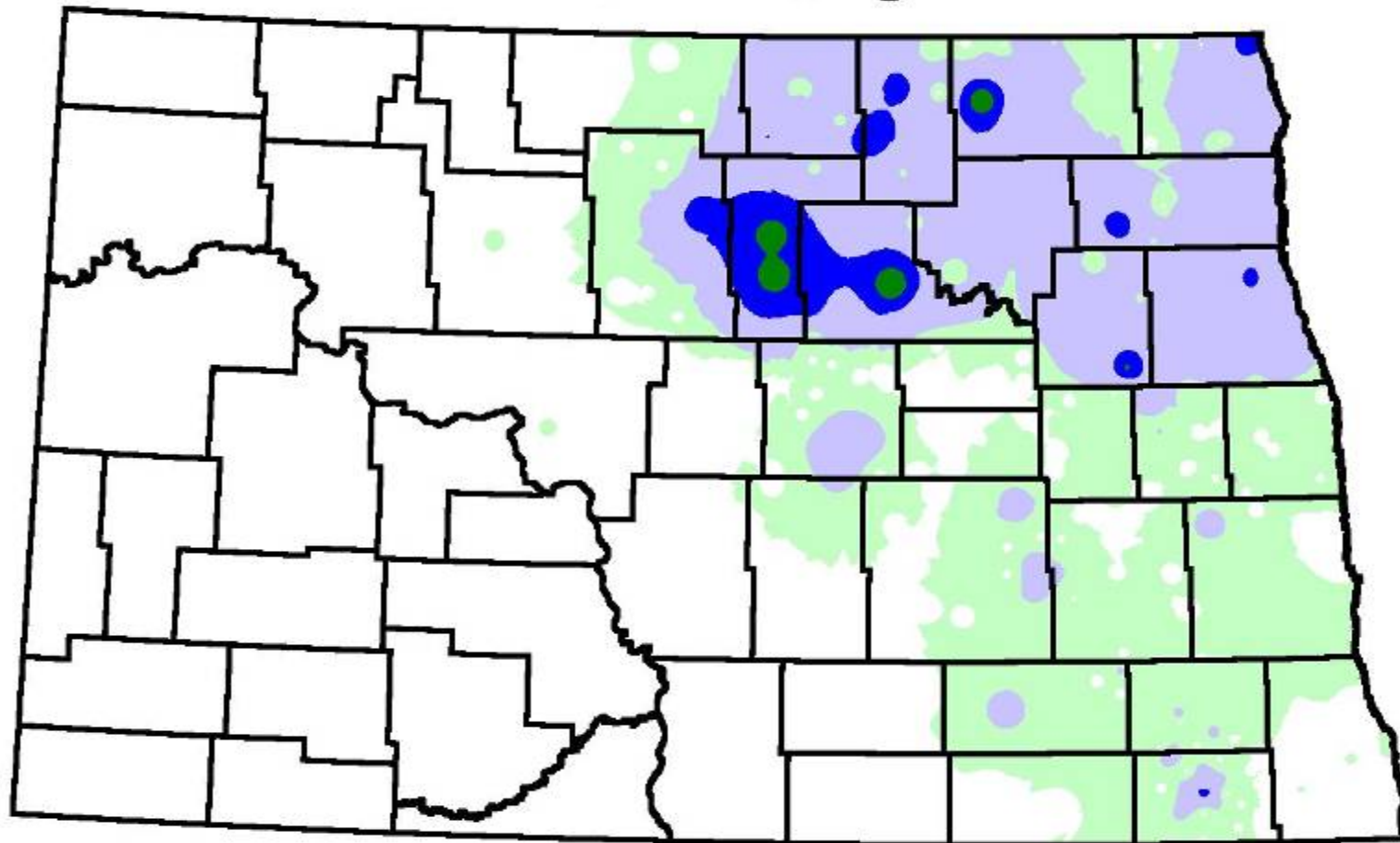
**If** FHB risk is high



FHB risk, 6/22-7/1 2003



**ND IPM Survey - 2003**  
**Wheat Scab Field Severity Index**  
**Zadoks Growth Stage 71+**



**Scab Field Severity Index**

Percent = Incidence X Severity / 100





# Fungicides for FHB (scab) Control

- **Headline, Quadris and Stratego not recommended for scab control because products containing strobilurin fungicides occasionally increase DON levels**
- **Folicur as Section 18 is the product most consistent in reducing FHB (scab) and DON**
- **Tilt, and Mancozebs also available (Tilt heading application (24c) limited to wheat)**

# Uniform Wheat Fungicide Results, ND

**2003** across 4 locations (Fargo, Carrington, Langdon, Minot)  
and 2 Wheat Classes\*

Trt & Rate/A	Leaf Dis %	FHB FS %	Damage %	DON Ppm	Yield Bu/A	Twt Lbs/bu
Untreated	48a	8.6 a	7 a	2.7 a	60 c	59.5b
Folicur 4 fl oz	14 b	3.7 b	3 b	1.5 b	70 b	61a

\*Fungicide applied at early flowering = Feekes 10.51 with forward/backward nozzels; 18 gpa, 40 psi

\*Leaf disease on flag leaf; FHB FS = field severity; DON = vomitoxin.

\*Numbers followed by different letters are significantly different at the 95% confidence level

- Varieties: Russ, Oxen, Ingot HRSW; Munich, Plaza, Mountrail durums;
- Mist applied at Fargo and Langdon; overhead irrigation at Carrington

# ND Fungicide Results across 5 locations and 3 spring wheat and 3 durum cultivars, 2001\*

(NDSU data from M. McMullen, K. McKay, J. Lukach, B. Schatz)

Folicur applied at early flowering

Treatment**	% Lf Dis.	%FHB FS	DON ppm***	Yld bu/a	Twt lbs/bu
Untreated	58.9	13.0	5.1	43.2	55.6
Folicur 4 fl oz	32.1	4.1	3.4	54.2	57.1
Fungicide Response	-26.8	-8.9	-1.7	+11.0	+1.5

\* Fargo, Carrington, Langdon, Minot, Garrison; cultivars were Oxen, Russ and Grandin spring wheat and Plaza, Munich, and Monroe durum

\*\*All fungicide treatments had 0.125% Induce added; all treatments applied with ground sprayer equipped with forward backward nozzles, in 15-20 gpa

\*\*\*DON (vomitoxin) data wasn't available from Langdon

## HRS Variety x Fungicide Reaction – Carrington, ND 2003 (G. Endres and B. Schatz)

Treatment*	Leaf Spot %	Leaf Rust %	FHB FS %	DON ppm	Yield Bu/A (bu increase)
Alsen Untreated	36	3	3	0.1	47
Alsen + Folicur	6	<1	1	0.1	53 (6)
Ingot Untreated	61	34	8	0.7	49
Ingot + Folicur	20	1	3	0.2	66 (17)
Reeder Untreated	44	18	11	1.3	41
Reeder + Folicur	13	<1	4	0.2	59 (18)
LSD 0.05	6	5	NS	0.4	4

\* Fungicide treatments were with Folicur at 4 fl oz/A applied at early flowering; 40 psi, 18 gpa, on soybean ground with some wheat straw added



# Examples of Wheat Fungicide Economics – Late season applic.

## ■ Yield increase

Current price: ~  
**\$3.70/bu**

for 14% protein

Cost of Folicur or Tilt  
\$10/product + \$4  
application = **\$14**

## ■ Discounts:

Test weight = **\$0.01**  
per  $\frac{1}{2}$  lb under 58  
lbs

Damage = **\$0.03** per  
each 1% over 1%,  
up to 5%;

**\$0.04** for each %  
above 5% damage

# Examples of Wheat Fungicide Economics – late season applic.

## ■ Alsen example: 6 bu yield increase

6 bu/A x \$3.70/bu price =  
\$22.20/A return

- \$14.00/A fungicide +  
application

= \$8.20/A return for yield

## ■ Quality increases

No damage in untreated.

If: 1.5 lb test wt increase  
to bring up to 58-59 lbs

2002 Uniform ND tests  
untreated: 56.5 lb/bu  
treated: 58 lb/bu

= \$0.03/bu return

Total \$ gain per acre with these figures of 6 bu/acre increase and 50 bu/acre total yield

$\$8.20 + (\$0.03 \times 50) = \$8.20 + \$1.50 = \$9.70/\text{Acre}$

# Examples of Wheat Fungicide Economics – late season applic.

- **Uniform trial example:**
- **10 bu increase across 4 locations in 2003**
- 10 x \$3.70 price/bu  
= \$37.00 return  
– \$14.00 cost of fungicide  
= **\$23/A return**

- **Quality improvements:**
- 2003 Uniform ND tests  
untreated: 7% damage  
treated: 3% damage  
= **\$0.14/bu return**
- 2002 Uniform ND tests  
untreated: 56.5 lb/bu  
treated: 58 lb/bu  
= **\$0.03/bu return**

Total \$ gain per acre with these figures of 10 bu/acre increase and **50 bu/acre total yield**

$$\text{\$23.00} + (\text{\$0.14} \times 50) + (\text{\$0.03} \times 50) = \text{\$23} + \text{\$7} + \text{\$1.50} = \text{\$31.50/Acre}$$

# Economics of Fungicide Use – Durum 2000, Minot

(analysis by Kent McKay, NCREC, Minot)

Untreated Yield:	34.0 bu/acre
Untrt Test wt:	56.5 lbs (terminal grade)
Discount:	\$1.00/bu
Return on untrt.	\$1.90/bu = \$64.60/acre

Treated Yield:	44.2 bu/acre
Treated Test wt:	58.9 lbs (milling grade)
Discount:	20 cents/bu
Return on trtd:	\$2.70/bu=\$119.34/acre
Cost of trt:	\$14/acre
<b>Net Return with trt:</b>	<b>\$40.74/acre</b>

Above results with Folicur applied once at 4 fl oz at flowering



# Are Fungicides Worth the Money for Wheat?

- Yes - when risks factors are properly considered.
- NDSU has a good body of knowledge that supports real return with fungicides under disease pressure
- Risk of negative return is real **if:** environment, yield potential, variety susceptibility, disease forecasting **aren't** considered – or if
- Timing of application is incorrect.