

# Enhancing Yield of Wheat and Oat

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# Cereal Yields are Increasing, but have not kept pace with Oilseeds and Pulses

- *Yield potential of varieties*
- *Lodging*
- *Diseases*



# How do we increase yield?

- Genetic improvement increases yield potential
- Improved management ( eg. Fertilizer and seeding practices) helps crop to reach their full yield potential
- Improved crop protection prevents yield loss



# Disease Management

- Cereals
  - Leaf diseases on Oat and Wheat
  - Fusarium on Wheat



# Fungicide Response by Oat: 4 Trials at IHARF and NARF sites in 2012 and 2013

- Very little disease = No Fungicide response
  - Triactor has good disease resistance
- Some growers have seen good responses
  - AC Morgan with poorer disease resistance
  - Late seeding may get Crown Rust

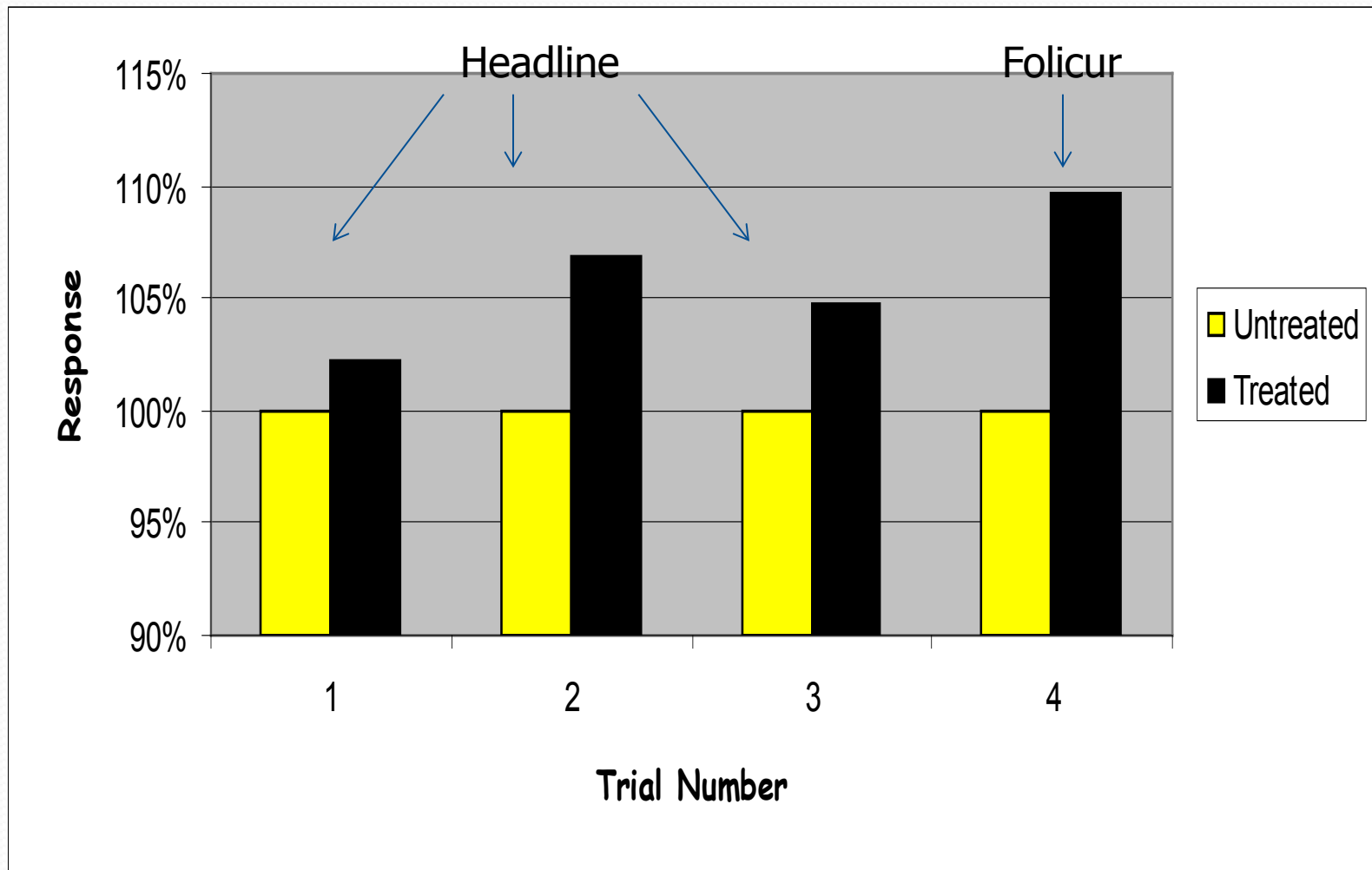


# Input Supplier Oat Fungicide Trials near Tisdale (not NARF)

- 3 Headline, 1 Folicur in 2009
- Applied early heading
- Strip trials in farmer fields, repeated 2 X
- Low to moderate disease pressure

# Oat Yield Response

Untreated = 158 bu/ac, Treated = 169 bu/ac a 7% increase



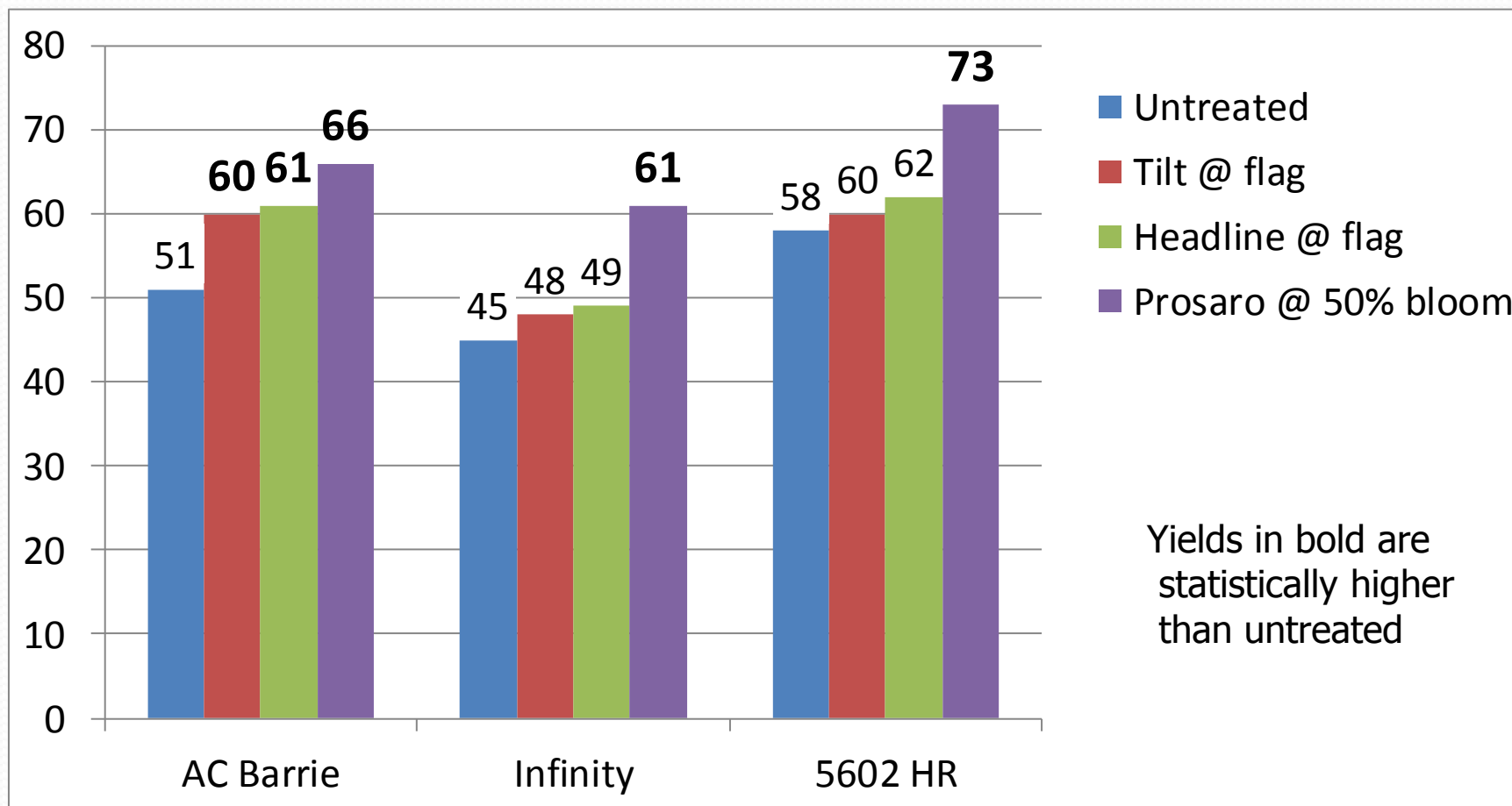
# Fungicides for Wheat 2009-2011

applied at flag leaf stage

Variety	Untreated	Tilt	Headline
AC Barrie	58	70*	72*
Infinity	67	73*	75*
2011 6503 HR	73	76	78



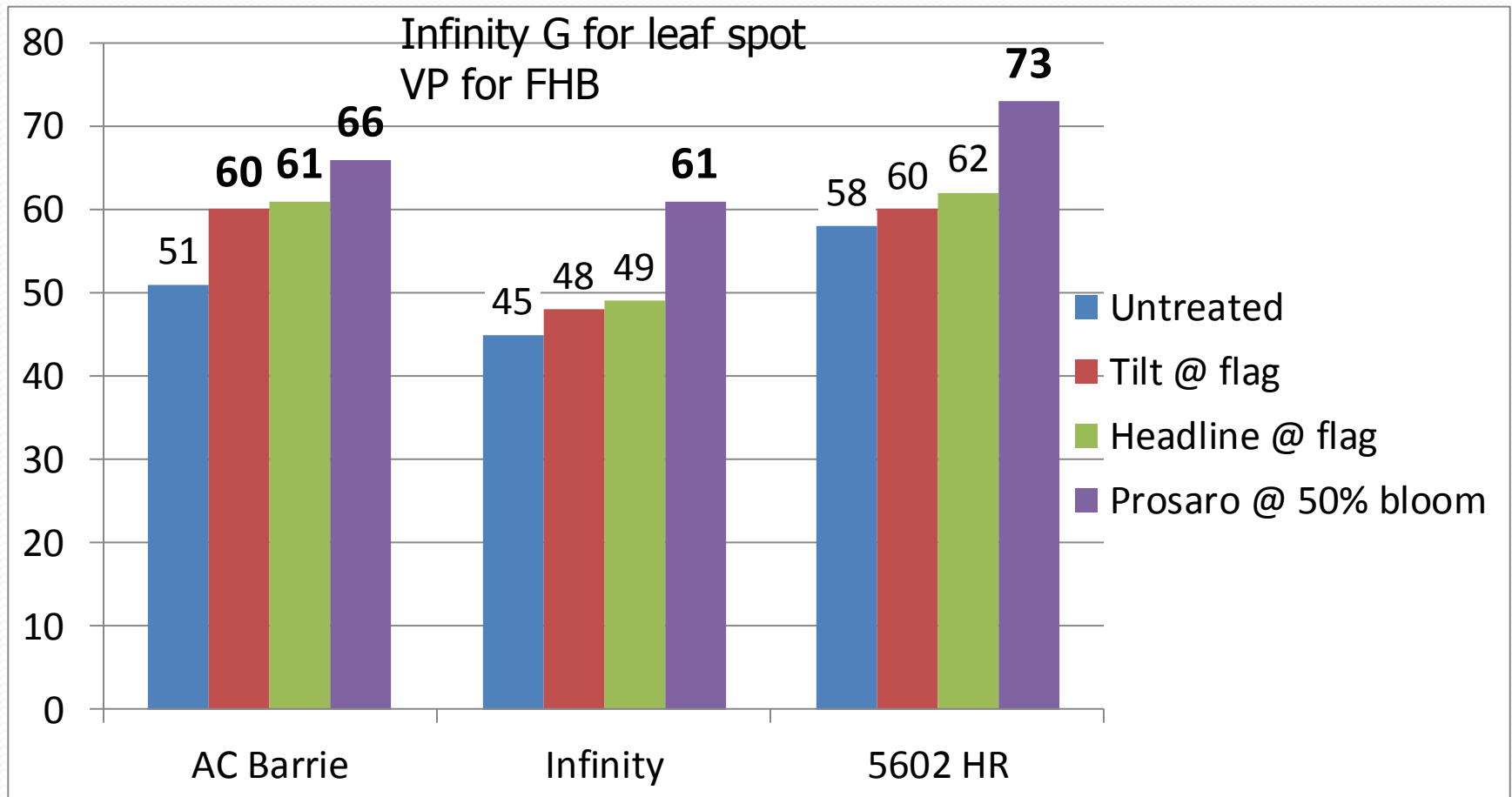
# Fungicides for Wheat 2012 (bu/ac)



# Fungicides for Wheat 2012 (bu/ac)

AC Barrie P leaf spot  
F for FHB

5602 HR G for leaf spot  
F for FHB



# Fungicide Timing on Wheat 2013

IHARF, NARF, WARC, WCA and CLC

- Unity VB and Shaw VB wheat
- Fungicides: Group 11 @ T<sub>1</sub>, Group 3 @ T<sub>2</sub> and T<sub>3</sub>
- Fungicide Timings
  - None
  - T<sub>1</sub>: Flag leaf,
  - T<sub>2</sub>: 75% Head Emergence
  - T<sub>3</sub>: 50% Bloom stage
  - T<sub>1</sub> + T<sub>2</sub>
  - T<sub>1</sub> + T<sub>3</sub>
  - T<sub>1</sub> + T<sub>2</sub> + T<sub>3</sub>

# Fungicide Timing and Leaf Spot Ratings

0= no disease to 12= up to 50% of flag area and >50% of lower leaf area affected.

Treatment	IHARF	NARF	WARC
Check	8.7	7.2	7.1
T <sub>1</sub>	7.6	5.0	5.1
T <sub>2</sub>	8.1	3.1	5.1
T <sub>3</sub>	8.0	3.2	5.4
T <sub>1</sub> + T <sub>2</sub>	7.5	2.7	4.0
T <sub>1</sub> + T <sub>3</sub>	7.5	1.5	4.8
T <sub>1</sub> + T <sub>2</sub> + T <sub>3</sub>	7.7	1.7	4.7

# Fungicide Timing and % of Heads Infected by Fusarium Head Blight

Treatment	IHARF	NARF	WARC
Check	51	83	6
T <sub>1</sub>	41	86	2
T <sub>2</sub>	33	73	2
T <sub>3</sub>	17	77	1
T <sub>1</sub> + T <sub>2</sub>	32	76	1
T <sub>1</sub> + T <sub>3</sub>	16	82	3
T <sub>1</sub> + T <sub>2</sub> + T <sub>3</sub>	11	79	1

# Fungicide Timing and *Stagnospora nodorum* (glume blotch) rating at WARC

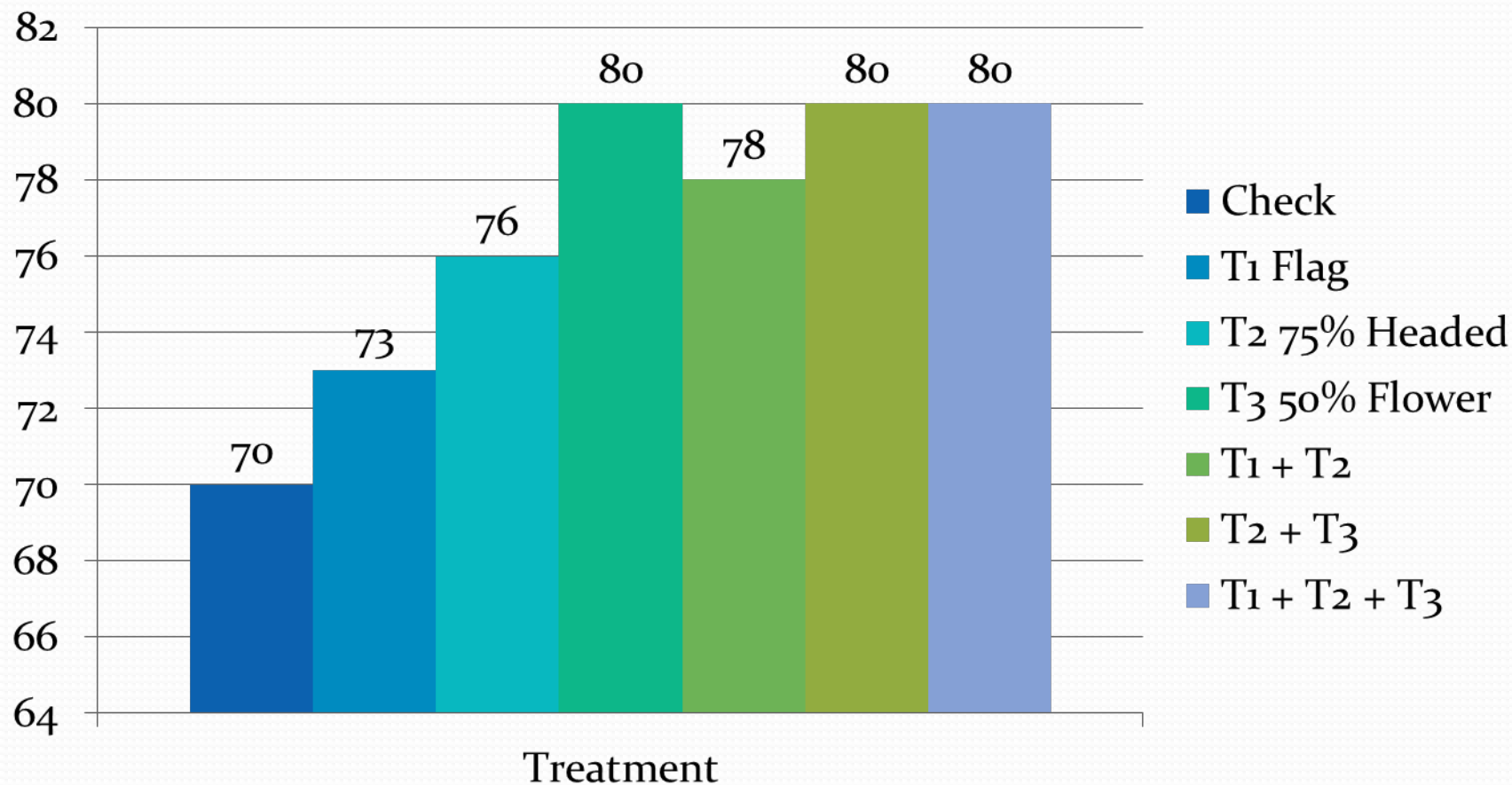
Treatment	Disease Rating
Check	7.0
T <sub>1</sub>	9.2
T <sub>2</sub>	5.8
T <sub>3</sub>	3.4
T <sub>1</sub> + T <sub>2</sub>	4.8
T <sub>1</sub> + T <sub>3</sub>	2.8
T <sub>1</sub> + T <sub>2</sub> + T <sub>3</sub>	2.7

# Fungicide Timing and Wheat Yield (bu/ac)

Treatment	IHARF	NARF	WARC
Check	79c	65b	67c
T <sub>1</sub>	78c	76ab	75bc
T <sub>2</sub>	80bc	70ab	77abc
T <sub>3</sub>	83ab	72ab	84ab
T <sub>1</sub> + T <sub>2</sub>	80abc	68ab	86a
T <sub>1</sub> + T <sub>3</sub>	84a	74a	83ab
T <sub>1</sub> + T <sub>2</sub> + T <sub>3</sub>	84a	74a	81ab

# Fungicide Timing and Wheat Yield 2013

(avg of 3 locations in 2013)





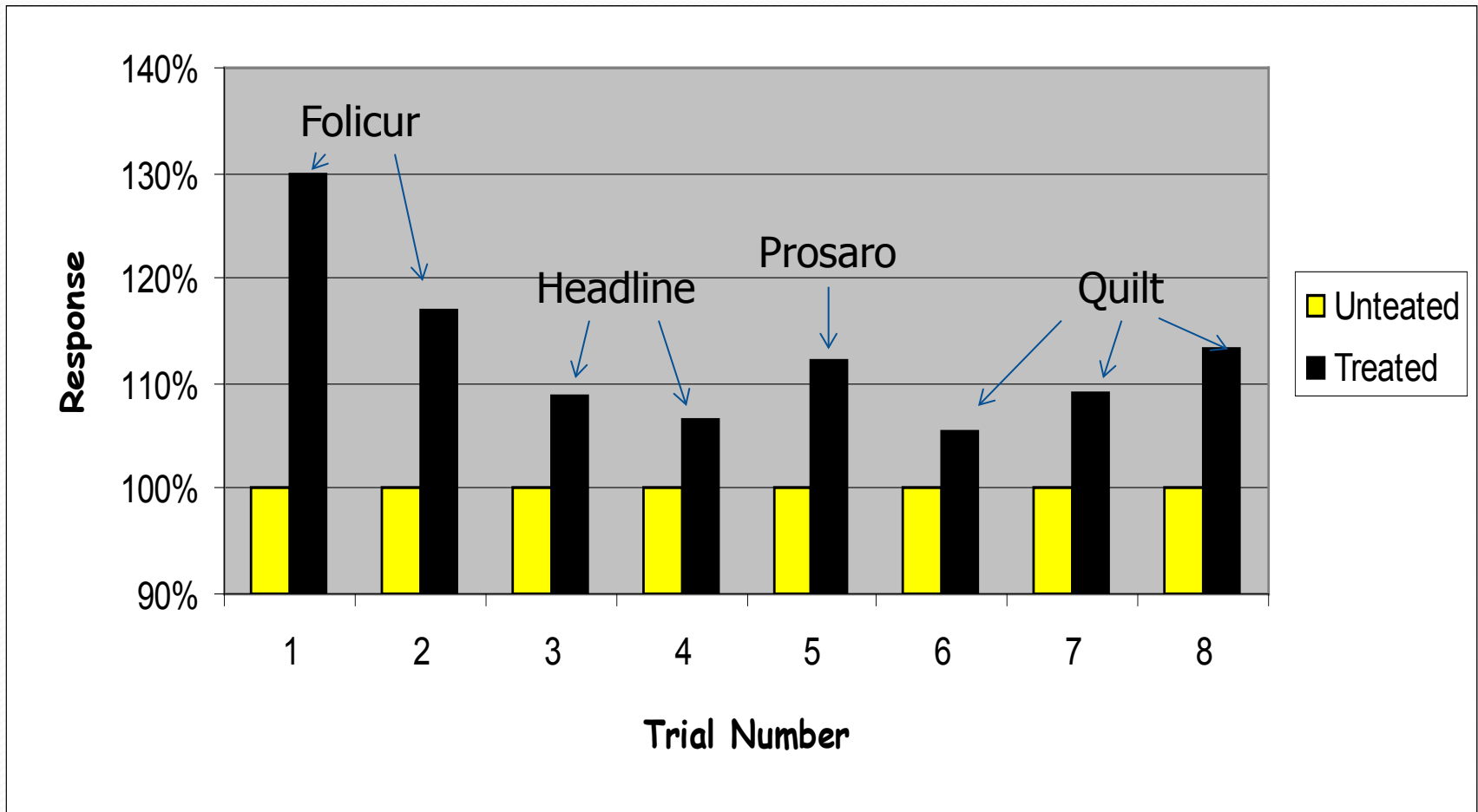
# Input Supplier Wheat Fungicide Trials near Tisdale (not NARF)



- 3 Quilt, 2 Headline, 2 Folicur, 1 Prosaro = 8 trials
- Headline and Quilt at flag
- Folicur and Prosaro at heading to 50% bloom

# Wheat Yield Responses

Untreated = 51 bu/ac; Treated = 57 bu/ac



# Summary; Wheat Diseases

- Critical to know what diseases to target
- Fusarium a bigger yield robber than leaf diseases in 2012 and 2013.
- Optimum timings don't appear to differ between varieties?
- Difficult to justify 2 applications.



# Summary; Wheat Diseases

- Use resistant variety for leaf disease and fungicides for fusarium.
- Start applications at 75% head emergence so can finish by 50% flower?



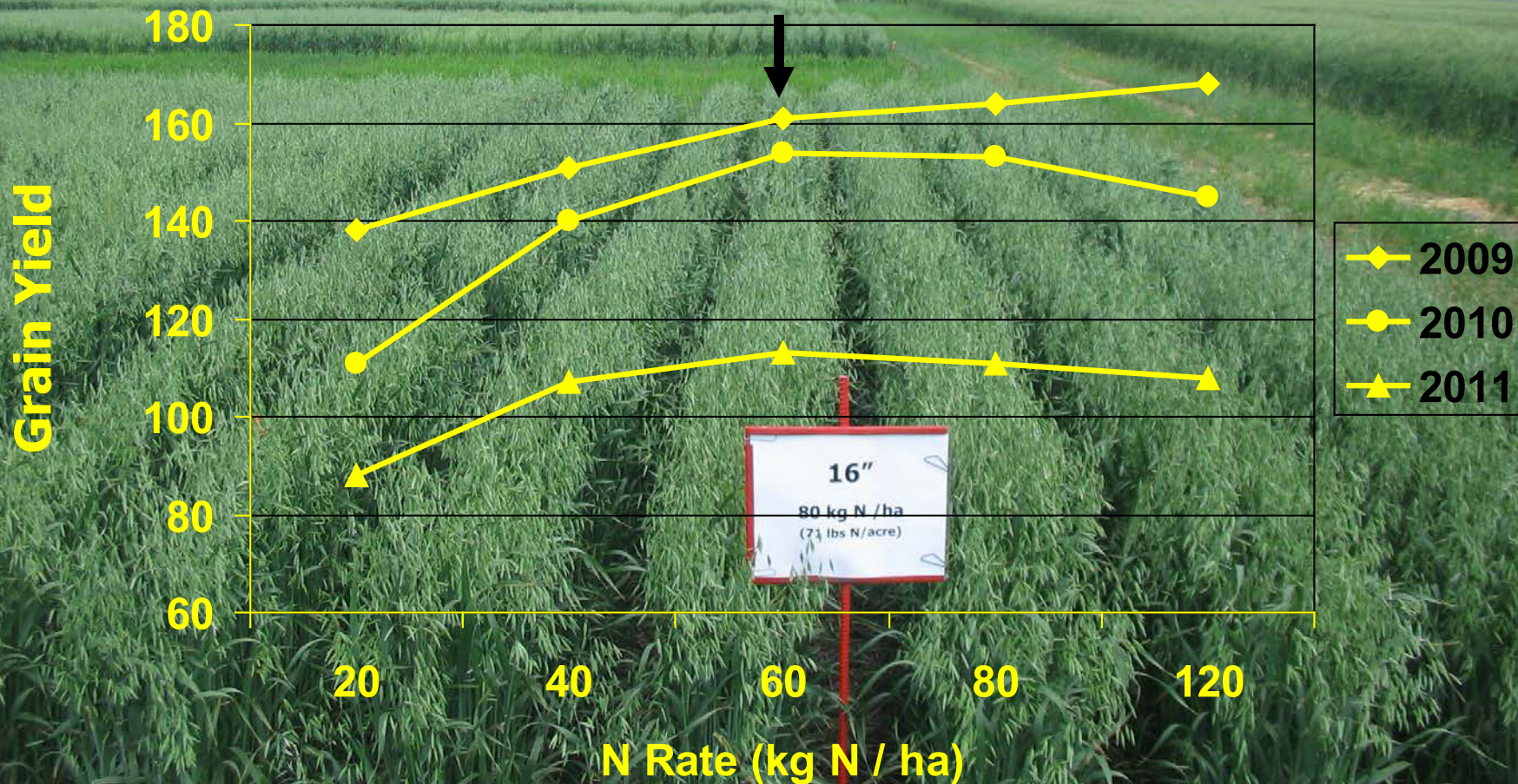
# Fertilizer Management

- Oat and Wheat N Responses

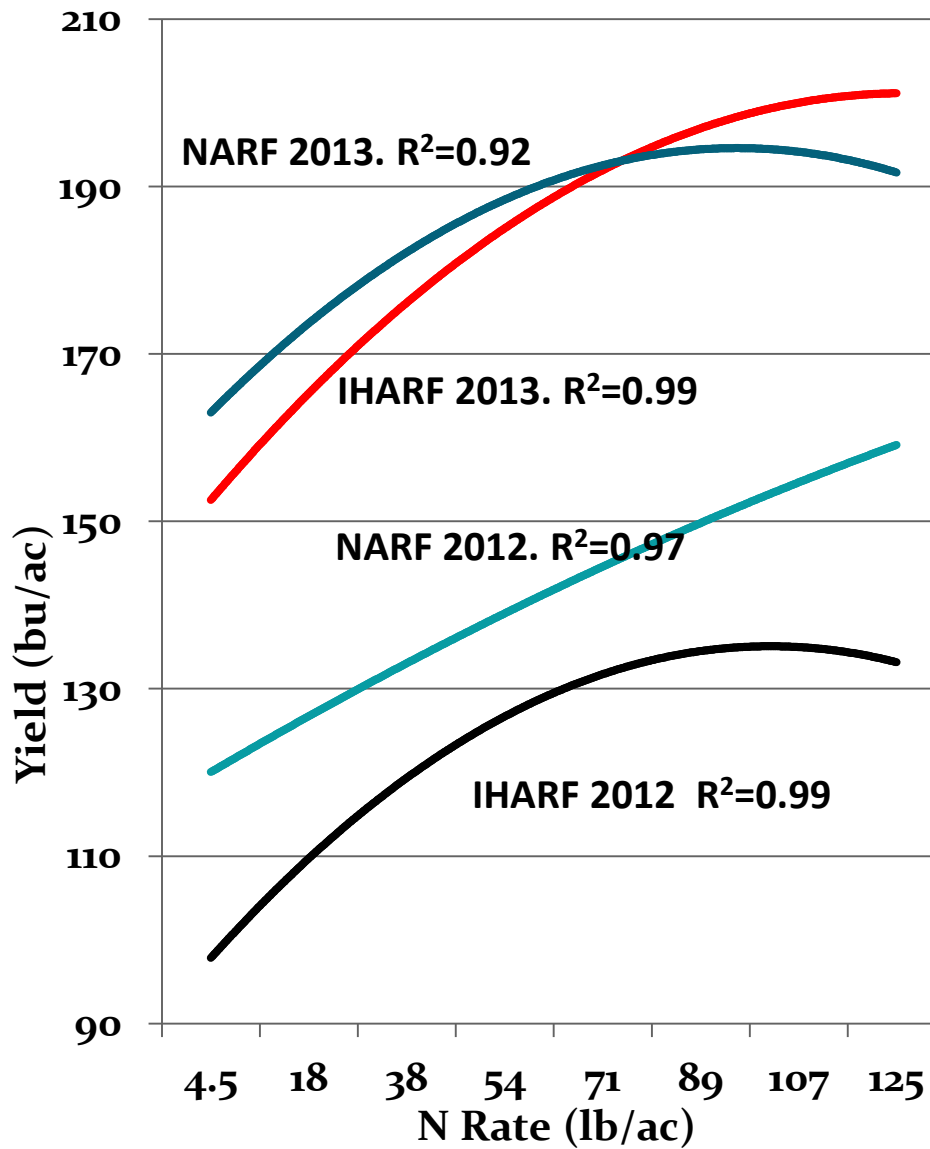


# Optimum N Rates at IH, 2009-11

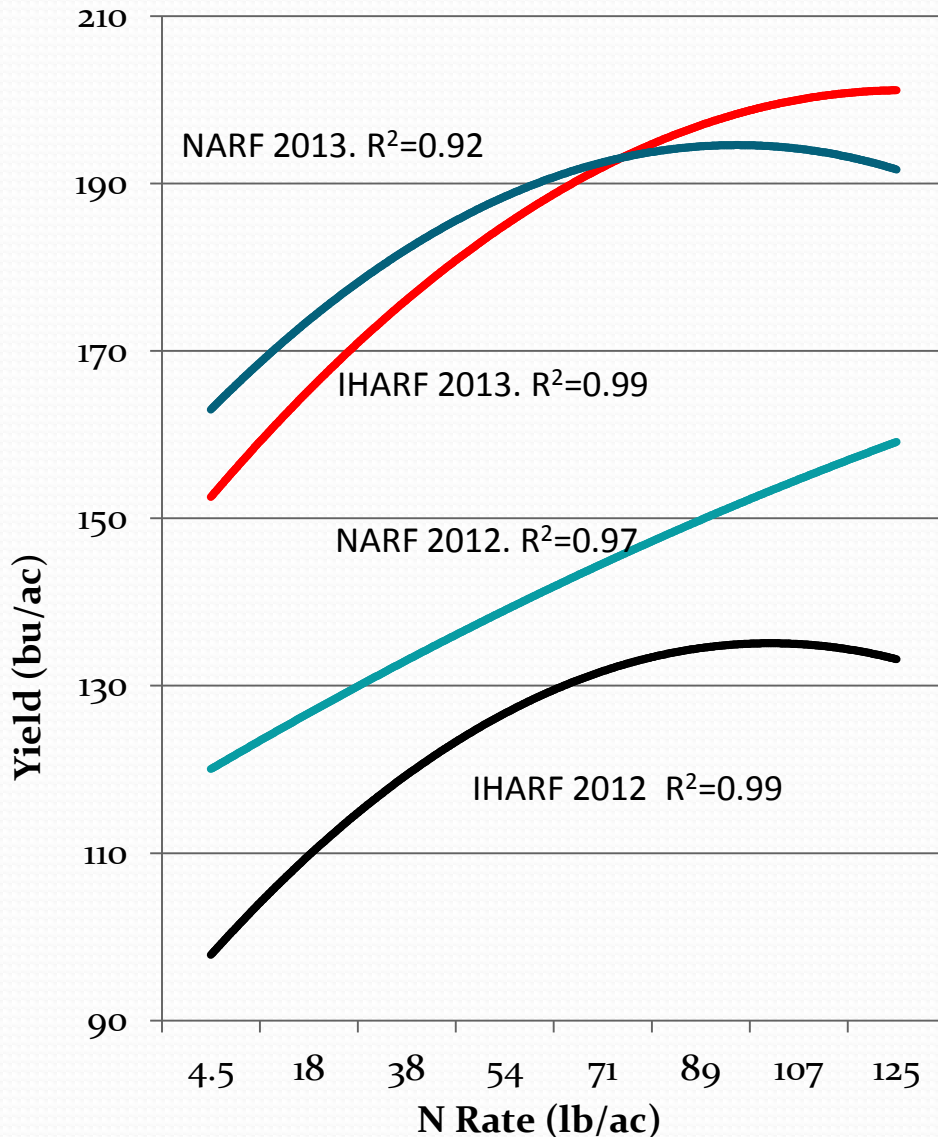
~Optimum N Rate @ 60 kg N/ha



# Oat Yield Response to N at IHARF and NARF in 2012 & 2013



# Oat Yield Response to N at IHARF and NARF in 2012 & 2013



After a series of years of favorable moisture and high yield, optimum N rates have increased, from 60lb/ac in 2009-11 to 80 or 100+ Lb/ac in 2012-13

Soil fertility levels appear to change over time, increasing when yields are low and decreasing in high yield cycles.



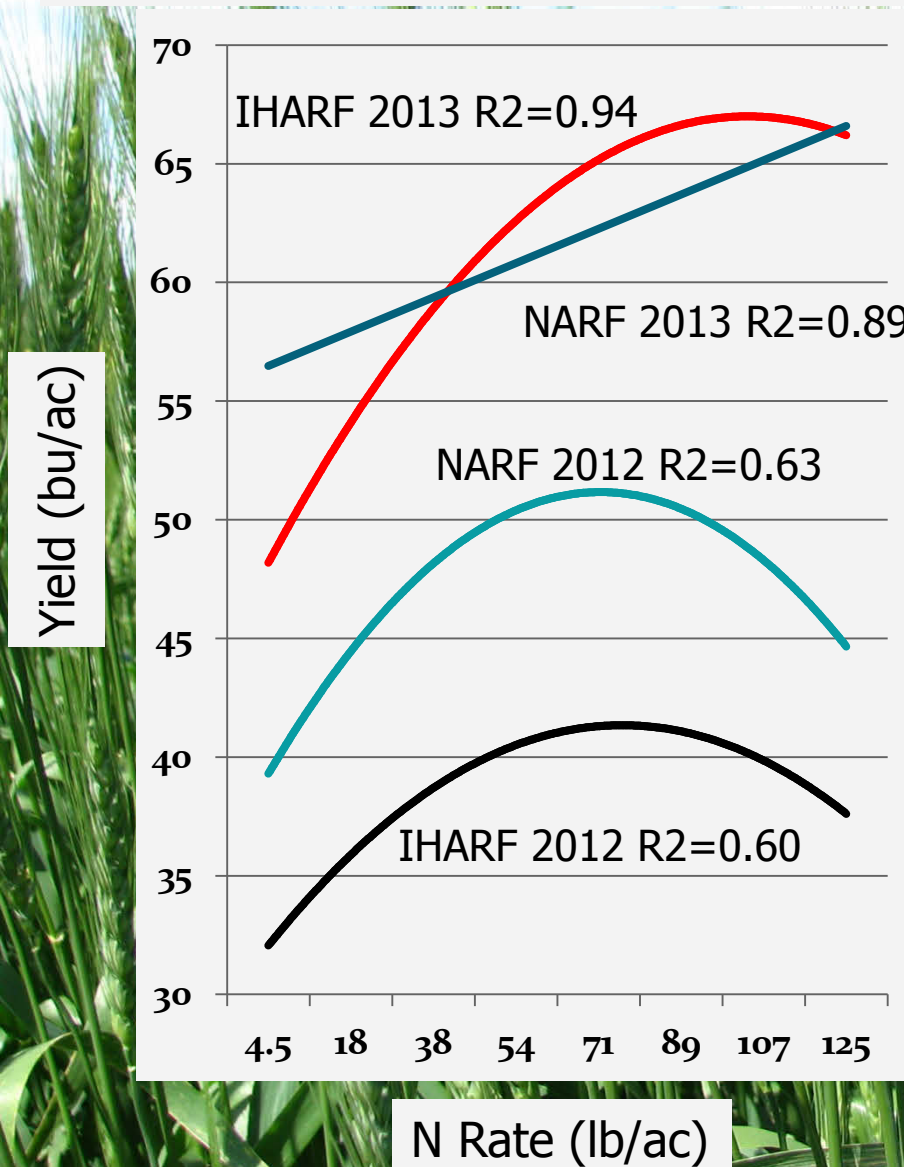
# Oat Summary

- When yields are less than what we target with N
  - 60 lb/ac of N should be enough
  - Use oat to glean N after more intensively managed canola or wheat
- When yield is at or above target yields
  - Require higher N rates (80-100 lb/ac) to optimize yield.

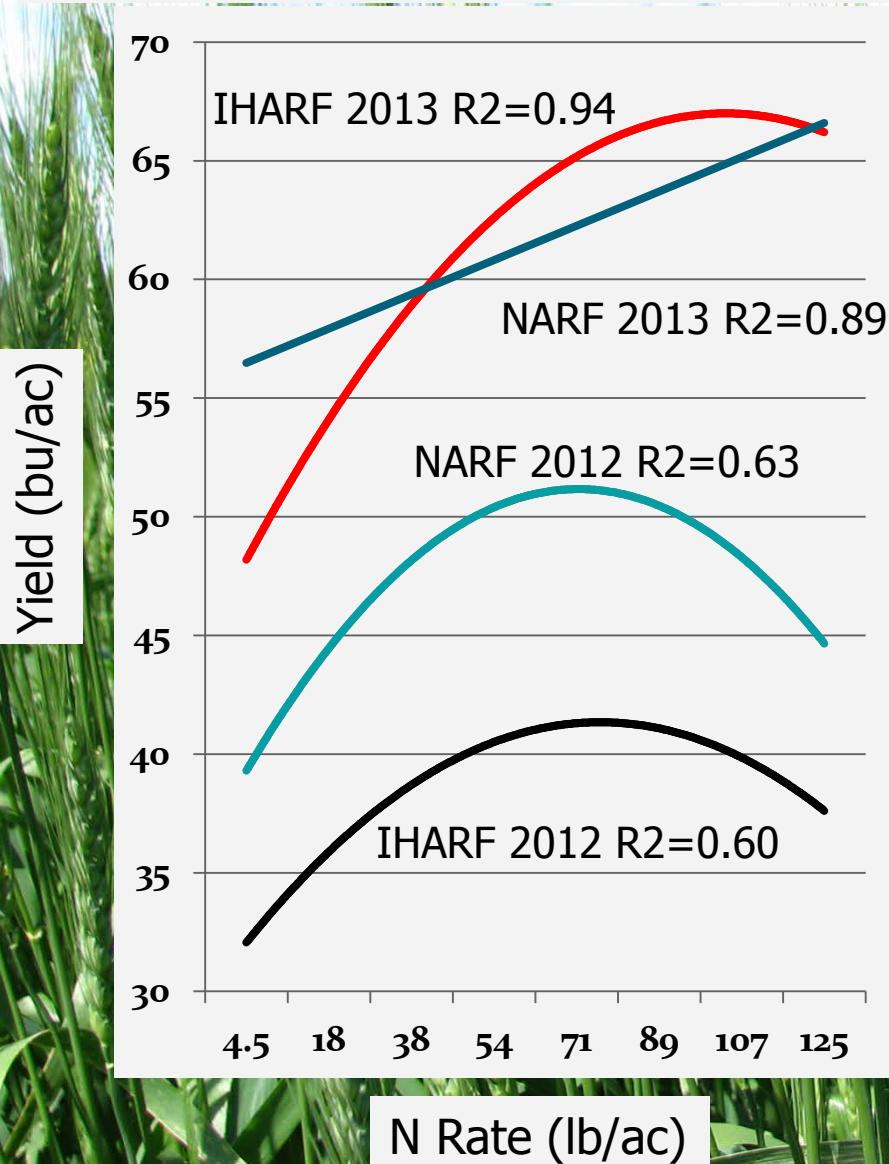
# Oat Summary

- On poorly managed or low organic matter fields
  - Require higher N rates
  - May need to rebuild soil nutrient supplies
- For 2014 consider higher N rates,
  - but be aware that excess N can reduce test weight, and crop may not meet milling quality

# Wheat Response to N at IHARF and NARF 2012 & 2013



# Wheat Response to N at IHARF and NARF 2012 & 2013

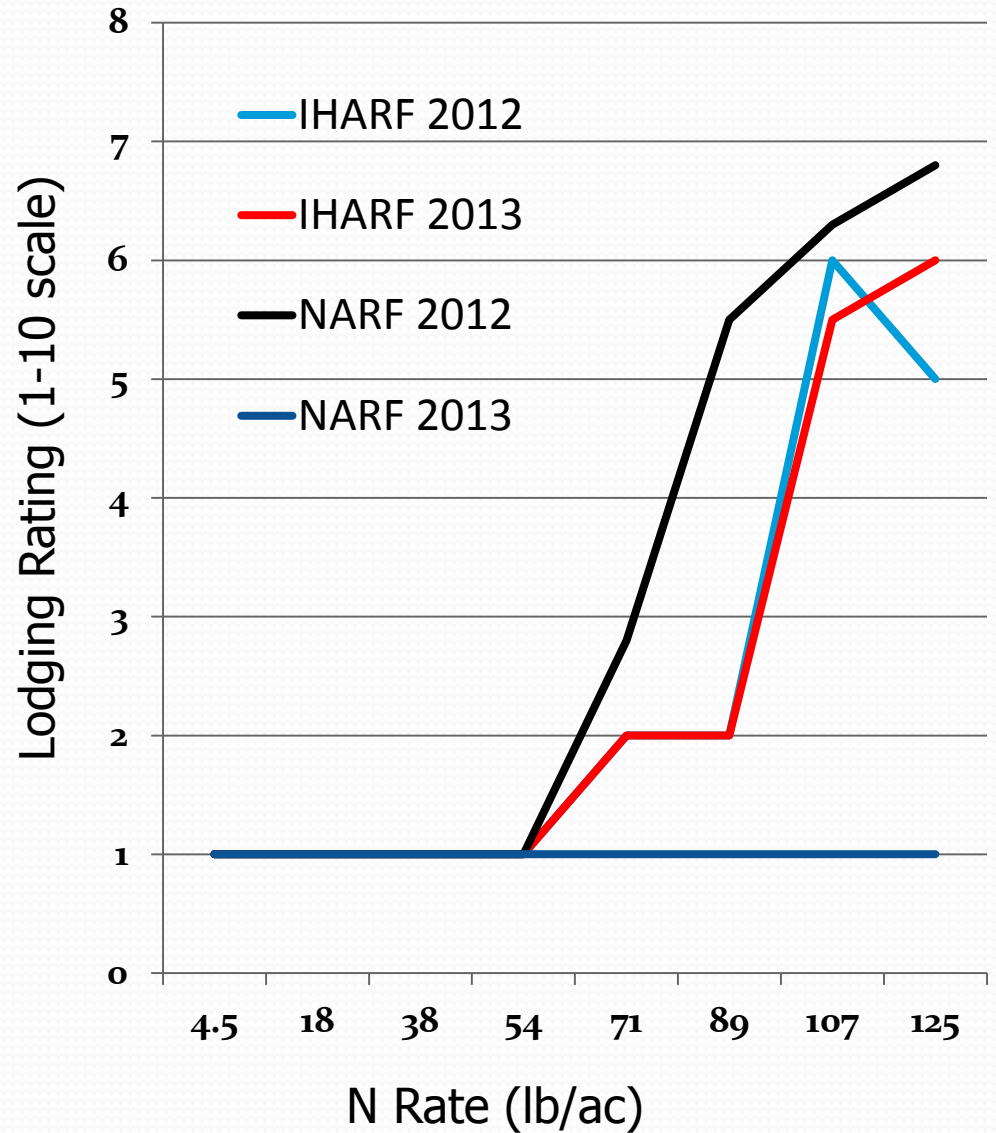
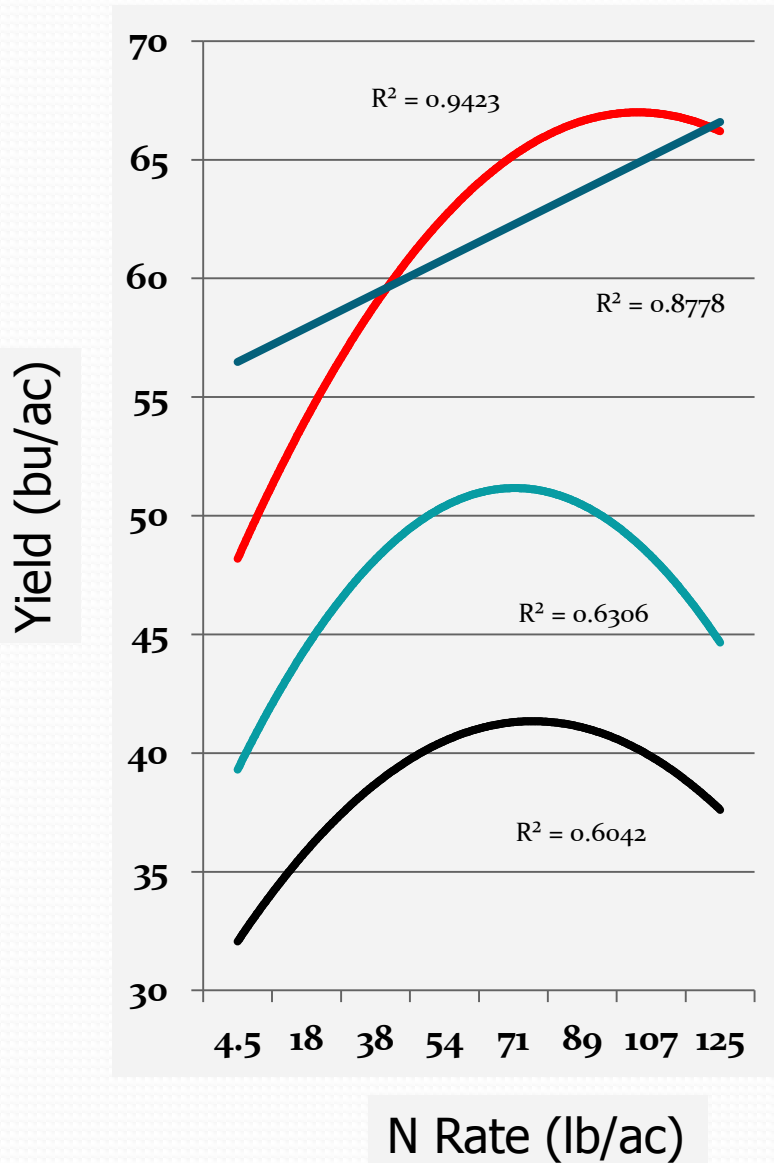


Optimum was about 60 lb/ac N in 2012, and 80 Lb/ac at IHARF in 2013 but not NARF 2013.

Why?

# Wheat Yield and Lodging Response to N

## IHARF and NARF 2012 & 2013



# Lodging Likely Limits Yield Responses to Fertilizer More Than Anything Else!



# Strategies to Overcome Lodging

- Lodging resistant varieties
- Restrict N Rates
- Growth Regulators
  - 2012 Results look promising
  - Expand research in 2013



# Growth Regulators

- Cycocel
  - Restricts cell elongation to reduce crop height (no root shortening)
  - New formulations are more reliable
  - Most effective at 3 leaf stage
- 2013 trials
  - Melfort and Indian Head
  - Zadoks 2.1; or 3.1; split applications
  - 100%, 125% and 150% fertility levels



# Growth Regulator (Manipulator) Effect on Wheat Height (inches), IHARF 2013

	100 Fert	125 Fert	150 Fert	Mean
Check	39.5	39.1	38.8	<b>39.1</b>
Zadoks 2.1	36.5	36.7	35.7	<b>36.3</b>
Zadoks 3.1	<b>32.7</b>	<b>32.6</b>	<b>32.7</b>	<b>32.7</b>
Zadoks 2.1 & 3.1	33.5	33.6	33.3	<b>33.5</b>
Mean	35.6	35.5	35.1	

100 Fert = 90-28-14-14 N-P-K-S

# Growth Regulator (Manipulator) Effect on Wheat Height (inches), NARF 2013

	100 Fert	125 Fert	150 Fert	Mean
Check	34.5	35.9	36.8	35.4
Zadoks 2.1	34.3	35.3	35.5	35.0
Zadoks 3.1	<b>30.5</b>	<b>30.3</b>	<b>31.1</b>	<b>30.6</b>
Zadoks 2.1 & 3.1	30.8	32.7	34.3	32.6
Mean	<b>32.5</b>	<b>33.5</b>	<b>34.4</b>	

100 Fert = 90-28-14-14 N-P-K-S

# Growth Regulator (Manipulator) Effect on Wheat Yield (bu/ac), IHARF 2013

	100 Fert	125 Fert	150 Fert	Mean
Check	70.0	72.1	75.4	<b>72.5</b>
Zadoks 2.1	76.8	77.5	84.1	<b>79.5</b>
Zadoks 3.1	81.3	84.9	89.1	<b>85.1</b>
Zadoks 2.1 & 3.1	80.8	80.8	88.6	<b>80.0</b>
Mean	<b>77.2</b>	<b>78.8</b>	<b>84.1</b>	

100 Fert = 90-28-14-14 N-P-K-S

# Growth Regulator (Manipulator) Effect on Wheat Yield (bu/ac), NARF 2013

	100 Fert	125 Fert	150 Fert	Mean
Check	46.1	49.2	54.9	50.1
Zadoks 2.1	48.1	48.7	53.6	50.1
Zadoks 3.1	45.8	52.1	51.9	49.9
Zadoks 2.1 & 3.1	40.4	49.6	56.6	48.2
Mean	<b>45.2</b>	<b>49.9</b>	<b>54.2</b>	

100 Fert = 90-28-14-14 N-P-K-S

# Plant Growth Regulator Summary

- Much higher yields are possible with PGR AND higher fertilizer rates.
- How reliable are responses to PGR?
- Are additional yield increases possible by combining PGR, Fert and higher plant densities, precision management)?
- Will other factors become limiting (micros, water)?
- What about PGR on other crops?



# Some Take Home Messages

- Consider Oat to ‘Glean’ excess N from previous years in lower yield cycles
- Fertilizer Rates need to Increase in High Yield Cycles
- May need lodging resistant wheat to optimize N
- Growth Regulators may work better than lodging resistance
- Use resistant cultivars to avoid fungicides
- Know what diseases to target with fungicides
  - Resistant cultivars for wheat leaf diseases, fungicides for fusarium

# Acknowledgements



**Saskatchewan  
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**NARF and AAFC Field Day July 23, 2014**

