

Fusarium: A Historical Perspective with Implications for the Future

Jochum Wiersma



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Industry Wants

Stable supply of HRSW with adequate grain protein and test weight and little to no DON at **no extra cost.**



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Growers' Needs

A positive net return for every acre he or she farms with **a crop** that fits in their respective agro-ecological niche.

(and don't think for a minute that they can afford to be loyal to wheat, durum or barley)



My Roots

- I'm the product of Van der Plank, Zadoks, and Parlevliet:
 - Scouted dad's winter wheat for EPIPARE
 - Disease breeding major @ WAU



I should have remembered....

‘Son....do you plan to graduate and get your degree.’

Don McVey, Fall of 1991



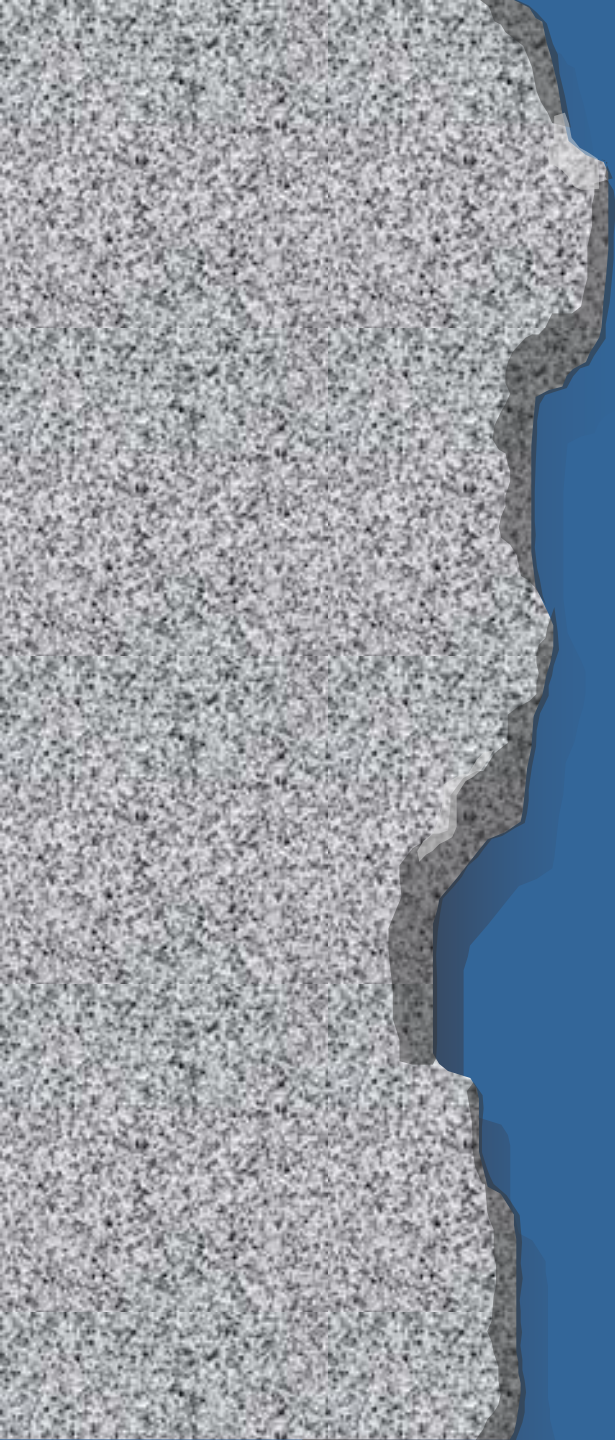
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Desperate Times...

- In response to the 93 and 94 FHB epidemics
- 3-year appointment
- Grower access expected (= check-off dollars)





Fusarium Head Blight or Scab

Wheat and Barley's Armageddon?

Foliar Fungicides

- Labels:
 - **Wheat:**
 - Folicur (tebuconazole)- section 18 label;
 - Benlate (benomyl) + Mancozab -section 2ee label;
 - **Barley:**
 - Folicur (tebuconazole)- section 18 label;
- Limitations:
 - **Price;**
 - **Efficacy & application technology (at best 50% suppression);**
 - **Inability to predict epidemics.**

Genetics

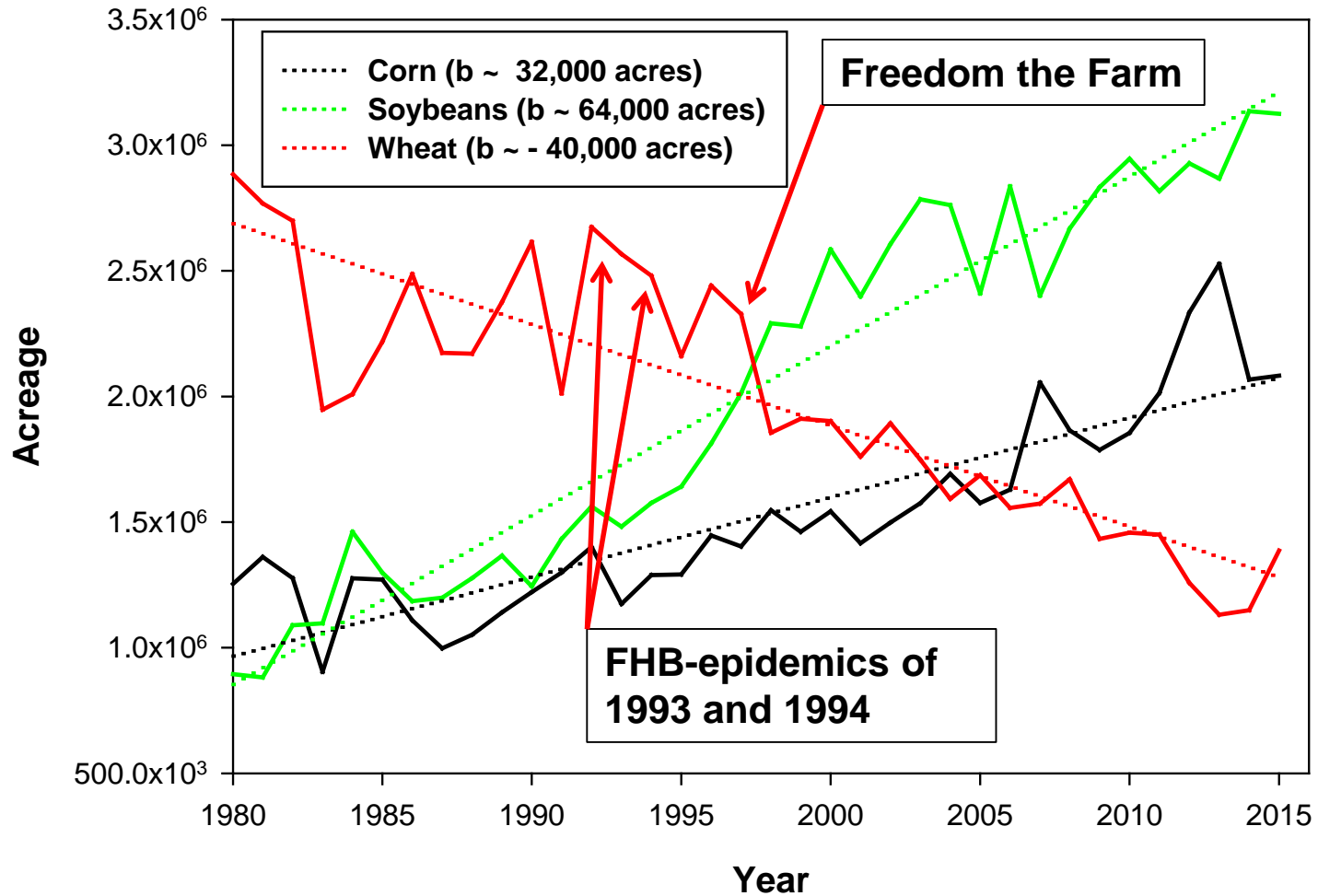
- In 1929 J.J. Christiansen, E.C. Stakman and F.R. Immer concluded that “the only effective method of controlling wheat scab is to grow resistant varieties”;
- Limitations:
 - No resistance to the initial infection/immunity found within the species (yet);
 - Long-term approach;
 - Intermediate products will have (severe) deficiencies in other key areas.

Stop Gap Measures

- P2375 dominant for nearly a decade
- Burn residue/ Moldboard plow
- Bacup, McVey, Sharpshooter
- Soybeans (but we can't blame scab for the rise in acreage alone)



The Slow Slide

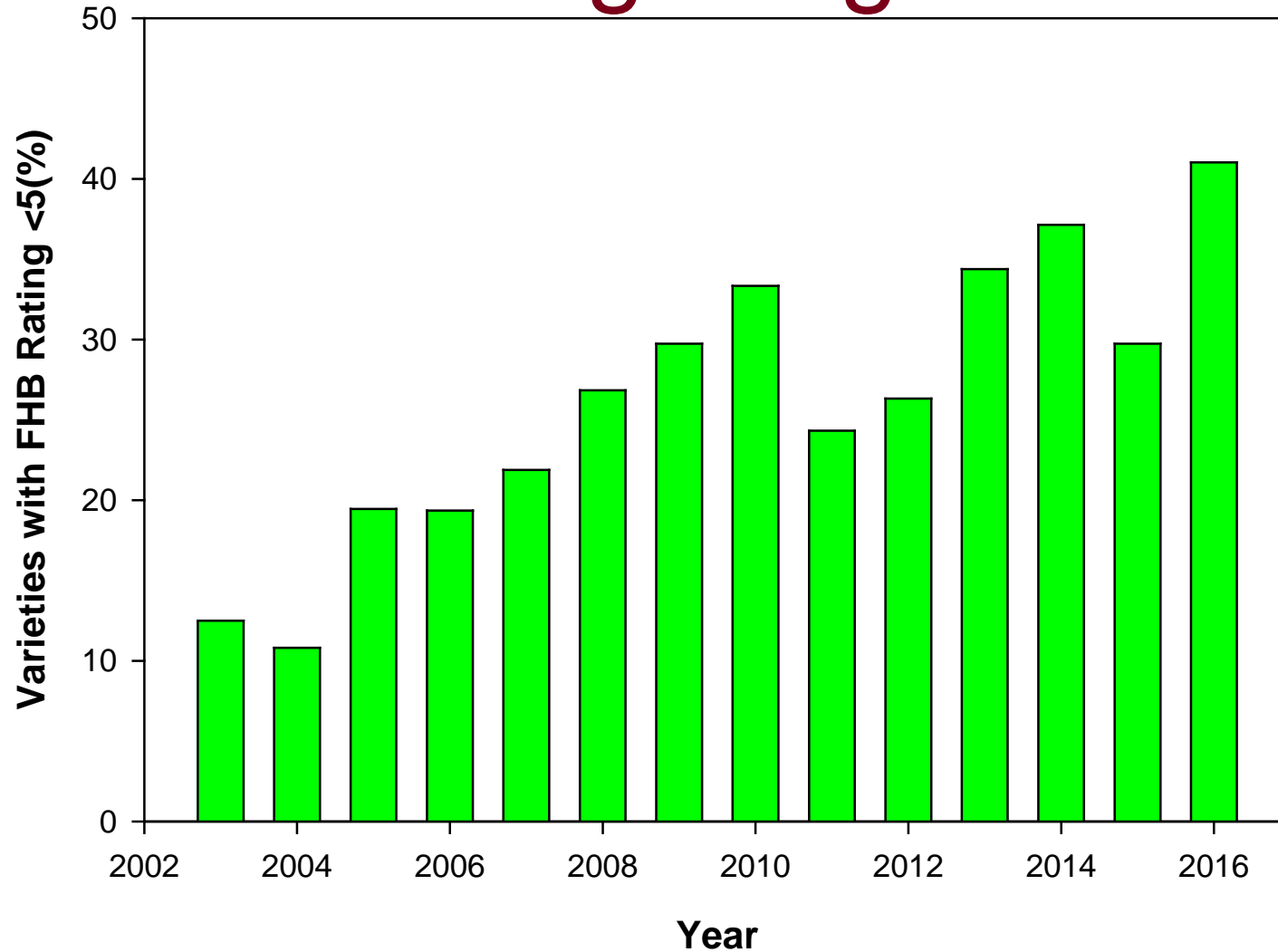


Turning into Nozzle Heads

- PTSD (post traumatic scab disorder)
 - Everything was blamed on scab even when it clearly wasn't the cause.
- Applications at F10.51 after 1998 slowly being adopted.
 - Cost was greatest barrier to adoption.



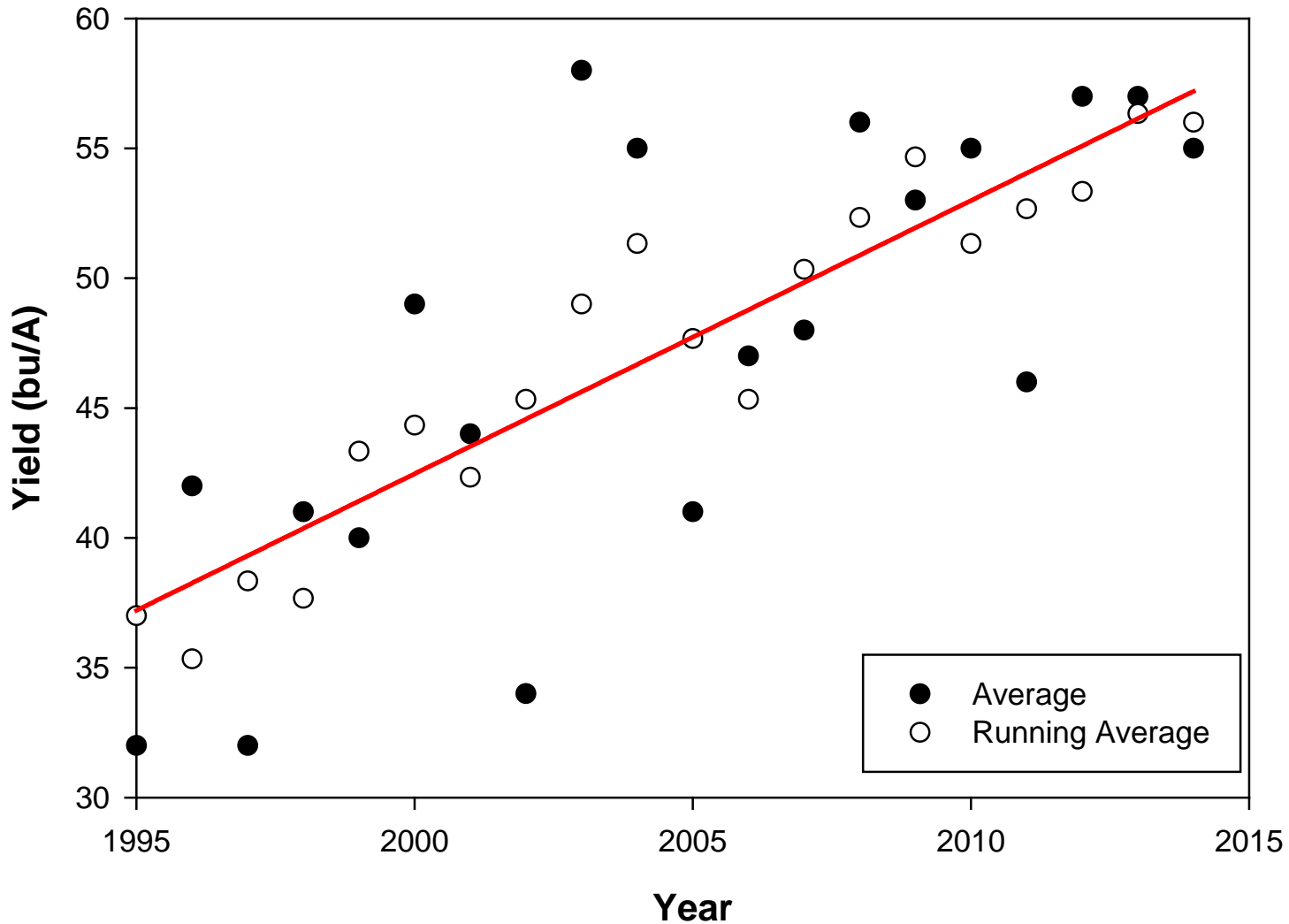
Making Progress



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Making Progress (or so it seems)



Towards the Whole Picture

- Wiersma, J.J. and C.D. Motteberg. 2004. Evaluation of five fungicide application timings for control of leaf spotting diseases and Fusarium Head Blight in Hard Red Spring Wheat. Can. J. Plant Pathol. Vol. 27: 25-27.
- Len Francl's adaptation and expansion of Zadoks' EIPRE to RRV has been a crucial learning/validation tool for disease risks.



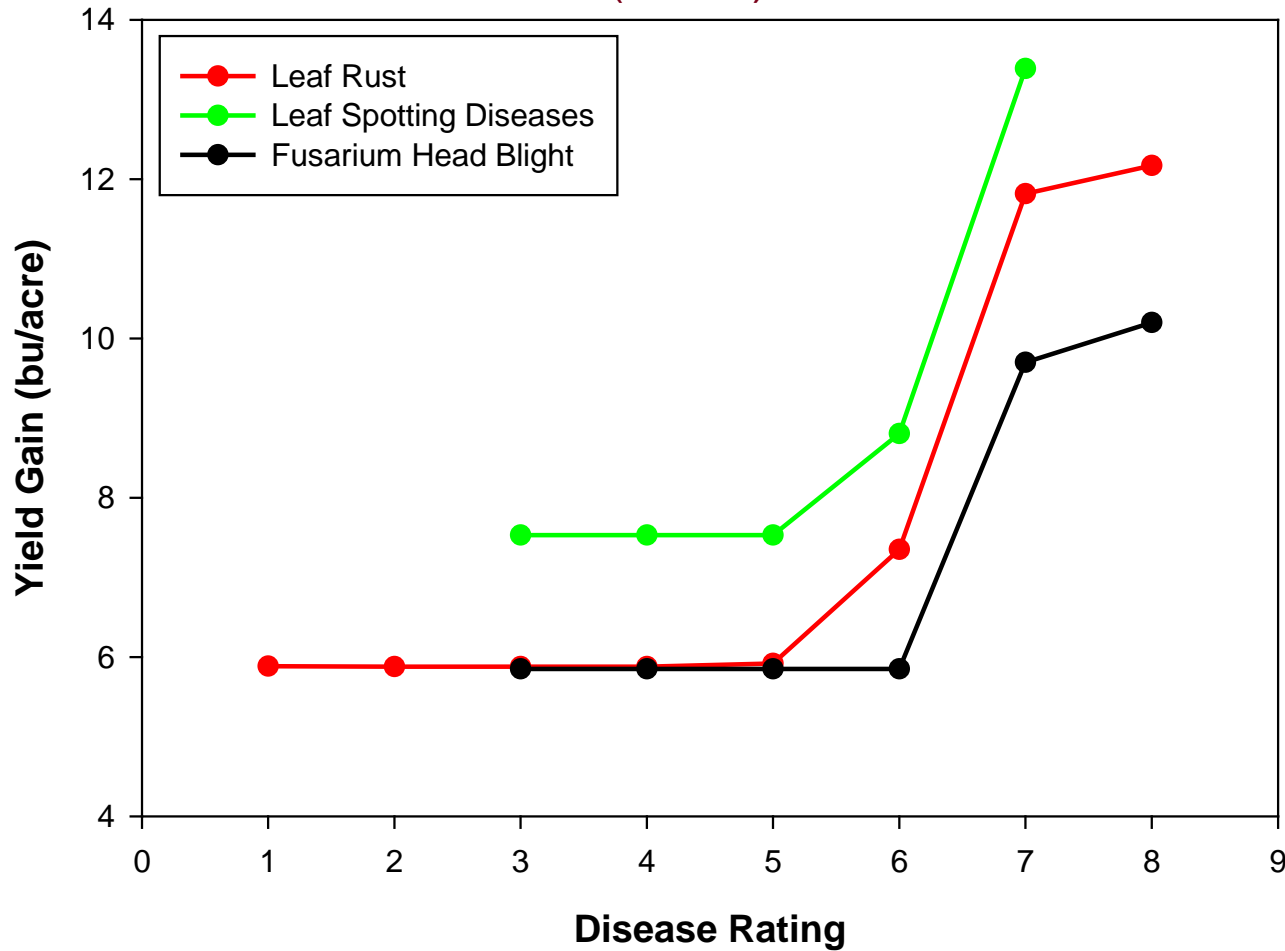
Warning: Messy Data Ahead

- Paired VT at 4 locations since 2004
 - No fungicide (conventional)
 - Fungicide @ F5, F9, F10.51 (intensive)
- $\Delta_{\text{yield}} = \text{Yield}_{\text{Intensive}} - \text{Yield}_{\text{Conventional}}$
- 4 parameter logistic regression on the $\bar{\Delta}_{\text{yield}}$ per disease
 - Highly unbalanced dataset makes that that I need to use means across varieties and environments



Nozzle Heads

(Part II)



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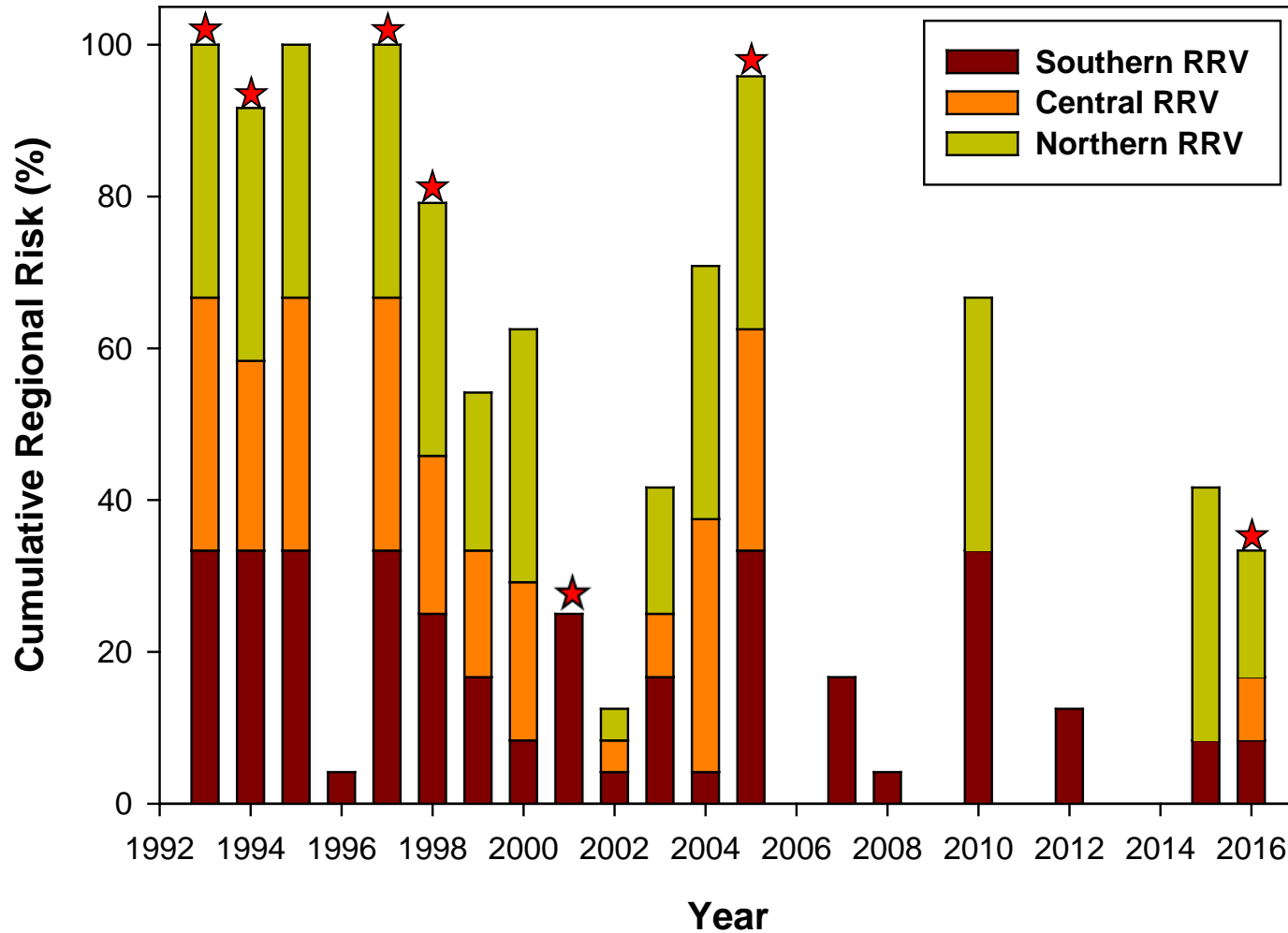
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Bang For My Buck

- We gain more bushels from control of leaf spotting diseases > leaf rust > Fusarium head blight
- Yield responses don't get significantly bigger until rating of 5 or higher



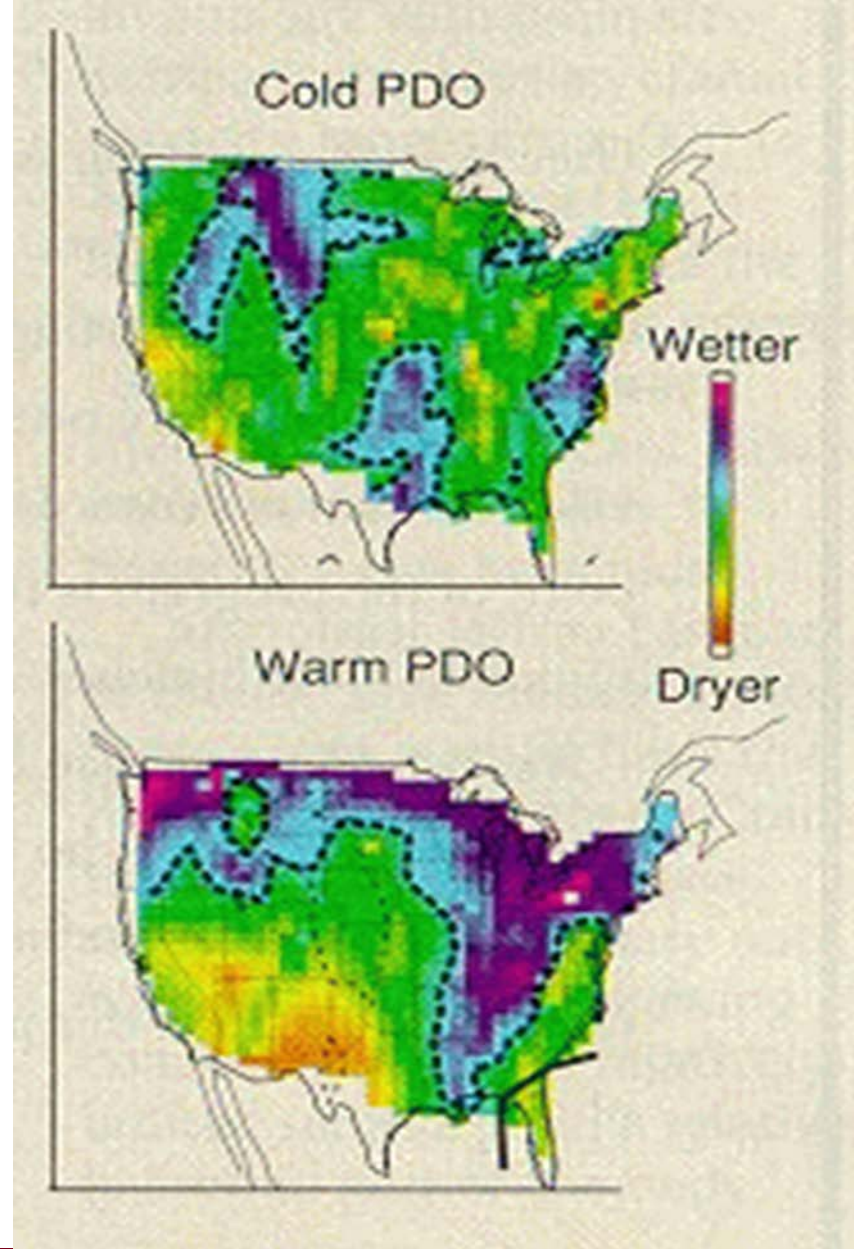
The Rearview Mirror



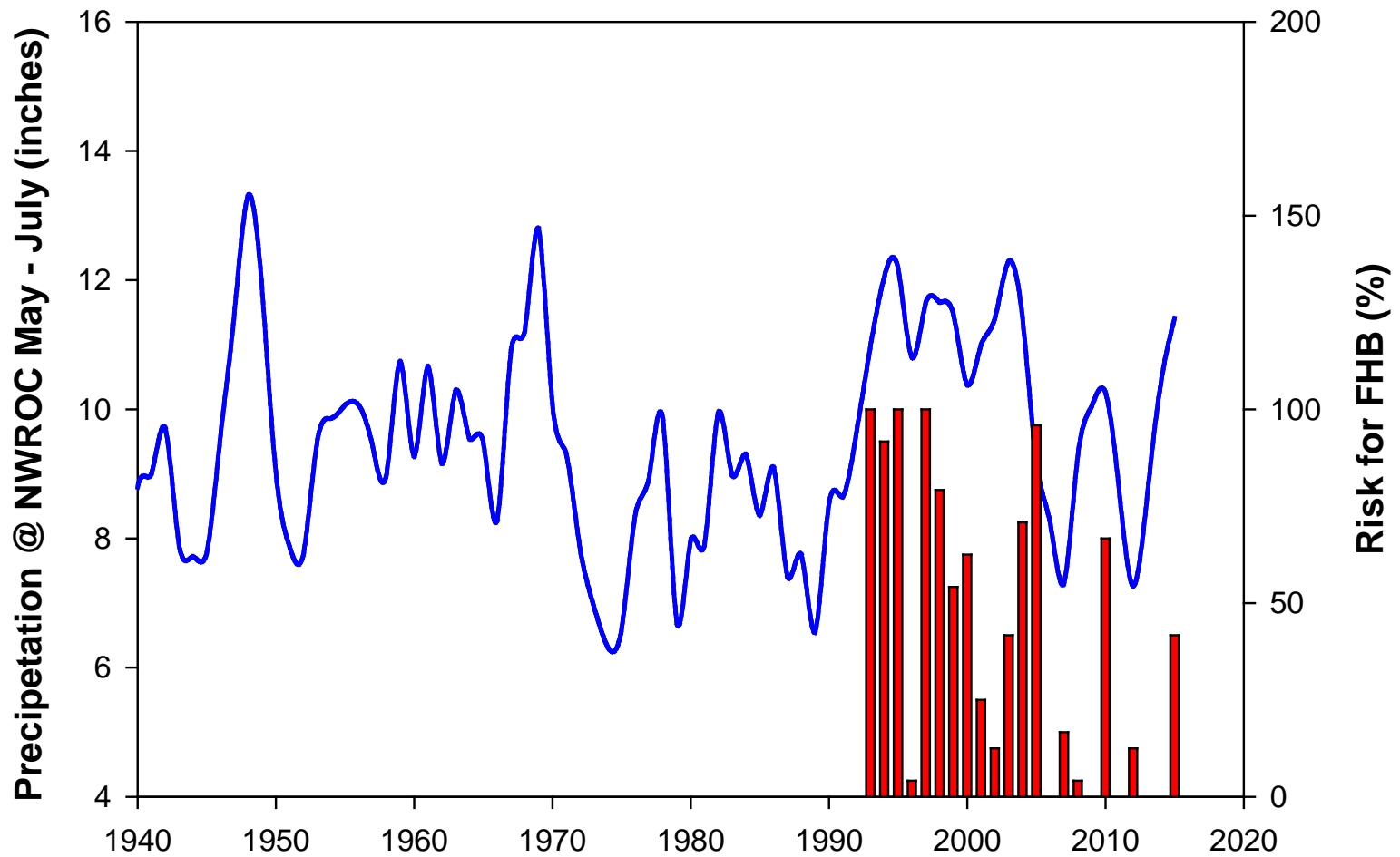
What Worries Me

(Part 1)

- Pacific Decadal Oscillation
 - Wet vs. dry cycles in Northern Great Plains
 - Explains, for example, the rise and fall of Devils Lake



The Long View

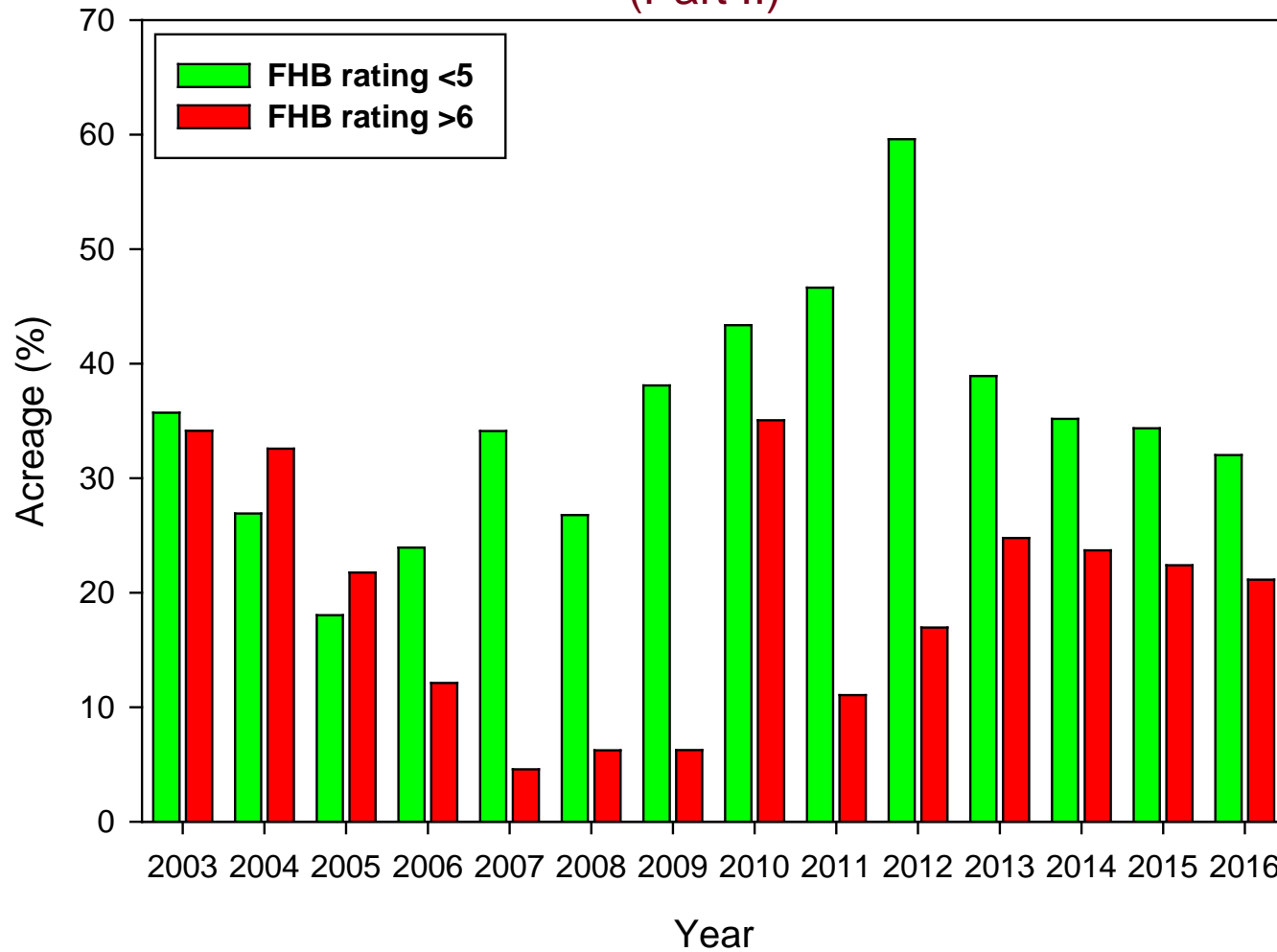


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What Worries Me

(Part II)



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What Worries Me

(part III)

- Climate is moving to more unfavorable temperatures and precipitation patterns
 - Wetter springs (=delayed planting)
 - Warmer June (=diseases)
- Shifts to pathogens that favor warmer conditions:
 - CRR -> FCR
 - *F. culmorum* -> *F. graminearum*
- Increase in CO₂ concentration offsets some of the yield losses due to heat stress

Table 4. Linear trends in temperature and precipitation for the variables included in the multiple regression models for each barley site.

	Linear trend (1980–2012)
Crookston, MN	May Tx: -3.12°C Jun Tm: 0.69°C Jun P: 3.04 mm
Morris, MN	Jun Tm: 2.08°C Winter P: 7.54 mm
St. Paul, MN	Jul P: -13.04 mm Jun Tx: -0.25°C Jul Tm: 0.48°C Apr P: 14.86 mm

Tx, maximum temperature; Tm, minimum temperature; P, precipitation; MN, Minnesota.

Trends are in $^{\circ}\text{C}$ or mm per 33 years (1980–2012).



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Take Home

- Growers' priorities are:

Bushels>Straw strength>Grain Protein>Diseases

- Misted and inoculated nurseries **absolutely essential** to maintain current level of FHB resistance
- FHB will always be here and rise to the occasion.

**The next wet cycle will show us
whether we have made progress**



A Big Thank YOU!

- Andrew Friskop
- Leon Osborne (the other one)
- David Torgerson
- Madeleine Smith
- Jim Anderson

