Wheat: How Much Appetite for Risk (and Reward) Do You Have?

Agvise Laboratories Winter Seminar

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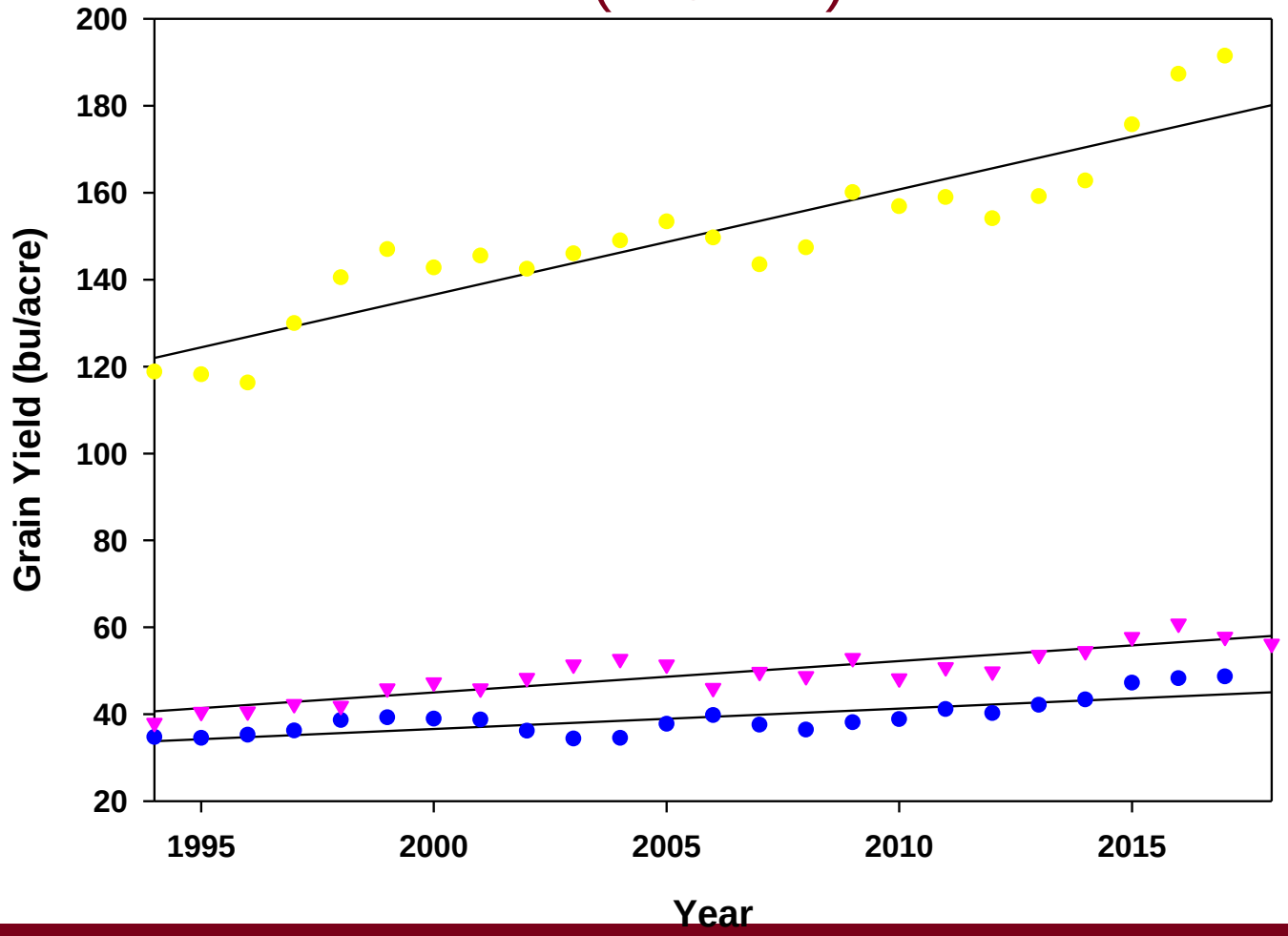
Driven to Discover℠

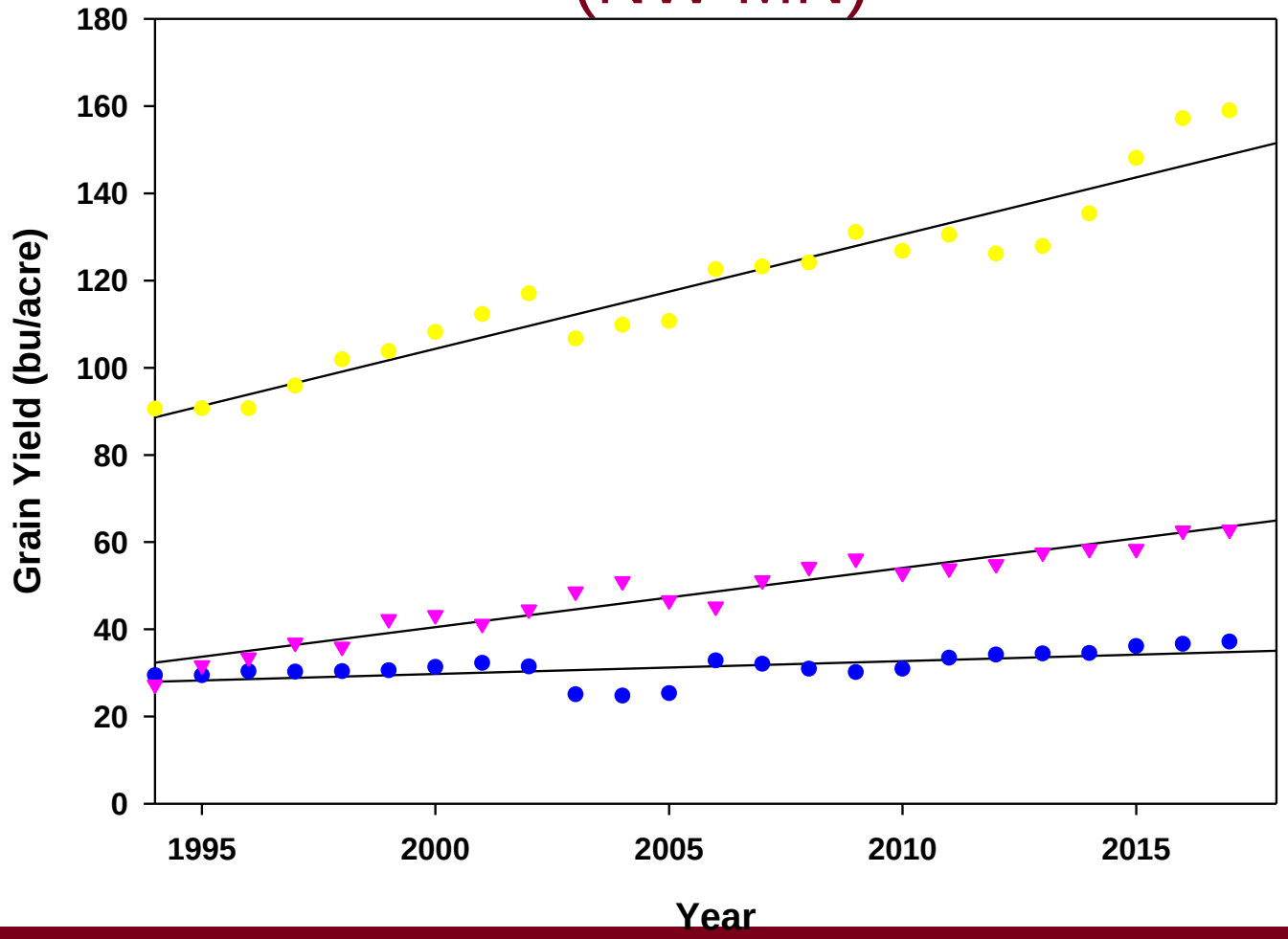
Yield over Time

(WC MN)



Yield over Time

(NW MN)



Making Gains

Commodity	Northwest	West Central
	(---------- % gain yr/yr----------)	
Corn	1.6	1.8
Soybean	0.9	1.5
HRSW	2.6	1.2

Some Dogmas

- If it yellow it must be #2 corn
- If it has a hilum it must be a soybean
- If it is HRSW you will docked ten different ways

Forces at Play

- Farm Programs:
  - ‘Freedom to Farm’
  - Loan Rates
  - Crop Insurance
- Markets:
  - Tighter specifications
- Production Challenges/Opportunities:
  - Genetic Improvements
  - Biological Stresses (FHB, crown rust)
  - ‘Roundup Ready’ crops
  - Climate Change?

Sustainable Development of Multifunctional Landscapes

- Why even talk about HRSW?
  - Crop rotation advantages:
    - Non-pest related
    - Pest related (applying IPM principles)
  - Crop water usage:
    - Corn is most efficient with water

Example Rotational Research

Previous Crop	*Wheat Yield*			
	Conventional		*No-till*	
	Actual	*Relative*	*Actual*	*Relative*
Wheat	33.8	100	33.3	100
Soybean	45.3	134	44.9	135
Sugar beet	40.8	121	38.8	117
Sunflower	39.3	116	39.1	117
Corn	38.6	114	37.3	112
Flax	38.0	112	37.5	113
Barley	37.0	109	36.0	108

Source: 'Soybean Production' NDSU Extension Service

Water Usage

Crop	*Seasonal Water Usage*	*Daily Water Usage*	*Water Use Efficiency*
	(inch/season)	(inch/day)	(lbs/inch used)
Dry Edible Beans	10.2	0.14	218.7
Spring Wheat	11.9	0.16	128.1
Barley	12.6	0.15	222.1
Flax	13.7	0.13	41.5
Sunflower	14.9	0.14	119.7
Corn	16.3	0.14	307.3
Soybean	16.9	0.13	139.2
Sugarbeet	20.4	0.15	(1.0)

Source: Ennen, M.J. and J.W. Bauder. 1981. Water Use of Field Crops in Eastern North Dakota. Farm Research 38: 3-5.

Crop Rotation

- What the data tells us:
  - Crop rotations work – there are advantages to include SGs in rotations, even in a CS or CC world
  - SB prefer an SG the year prior.

- What the data doesn't tell us:
  - No comprehensive enterprise/systems analysis:
    - Economies of scale
    - Labor film
    - Input cost differentials

Integrated Pest Management

- Crop rotation is an integral part of integrated pest management and can provide relief for:
  - Soybean cyst nematode (>4 years and in combination with use of resistance genes)
  - Herbicide resistant weeds (>2 years)
  - Extended diapause corn rootworm (>2 years)
  - Transgenic corn rootworm events that are faltering (>2 years)

Herbicide Resistant Weeds I

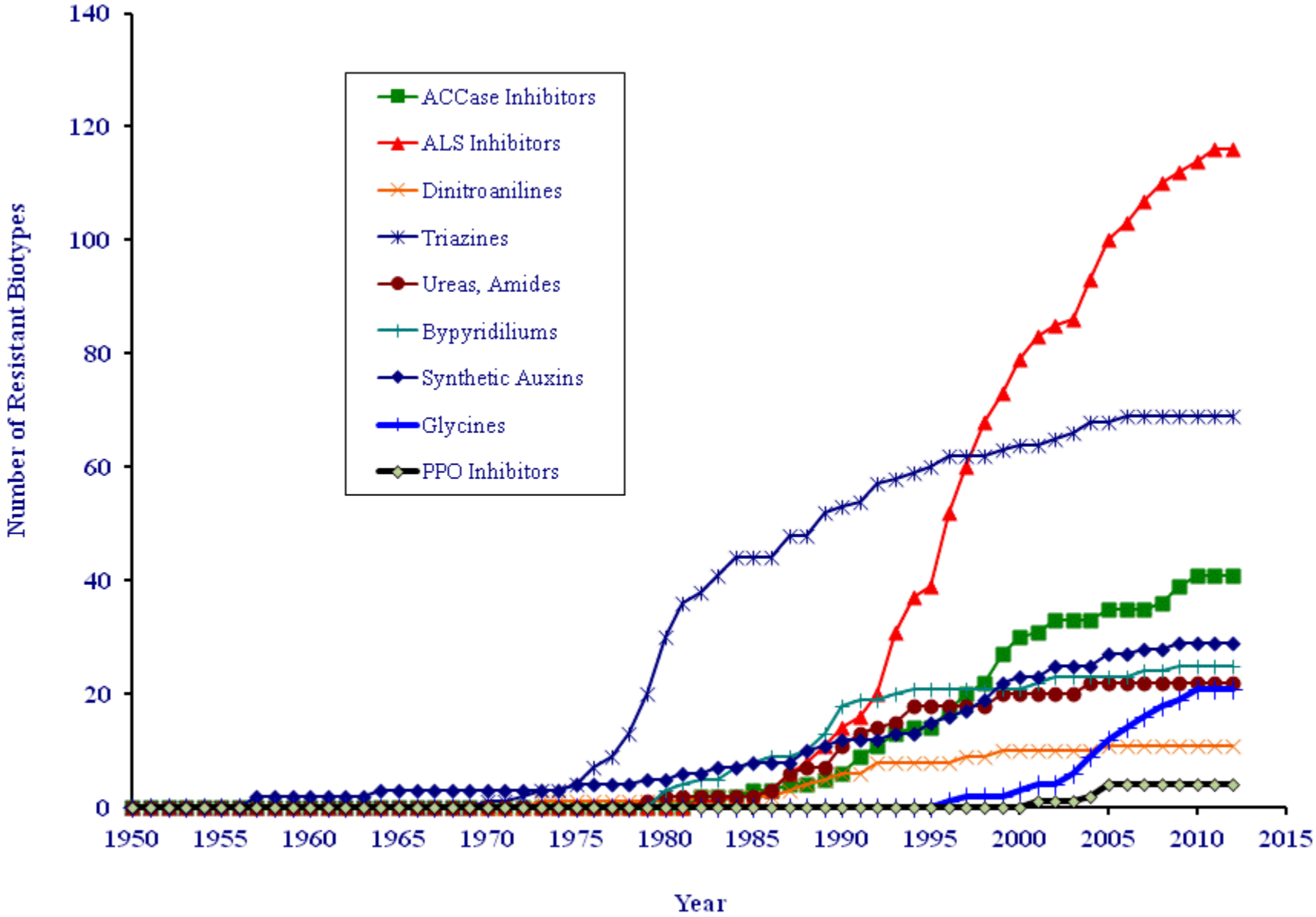
- Globally 396 herbicide resistant biotypes, belonging to 210 species have been confirmed (source: www.weedscience.org/ln.asp):
  - 123 species are dicots
  - 87 species are monocots

  - 129 species are ALS inhibitor resistant
  - 69 species are photosystem II inhibitor resistant
  - 42 species are ACCase inhibitor resistant
  - 30 species are synthetic auxins resistant

Herbicide Resistant Weeds II

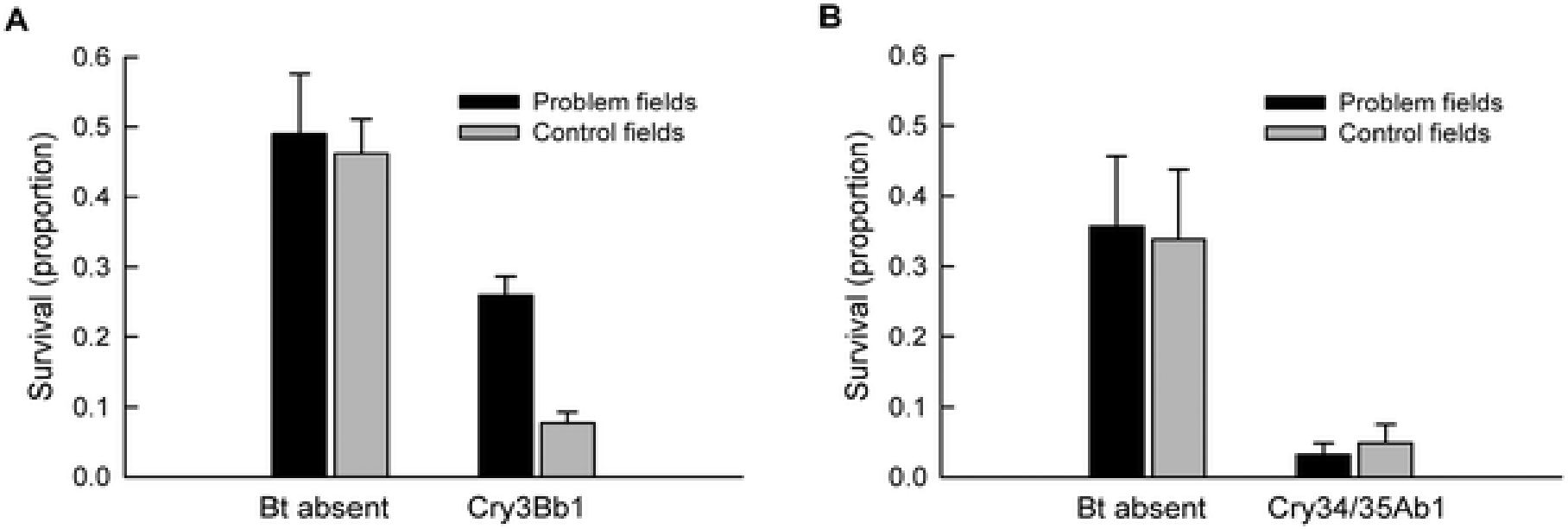
- In 1997 Laura Bradshaw et al. (Weed Technology 11: 189-198) argued that it would be highly unlikely that glyphosate resistant weeds would develop.

- As of this year there are 24 species known to have developed resistance to glyphosate worldwide, of which 12 have are also confirmed in the US ;
  - Kochia has been confirmed in North Dakota in 2012



Source: Ian Heap
http://www.weedscience.com

Field-Evolved Resistance to Bt Maize by Western Corn Rootworm



Gassmann AJ, Petzold-Maxwell JL, Keweshan RS, Dunbar MW (2011) Field-Evolved Resistance to Bt Maize by Western Corn Rootworm. PLoS ONE 6(7): e22629. doi:10.1371/journal.pone.0022629
http://www.plosone.org/article/info:doi/10.1371/journal.pone.0022629

Opportunity Cost

- The cost of any activity measured in terms of the value of the next best alternative forgone (source: Wikipedia)
  - Monetary advantages resulting from rotational choices when compared to a monoculture ‘should’ be assigned to the previous crop(s) and not be included in enterprise analysis for the crop itself

What is Your Goal? Why?

Limit your losses per acre?

or

Limit your losses per bushel?

A Reductionist View

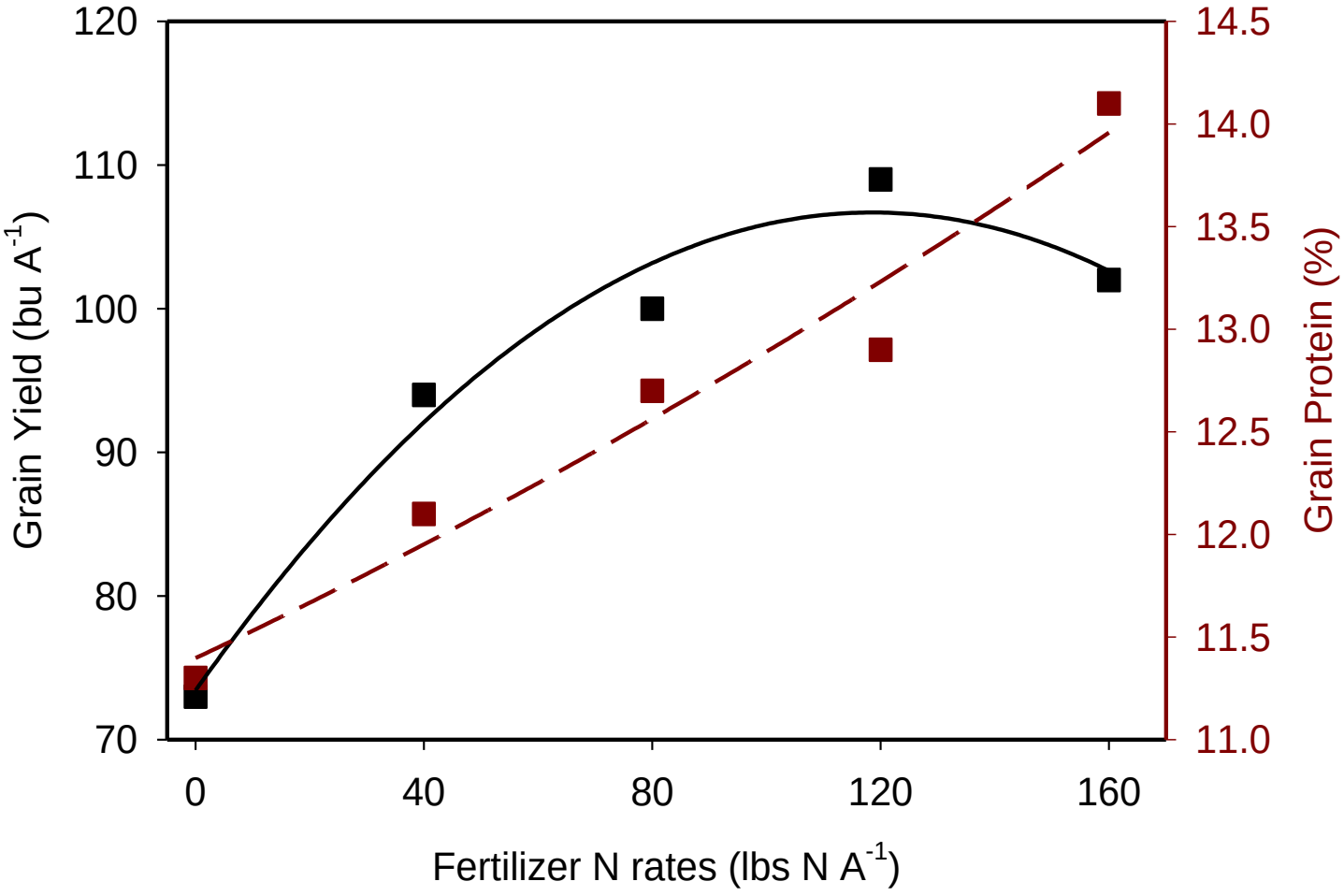
Know Thy Limits

85

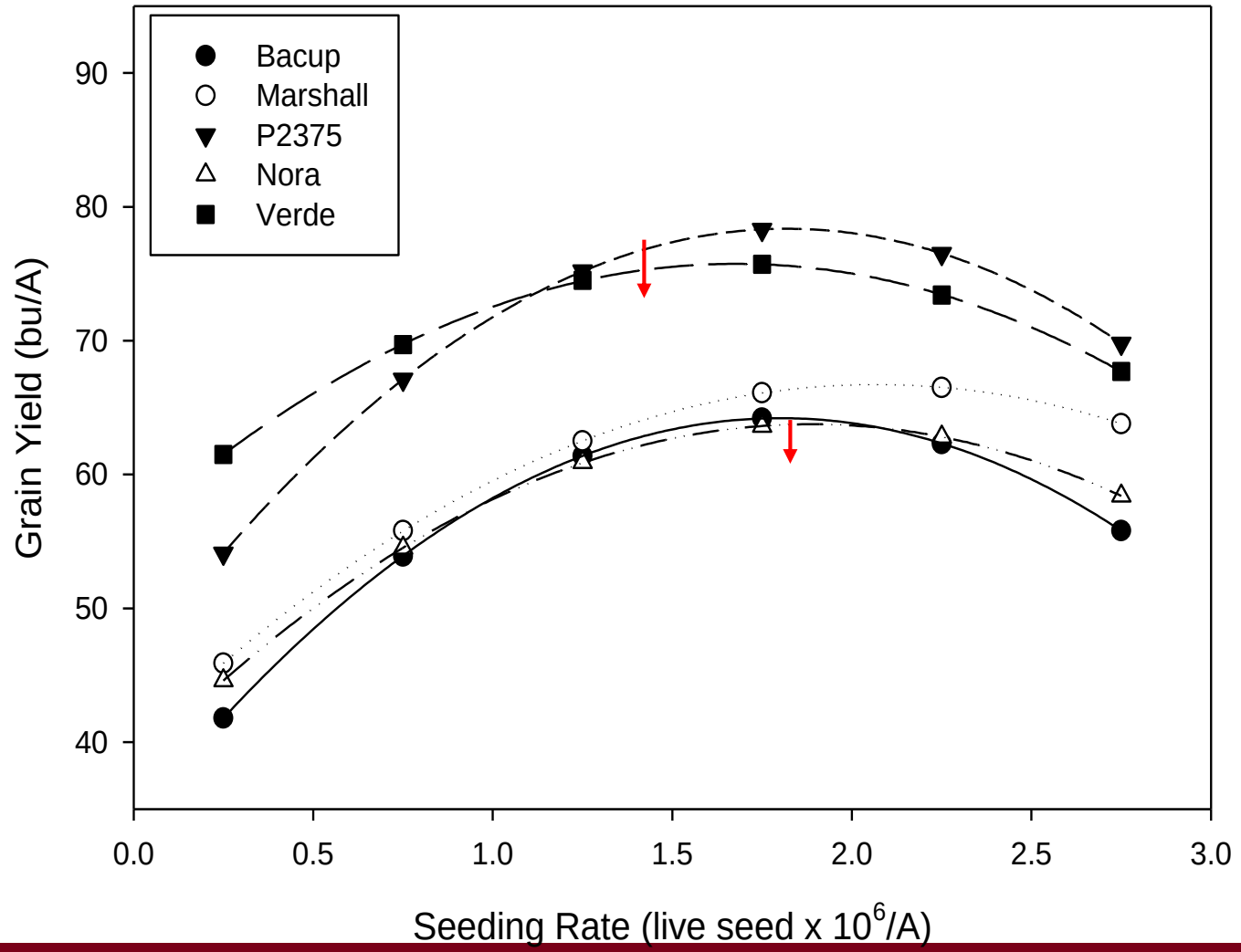
A Simple Recipe

- The early bird get the worm
- Breakfast is the most important meal of the day
- Play with a full deck
- Tall tress catch more wind
- An ounce of prevention is better than a pound of cure
- Dress for success

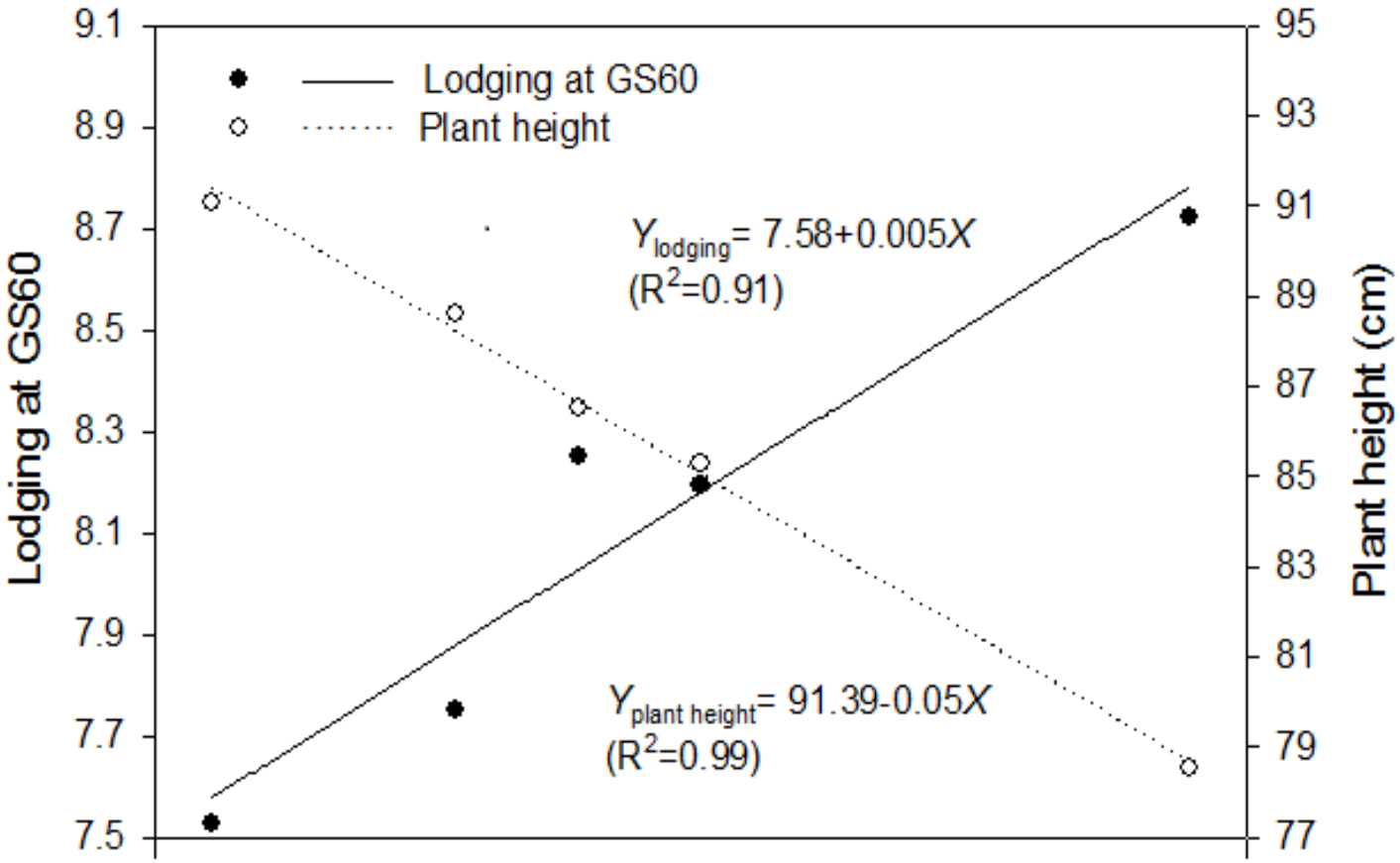
BREAKFAST IS..



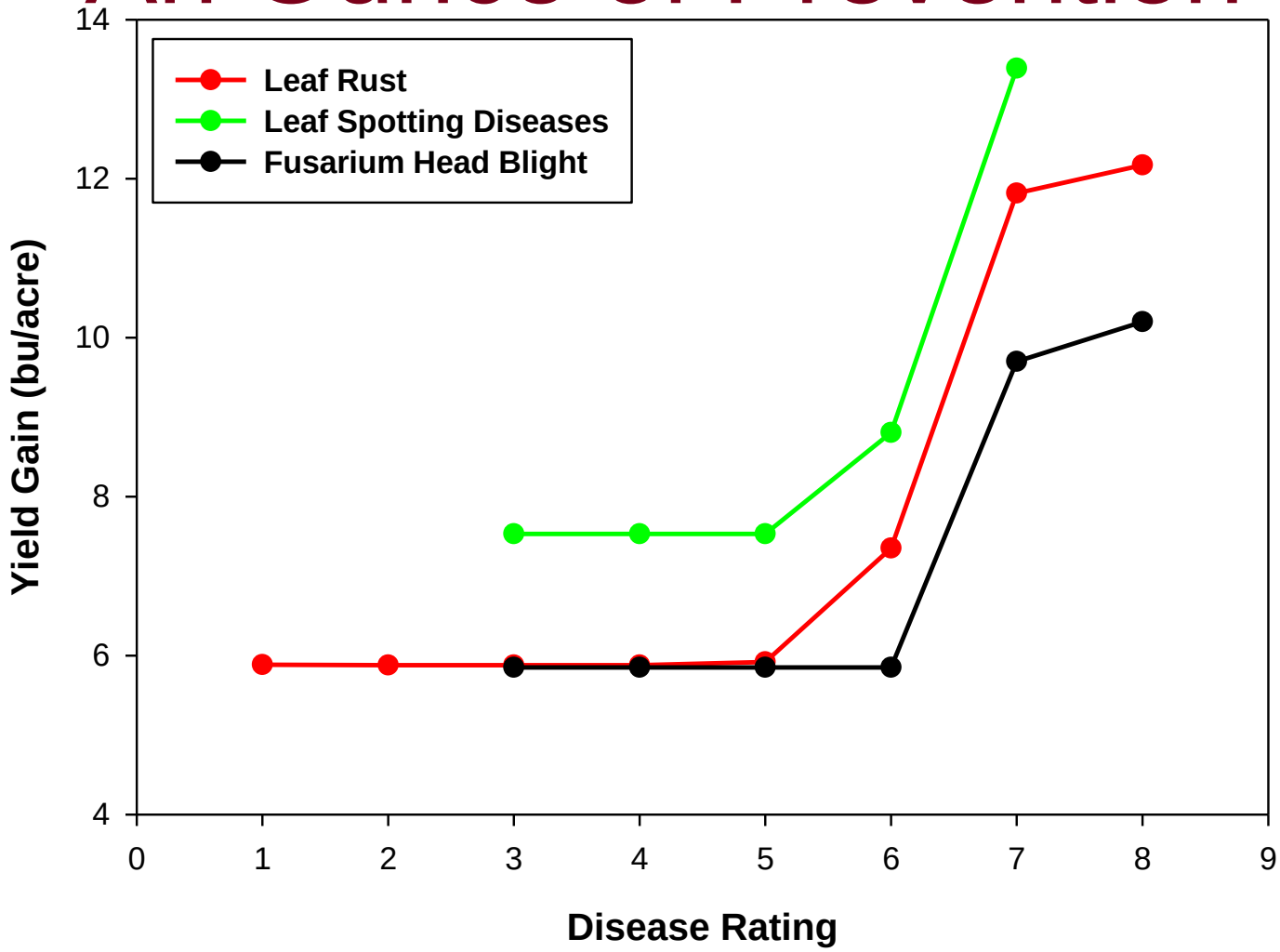
Play with a Full Deck



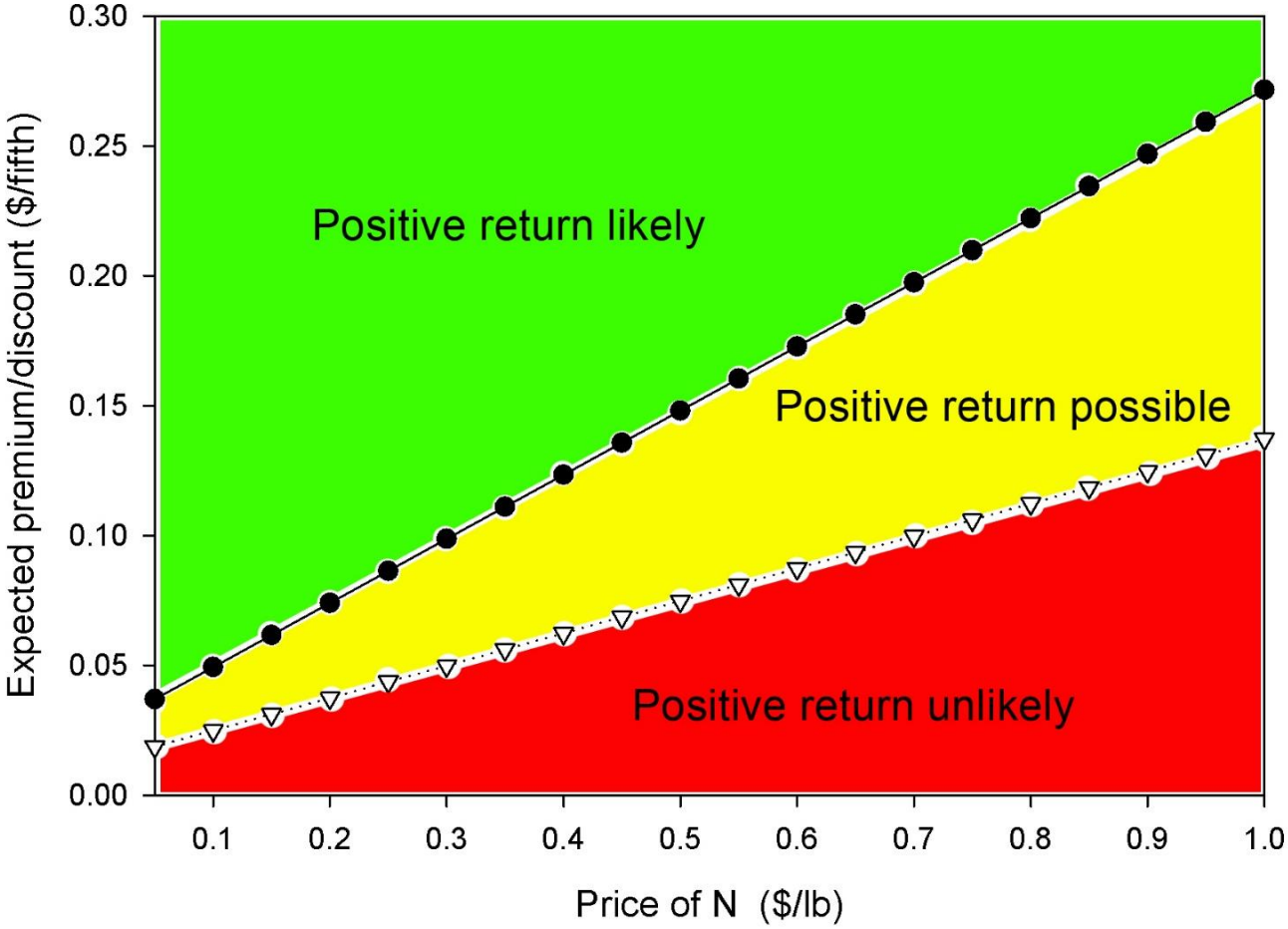
Tall Trees Catch More Wind



An Ounce of Prevention



Dress For Success



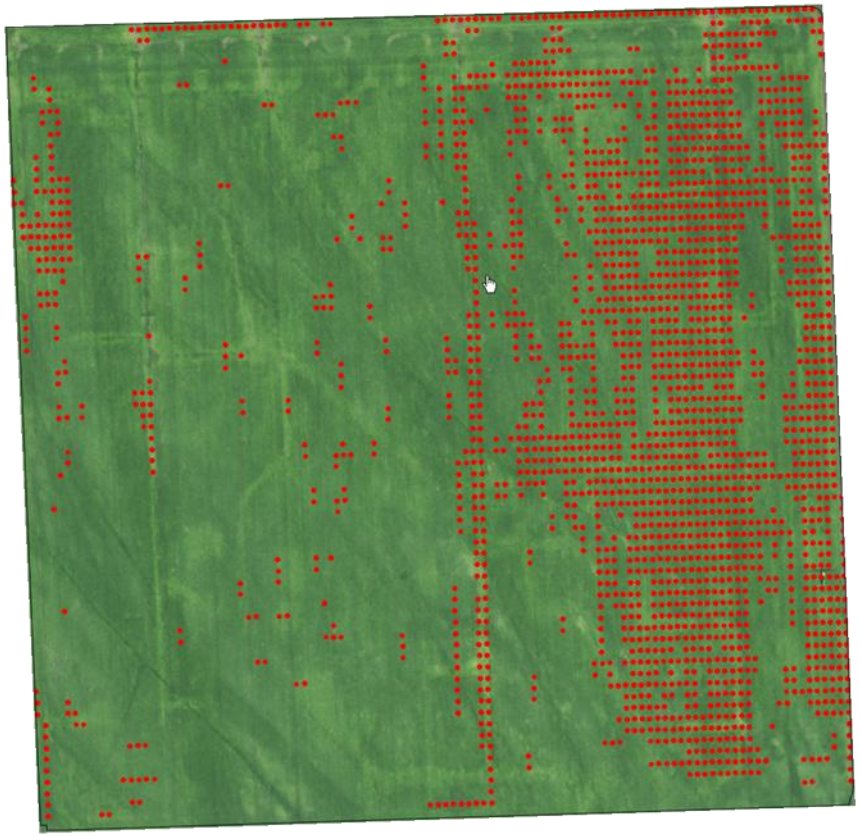
How to be the lowest cost producer per bushel?

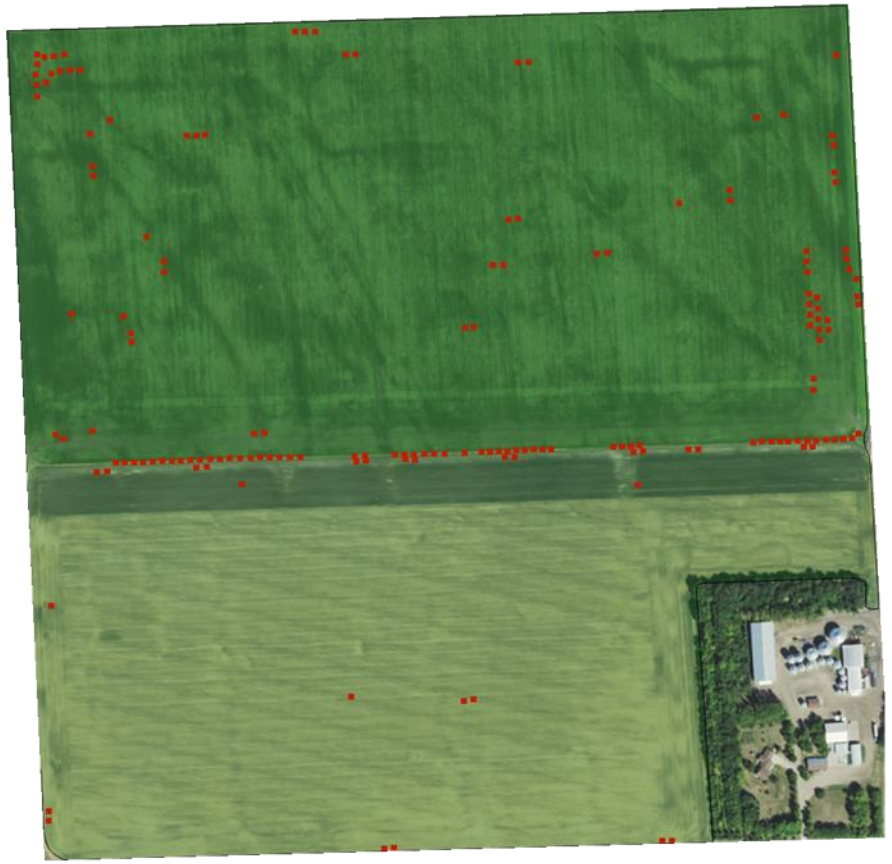
Cutting Costs

Seed Treatments

- Only if:
  - You have scabby seed with poor germination,
  - You know that you had a loose smut in the field that you saved for seed
  - You have a history of common root rot and/or wire worm in a field should you consider a seed treatment.

Grass Herbicides





Images courtesy of AWG Farms Inc.

Early-season Fungicide

- Do you need to tank mix a fungicide in at the time of weed control?

Late-season insecticide

- Do you need an insecticide tank mixed in with your fungicide application at Feekes 10.51?

If there are no or very few aphids present at Feekes 10.51, you shouldn't expect an economic return of the insecticide.

Pre-harvest Glyphosate

Fairy Pixie Dust and Other Crop Inputs

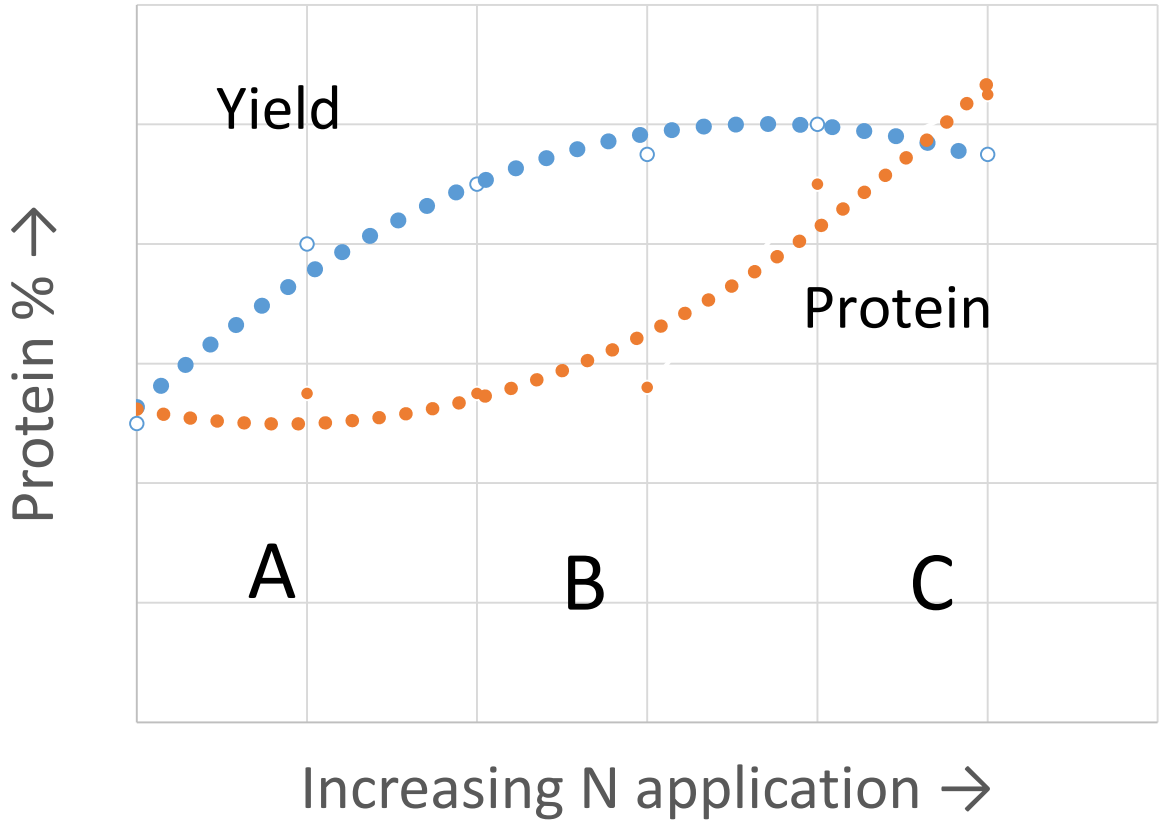
What Did I not Talk About?

N

First Limiting Factor

- Plants can take up N very rapidly:
  - Up to 8-10 kg N ha^{-1} day^{-1}
  - But water has to be present…
- N is used heavily in photosynthesis:
  - RuBisCo accounts for 50% of soluble protein in leaves and 20-30% of total N in leaves
- Genetic differences for:
  - N uptake efficiencies (NUE)
  - N remobilization efficiencies (NHI)

Conceptual Model



Part A: Protein changes very little

Part B: Protein change begins to increase, yield begins to slow

Part C: Protein changes rapidly, grain yield very little

Adapted from Mason, 2007

The Cost of Grain Fill

- Conversion ratios:
  - Carbohydrates: 0.83
  - Protein: 0.40

- Remobilization vs new
  - N: ~ 80% remobilized and 20% new
  - C: ~ 20% remobilized and 80% new

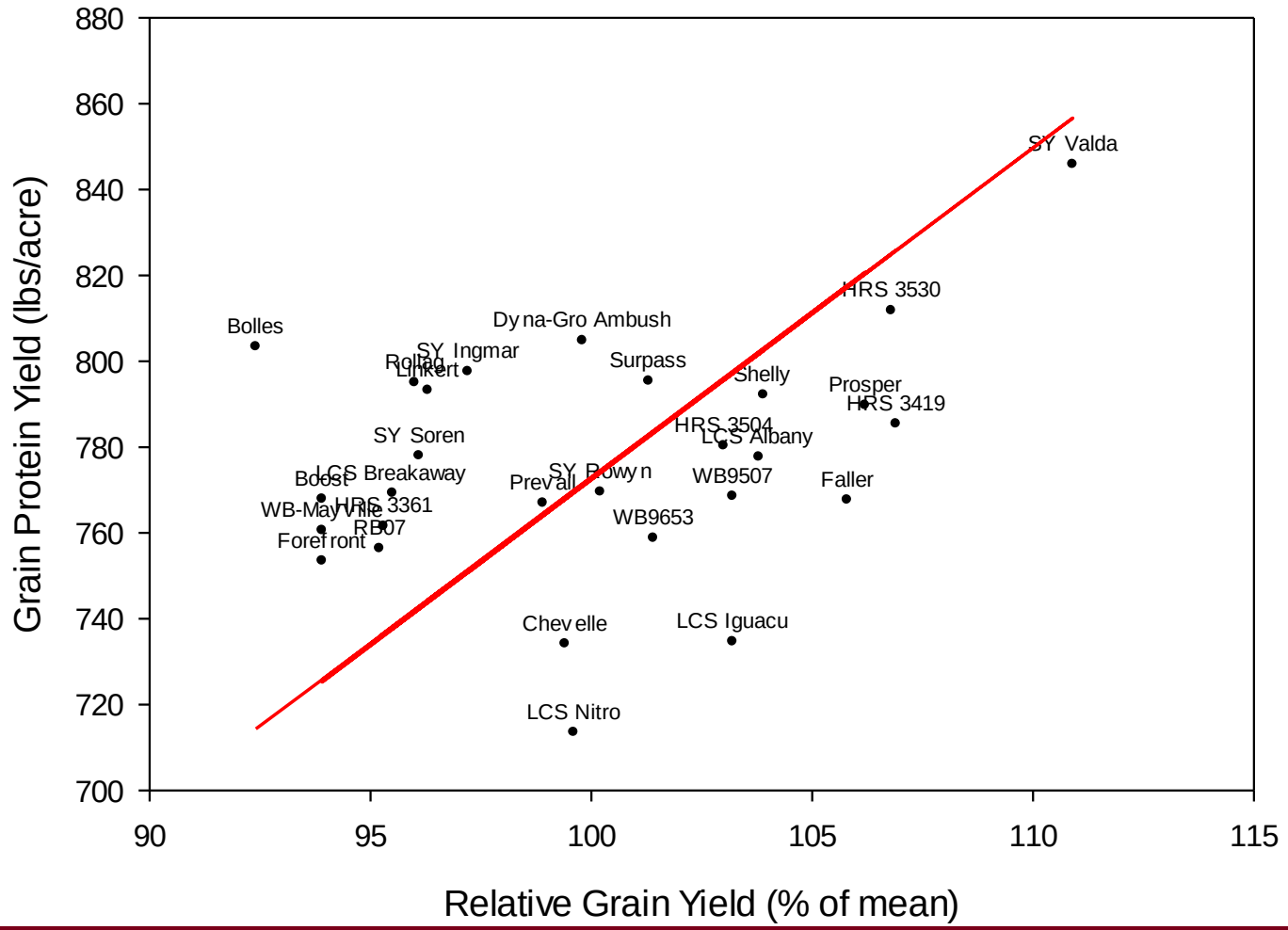
High Yield or High Grain Protein?

- High yielding varieties appear to be able to both remobilize as well as produce de-novo more starch and grain protein
  - Only under cool conditions did Glenn ‘catch-up’ to Faller (GPC-1, stay green effect?)
- N management (rate) didn’t override this response - meaning that the larger amount of grain protein produced is diluted by even more starch

Bottom-line

- High protein varieties appear to be lazy
- High yield varieties will take advantage of favorable conditions when available
- Only late season N will allow you to manage the total amount of GP produced

The Big Red Line



QUESTIONs?

If we knew what it was we were doing, it would not be called research, would it?

Albert Einstein