

# **The Good, the Bad and The Ugly of Soil and Crop Amendments**

**Rigas Karamanos**



Rigas received his BSA from the University of Thessaloniki, Greece and his M.Sc. and Ph.D. in Soil Chemistry and Fertility from the University of Saskatchewan. He has taught at the University of Saskatchewan and McGill University, and has served as the Senior Research Agronomist with Esso Chemical Canada, Director of the Saskatchewan Soil Testing Laboratory and Enviro-Test Laboratories Saskatoon and Manager of Agronomy with Westco and Manager of Agronomic Solutions for Viterra and Sr. Agronomist with Koch Fertilizer/Agronomic Services in Canada. He is now retired.

He was granted a Fellow and the Distinguished Agronomist award in the Canadian Society of Agronomy in 2013 and 2019, respectively, and was inducted in the Saskatchewan Agricultural Hall of Fame in 2015.

## **In today' market:**

- **A slate of “New” products and services are being brandished on the prairies these days.**
- **Producers are thirsty for innovations in agriculture and anything that is perceived that might give them an advantage in this age of high input prices.**

# **Understand what “Myths” are!**

- **Defy conventional wisdom, tradition**
- **Responses are sporadic or unpredictable without decision criteria**

**There are exceptions to generalizations, but we should be able to explain the circumstances**

- **For example, comparison between seasons is not valid as simple circumstances, e.g., a few days earlier seeding in combination with environmental conditions can have a marked impact on yields from year to year.**

# Rules of Thump

(from a medical show!)

- If it is too good to be true, it probably is
- Beware of hype. Hype hurts!
- Don't trust testimonials, because they are anecdotes; they are stories, not scientific data
- Look for the flipside; what did the opposing side say?
- **ULTIMATE STANDARD.** Is there published peer reviewed evidence?
- Ultimate decision is yours

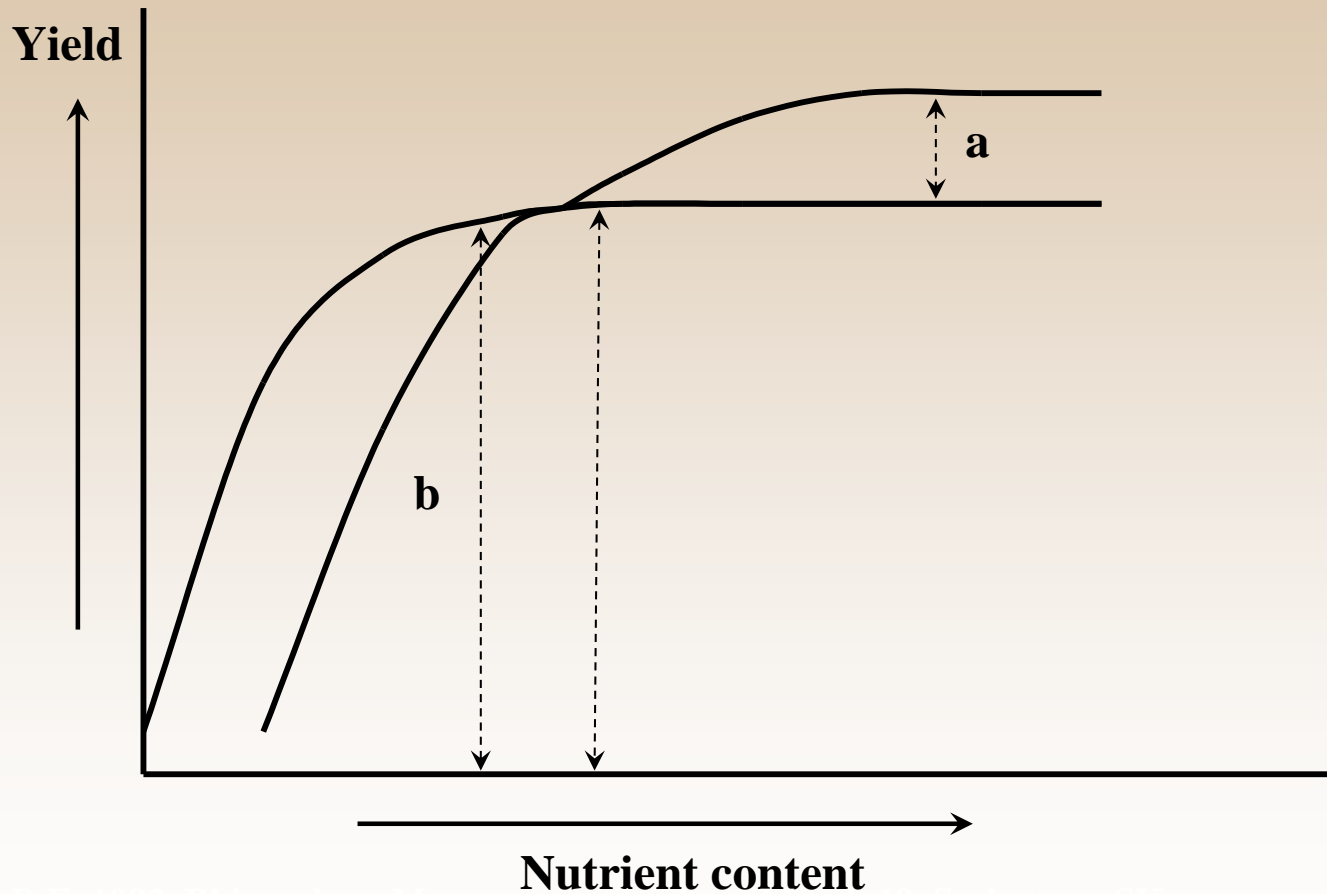
# **New Technology – How will it Affect Your farm?\***

**One of the major hurdles in bringing “new” products to market is the fact that most of the manipulation of the yield is taking place on the upper part of the yield curve, where proportional increases or differences often become a statistical nightmare to prove!**

# How Products work!

- **“Real” products**
- **“Other” products (miracle products)**

# How Products work!

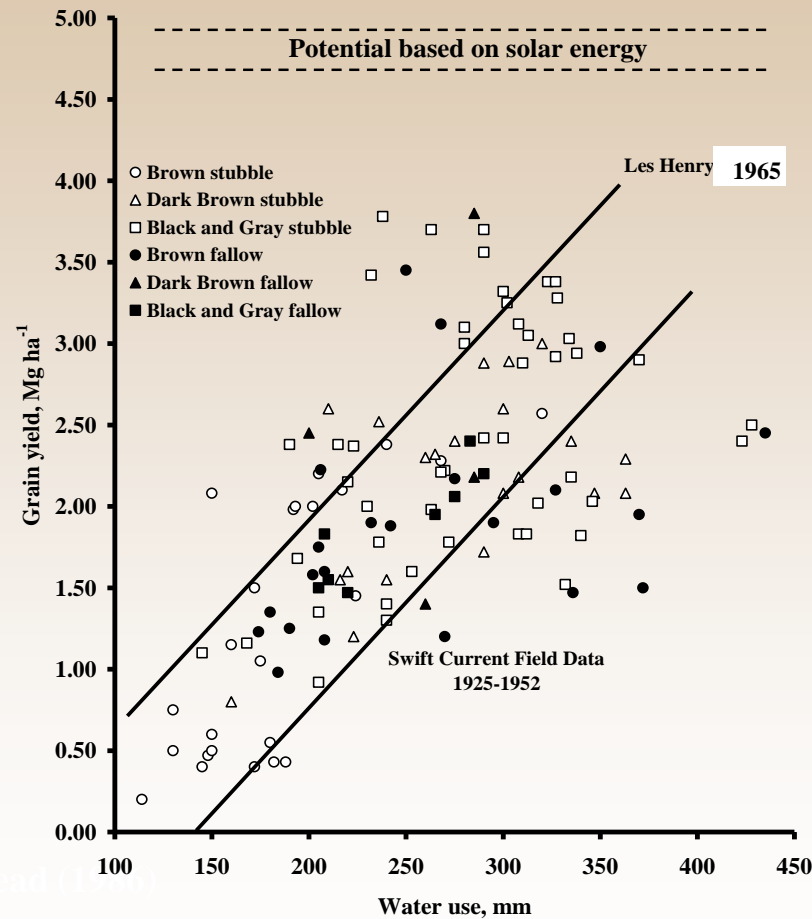


Koromannos, R.E. 1992. Rhizosphere Management. Saskatchewan Agriculture, 19. Saskatoon, SK.

# **What determines Maximum Yield?**

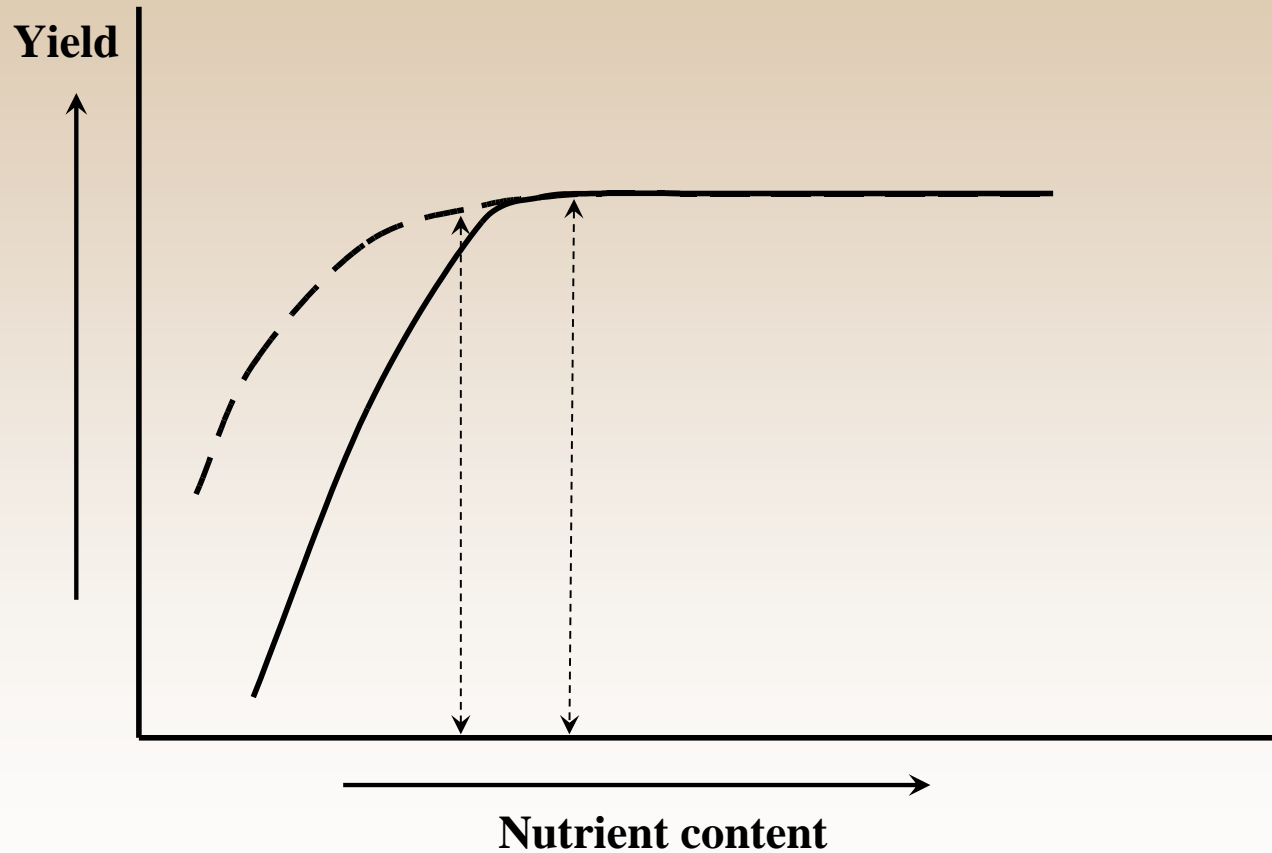
- **Crop genetics**
- **Solar radiation**
- **WATER**
- **Nutrients**

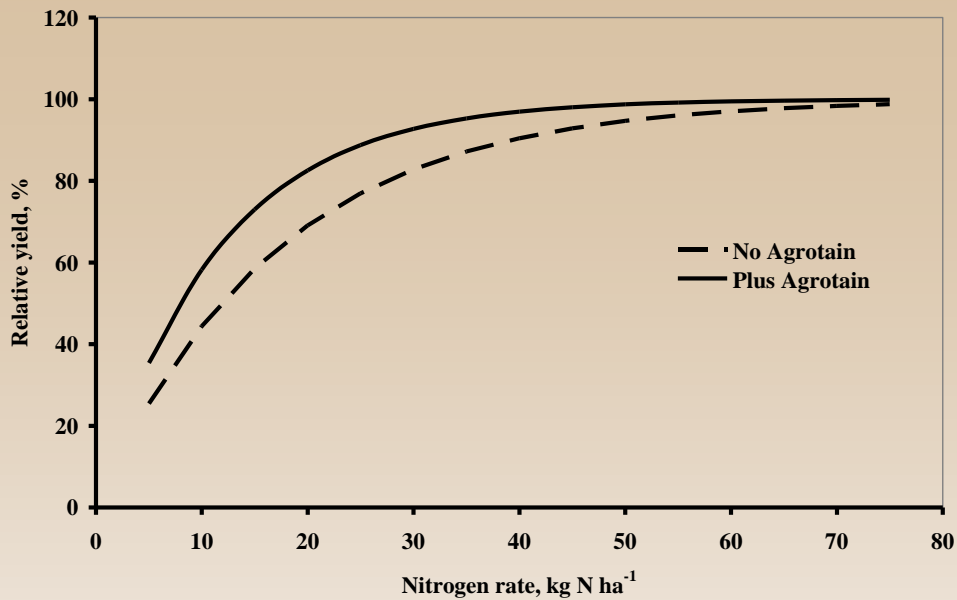
# Great example from the eighties



**How would “new” products  
work?**

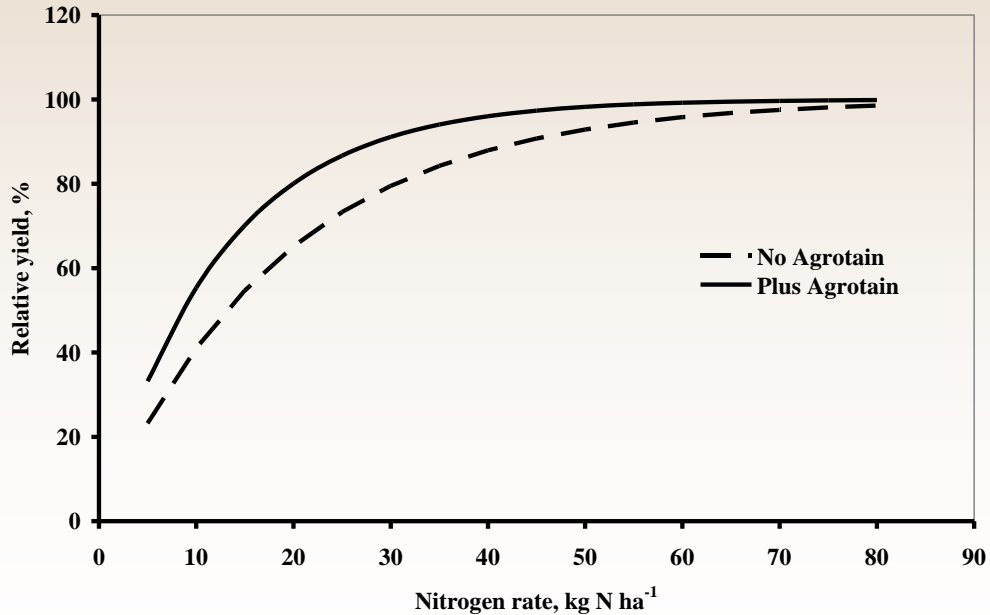
# Scenario A: Similar yields with less fertilizer

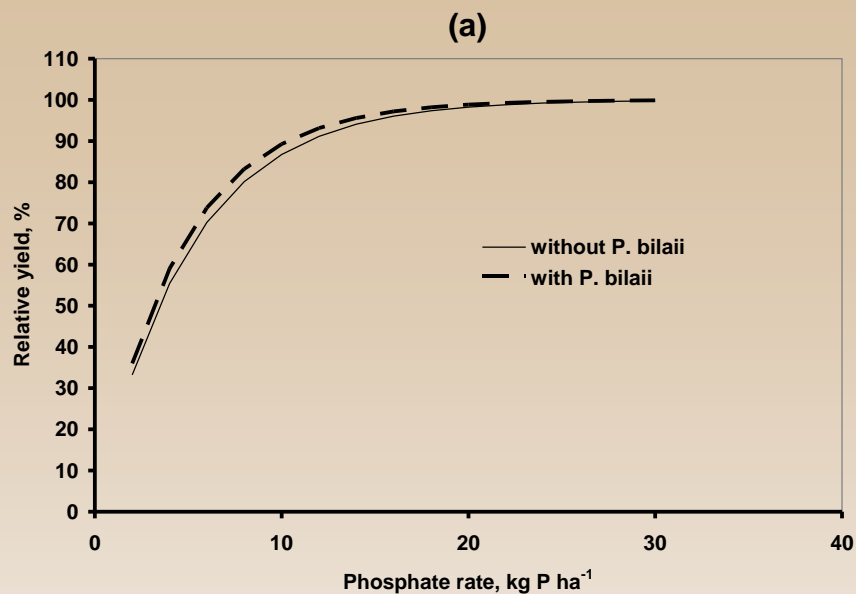




**Wheat (14 trials)**

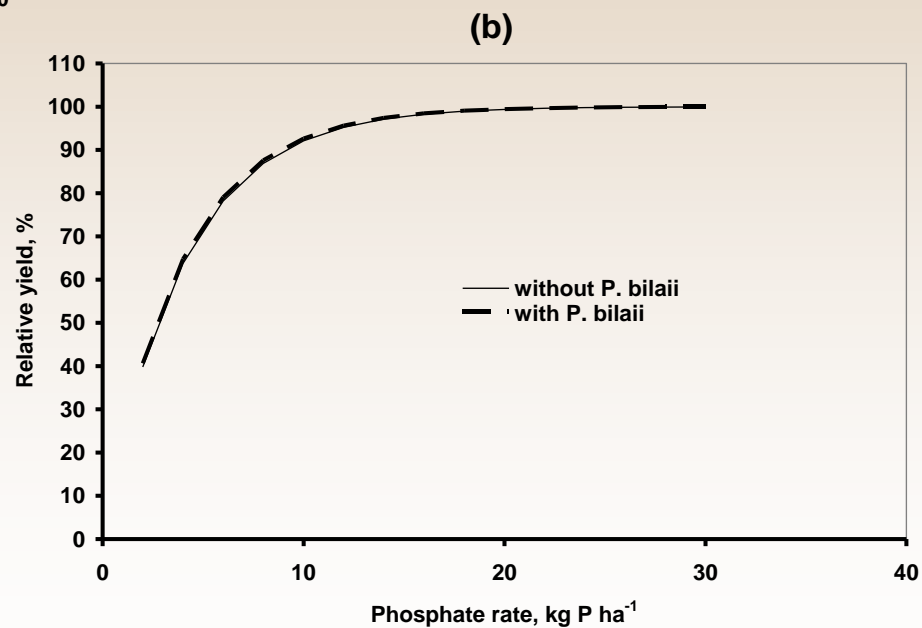
**Barley (18 trials)**

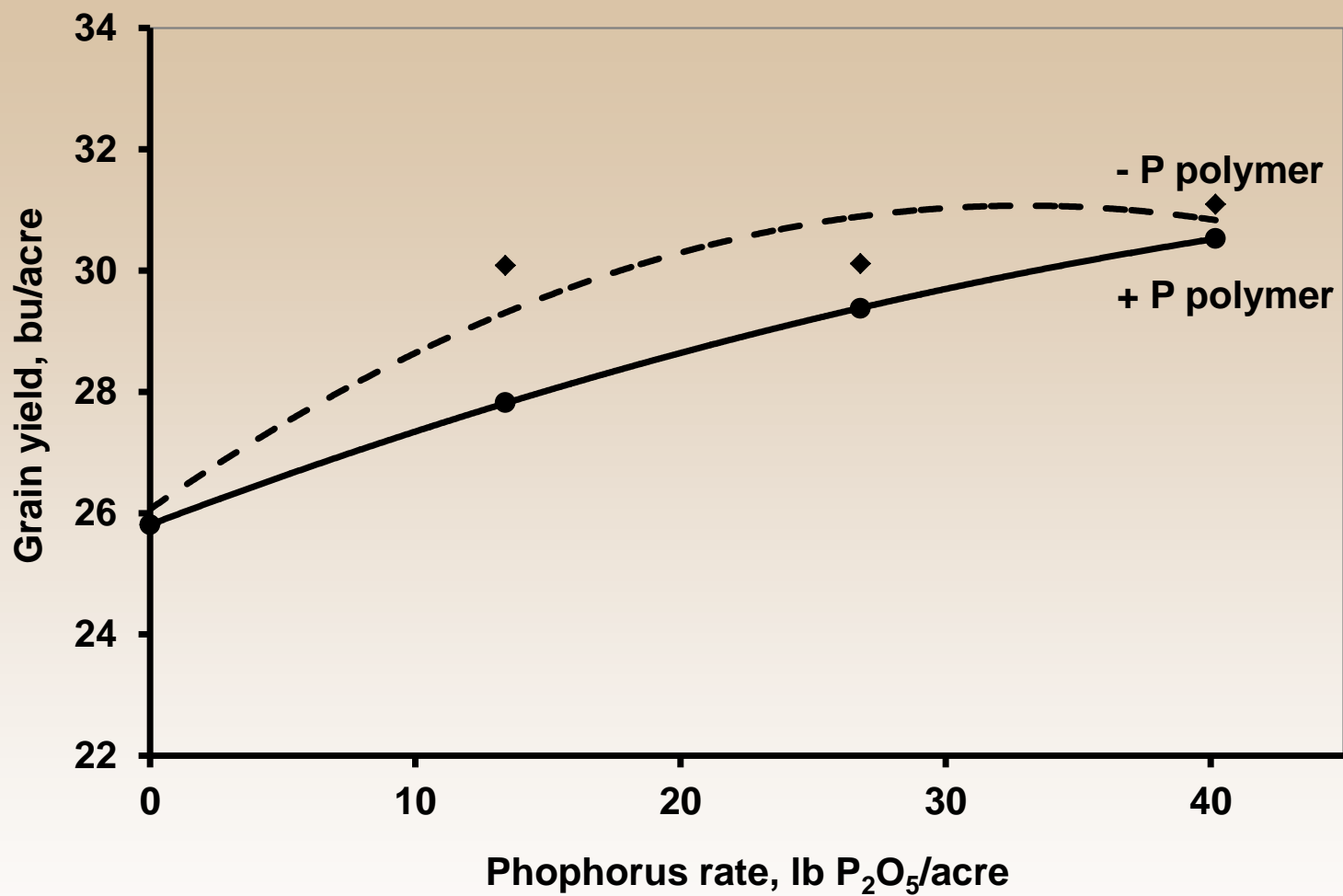




**Barley (20 trials)**

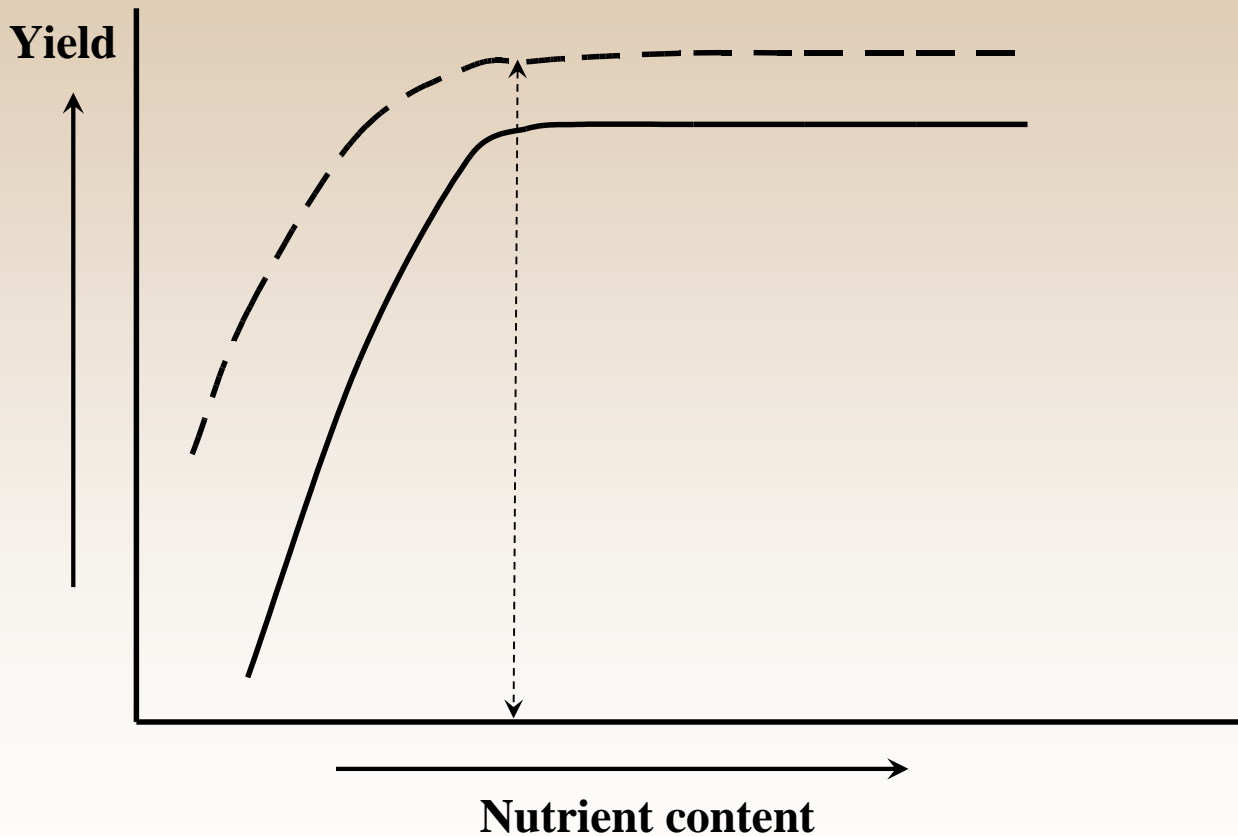
**Wheat (47 trials)**



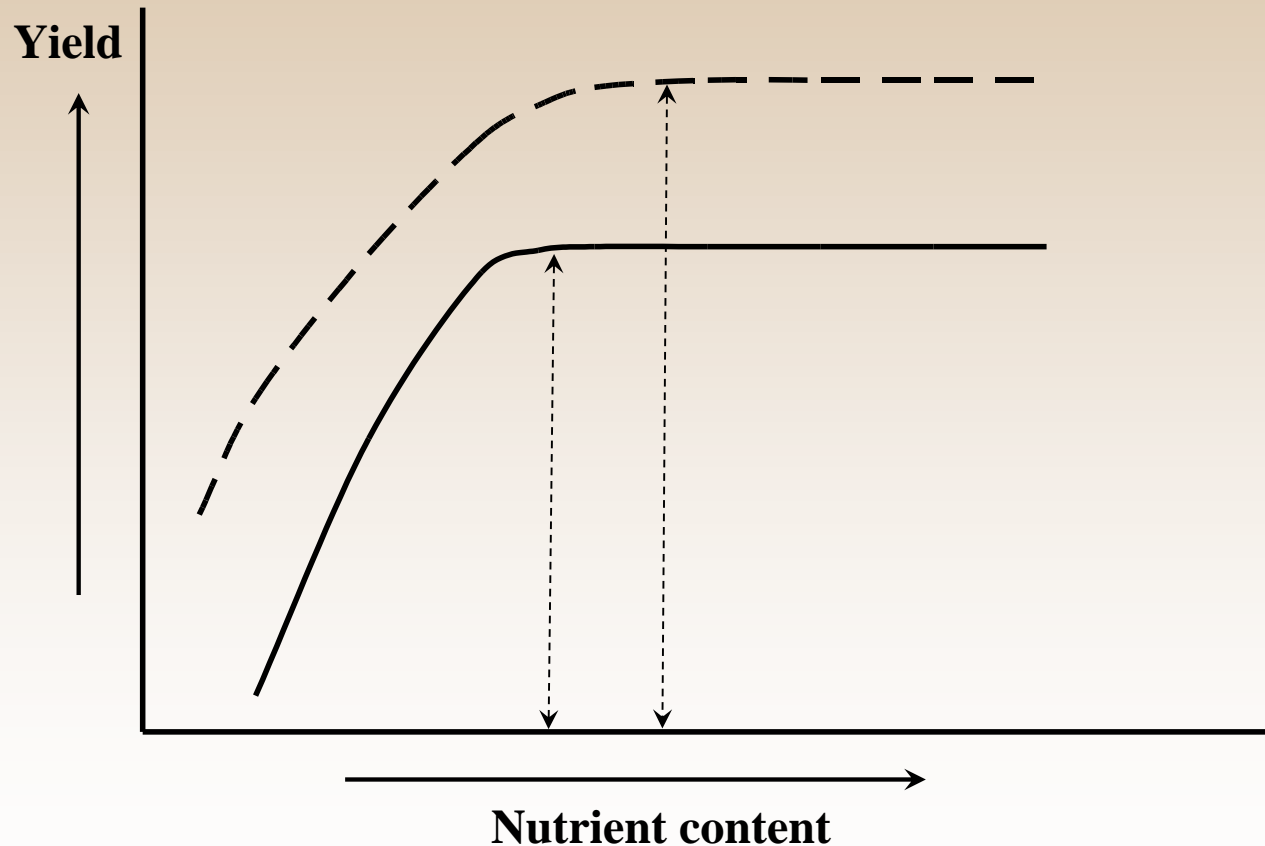


**Wheat (6 trials)**

## Scenario B: Higher yields with the same level of fertilizer



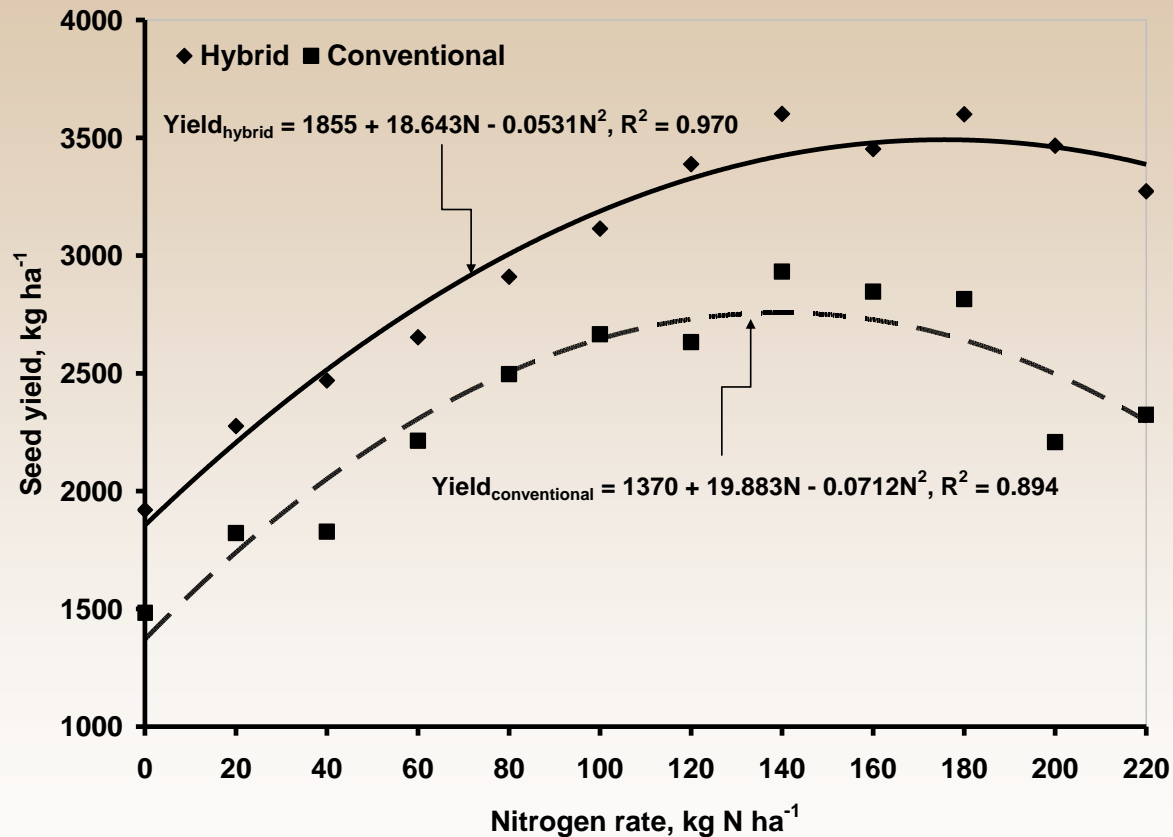
# Scenario C: Higher yields both at low and high Nutrient content



# **How are these scenarios achieved?**

- **Below et al. (2007): Through improvement of NUE with improved genetics and biotechnology!**

# Canola hybrids



Karamanos et al. 2005 J. Plant Nutr. 28: 1145 – 1161 and Karamanos et al. 2007 Can. J. Plant Sci. 87: 201–210.

# **Define what “works” means to you!**

- **Greener the next day?**
- **Higher nutrient concentration in leaves?**
- **Better than the neighbor's?**
- **Better than last year?**
- **Logical?**

# Types of Operating Costs

- ✳ **Essential: Seed.**
- ✳ **Enhancement: Fertilizer, Seed.**
- ✳ **Maintenance: Fertilizer, Herbicide.**
- ✳ **Protection: Herbicide, Insecticide, Fungicide.**
- ✳ **Insurance: Herbicide, Insecticide, Fungicide, Fertilizer.**

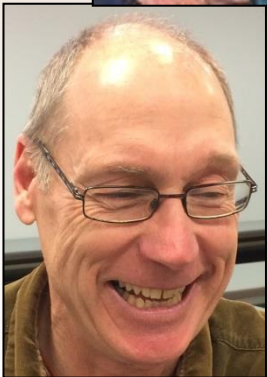
# Define what “works” means to you!

- ✱ Two inputs that contribute to Enhancement:
- ✱ Fertilizer, Seed

**These two will pay the bills!**

- Minimum \$2:\$1 return

# Introducing “Baloney and Science Inc.” (B&S)



- a group of us found it so difficult to criticize other people's snake oil, we decided to create our own
- our specialty is ... without telling any lies ... providing a custom blend of baloney and science that is carefully designed for each combination of product and situation
- “Respectable” Rigas Karamanos's and Don “Factual” Flaten's \$5.50/acre Product
- “Honest” John Heard's Acer Yield Enhancer and Nitrogen Replacer

*The “\$5.50 per acre” Treatment  
Will You Buy It?*

# **New treatment helps canola beat the weather**

**Now we are all aware that crop yields took a beating the last two years either because of drought or too much moisture. Frankly, I never understood this business of reporting “normal” for weather or crop production. All these years I have spent in agricultural reporting have taught me that each year is a normal in its own. In any event, one of the worst hit crops in 2021 was canola. Yields of the 2021 harvest reported by the Canola Council show that canola production in the prairies was between 21.4 to 40% lower compared to 2016-20.**

# Average canola yield, bu/acre

YEAR	Manitoba	Saskatchewan	Alberta
2022	39.4	37	38.1
2021	32.7	25	28.9
Average 2016-2020	41.6	41.5	41.7

# **New treatment helps canola beat the weather**

**Professor Factual and I were confronted with the same issue back in 2001 and discussed the new treatment to address canola resistance to really dry or really wet conditions. We were very excited about the prospect of improving canola yields under extreme conditions. The best way to assess its impact was to set field experiments. We selected a site at Elm Creek, Manitoba at one of the most challenging soil types, Almassippi sandy loam, and a site at Herronton, Alberta in the middle of the drought belt to assess the impact of the \$5.50 per acre treatment under the harshest possible conditions.**

# **New treatment helps canola beat the weather**

**To compound the problem, the intense heat of July had a damaging impact on this as well as all canola crops in the area. The experiments were set up in a completely randomized block design with six replicates. We applied all nutrients according to soil test recommendations and herbicide treatments as required for each area.**

**At a farmer tour on August 23, both farmers and retail staff were impressed with the intense visual response to the \$5.50 per acre treatment. “I’d sure would like to know what’s in this treatment”, exclaimed Mr. Farmer, the farmer co-operator at the site. The impact of the treatment was not as pronounced at our Herronton site.**

# You've got to see it to believe it!



Elm Creek site

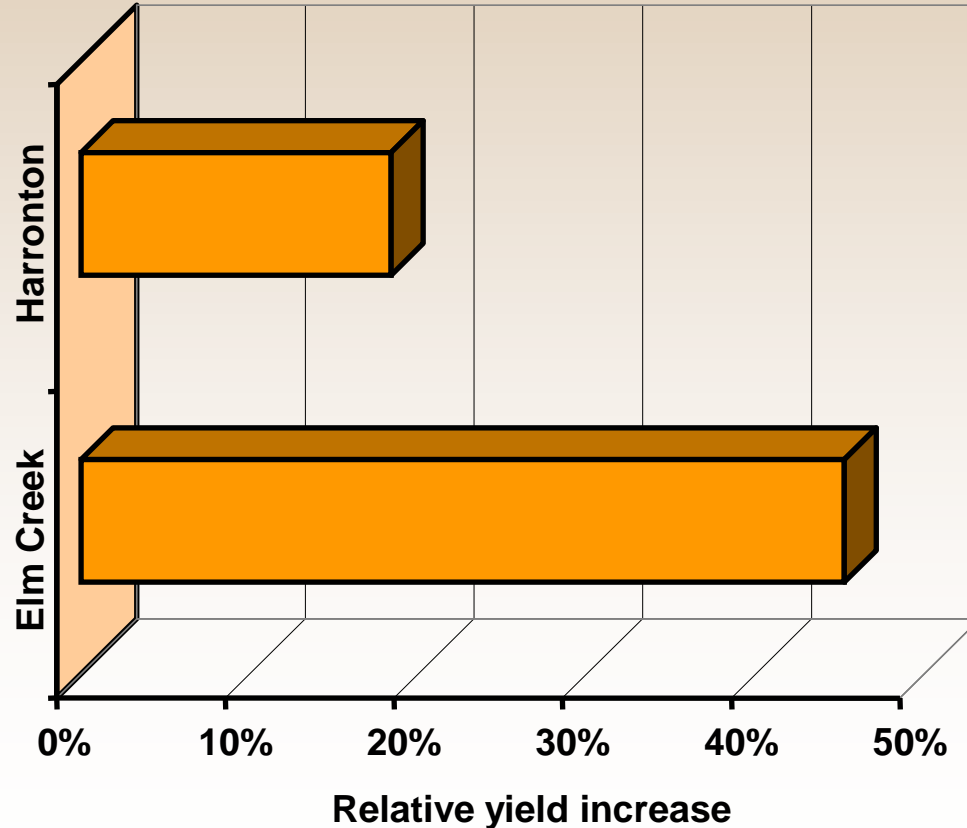
# **New treatment helps canola beat the weather**

**There were no surprises when the final results from the plots came in. A whopping 45.3 % yield increase at Elm Creek and a moderate but still significant increase of 18.4 % at Herronton. Although the increase at Herronton was much lower, it provided over a 2:1 return on the investment for the treatment.**

**“This treatment deserves further attention”, remarked Professor Factual, although he admitted that the mode of operation of the treatment is not quite clear as yet. Farmer co-operator Farmer commented, “it’s worth the money invested”, when he saw the results this fall.**

# New treatment helps canola beat the weather

Yield increase to \$5.50  
Treatment (U of XYZ 2001)



# New treatment (\$5.50/ac) helps canola (\$16/bu) beat the weather

Location	Yield, bu/acre		Yield increase		D\$Y/1\$
	Control	Treated	bu/acre	%	
Red Deer	47.2	47.9	0.6	1.3	\$1.7
Wetaskiwin	50.3	50.6	0.2	0.4	\$0.6
Herronton	11	10.9	-0.1	-1.2	-\$0.3
Herronton	10.3	12.2	1.9	18.4	\$5.5
Balzac	33.8	35.5	1.7	5	\$4.9
Balzac	33.2	33.5	0.4	1.2	\$1.2
Choicelend	42	41.5	-0.5	-1.2	-\$1.5
Elm Creek	17.6	25.5	8	45.5	\$25.6
Miami	26.9	31.2	4.3	16	\$13.8
<b>Average</b>	<b>30.3</b>	<b>32.1</b>	<b>1.9</b>	<b>9.6</b>	<b>\$5.5</b>

**\$12/bu**  
↓  
**\$4**

\*Karamanos, R.E. and Flaten, D. 2002. Proc. Soils and Crops 2002, Univ. of Saskatchewan, Saskatoon, SK and Karamanos, R. E. , Flaten, D. N. and Stevenson, F. C. 2014. Canadian Journal of Plant Science, (in press)

# Is This Real?



**“Yes, ... heck look at the huge yield increase”**

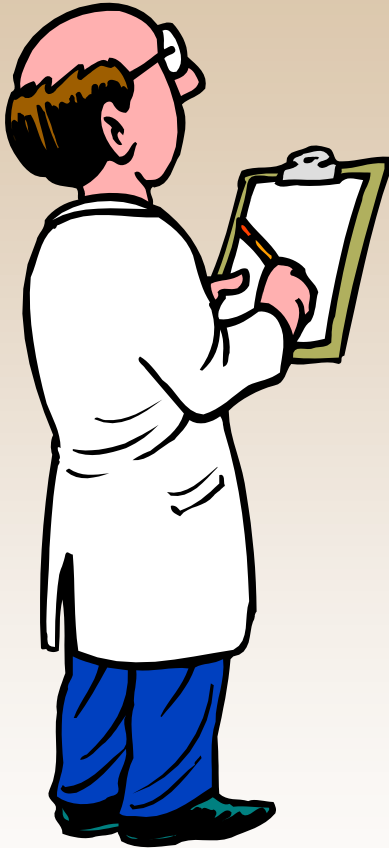
**“It’s 10%”**

**“We used six replicates, more than what other people do”**

**“This is real stuff man. You scientists like to confuse things with statistics. For the farmer 2 bushels is \$20 or even \$30+ per acre!”**



# Is This Real?



**“Depends”**

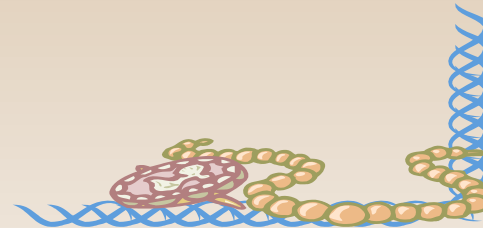
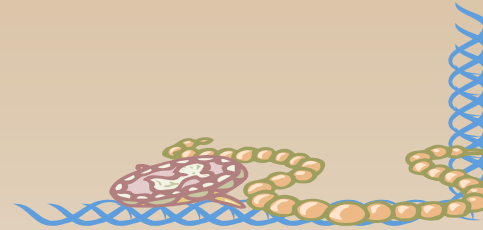
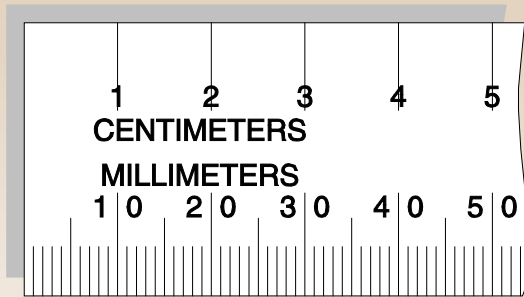
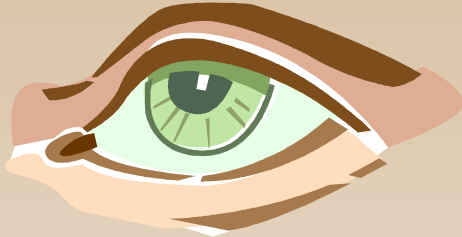
**“Need raw data”**

**“I have to carry a statistical analysis”**

**“Need more information on these experiments”**

**“10%, but was it significant?”**

# Is the Difference of 2 Bushels Real?



	Measurement in millimetres											$\Delta$
	1	2	3	4	5	6	7	8	9	10	Ave.	$\mu\text{m}$
Chain 1	20	20	19.9	20	20.1	20	20	20	20	20	20	+20
Chain 2	20	20	20	19.9	20	19.9	20	20	20	20	19.98	

# Is the Difference of 20 $\mu\text{m}$ Real?

**No!**

**Our tools do not allow us to “see” 20  $\mu\text{m}$  difference, so it’s not a real difference, because the error of “seeing” is greater than the difference.**

# Is there an “eye” in research?

**Yes!**

**It's called Variance.**

**We must calculate what the “eye” of each experiment allows us to see.**

**Some experiments allow us to see 2 bu/acre, some 10 bu/acre, etc.**

# **Result of statistical analysis**

- **Only one of the nine differences was statistically significant.**
- **In the 2011 MAC I gave a presentation:  
“Putting Practices and Products to the Test of Statistics”**

# New treatment (\$5.50/ac) helps canola (\$16/bu) beat the weather

Location	Yield, bu/acre		Yield increase		D\$Y/1\$
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Miami	26.9	31.2	0	0	\$0
<b>Average</b>	<b>30.3</b>	<b>31.2</b>	<b>0.9</b>	<b>2.9</b>	<b>\$2.6</b>

**\$12/bu**  
↓  
**\$1.9**



# Results of statistical analysis

- Of course, it would be wrong to base our decisions on ONE experiment

# Results of ONE experiment

- Independently of how well its was conducted, it offers information for ONE LOCATION and/or ONE SEASON. It could be the one out of twenty chances to get the wrong answer!
- Results must be valid for at least several seasons over a reasonably large farming area.

# Any Idea what the \$5.50 per acre treatment was?

- The size of the plots was 160 square feet



- Convert to 1 acre ( $43,560 \div 160 = 275$ )
- $2¢ \times 275 = \$5.50$

# Composition

- Zinc 54.7%
- Copper 3.6%
- Antimony       traces
- Lead            traces
- Arsenic         traces

# "Acer" ... A new biological activator to enhance growth and replace nitrogen



<http://insertmedia.office.microsoft.com>



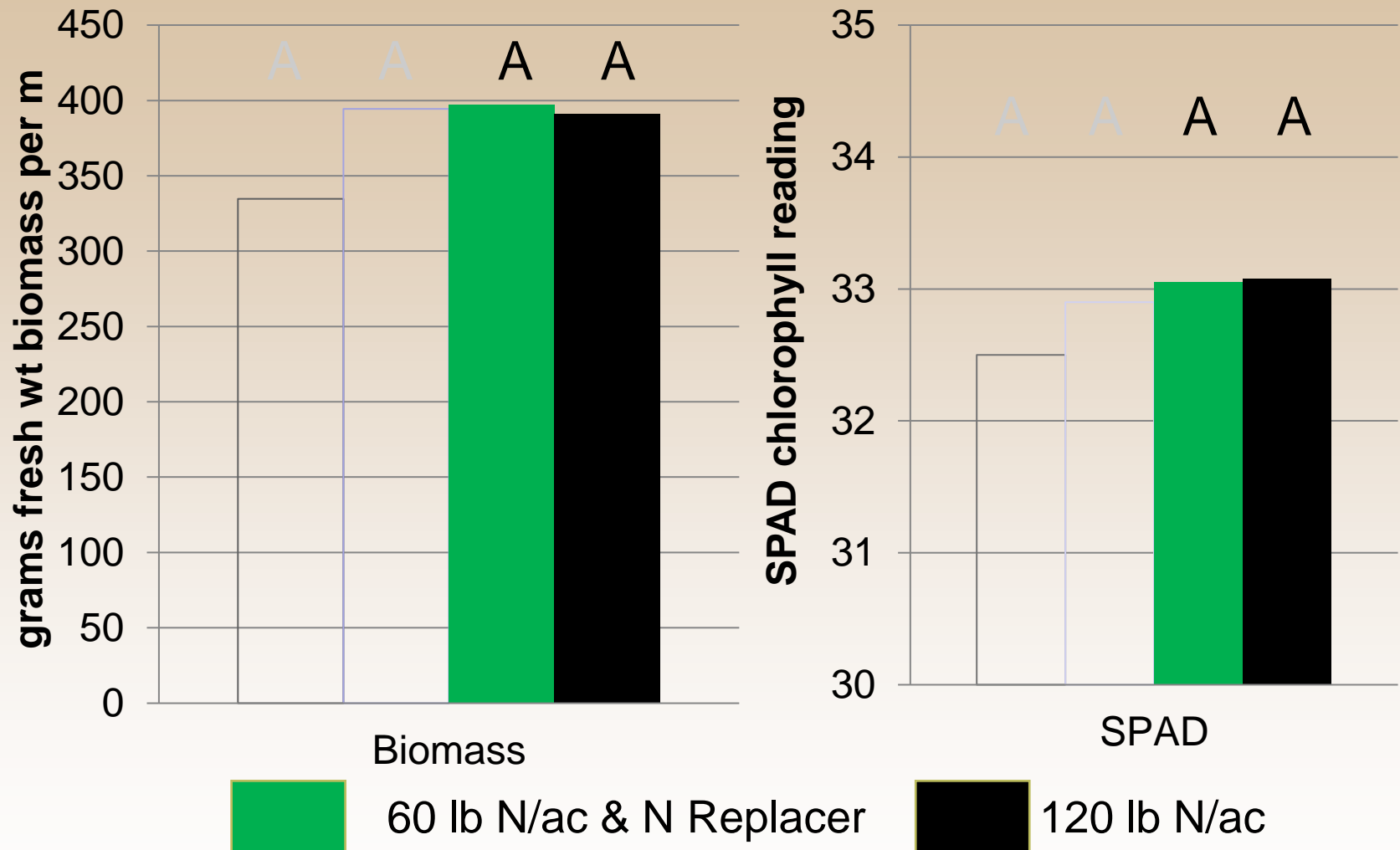
John Heard

# "Acer" Study #1 - Canola growth enhanced!!



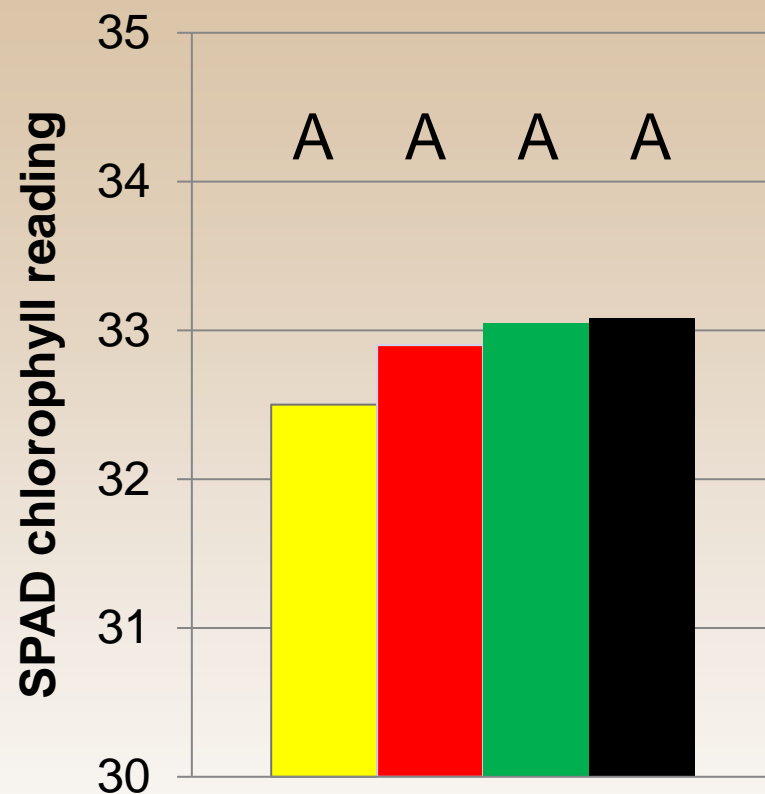
**\* Differences are significantly different at the 90% confidence level (10% error) at 2 of the 20 sites**

# "Acer" Study #2 - 60 lb N/ac Replaced!!



Bars under the same letter are not significantly different at the 90% confidence level.

# "Acer" Study #2 - 60 lb N/ac Replaced??



Biomass

SPAD



0 lb N/ac



60 lb N/ac



60 lb N/ac & N Replacer



120 lb N/ac

Previous crop = drowned out and fallowed soybeans

Soil test N = 98 lb nitrate-N/ac in 0-24"

N response was small & 60 lb N/acre was more than sufficient to meet crop needs

# Good

- A “good” product provides both agronomic and economic benefits to producers. Its behaviour is predictable within reason and its application is supported by ample scientific evidence. It mostly meets the criteria of type “b” response.

# Bad

- A “bad” product is one that provides sporadic agronomic and economic benefits to producers, so much so that those can be considered random events. Its behaviour is not well understood and the body of scientific research is limited. It mostly meets the criteria of type “a” response.

# Ugly

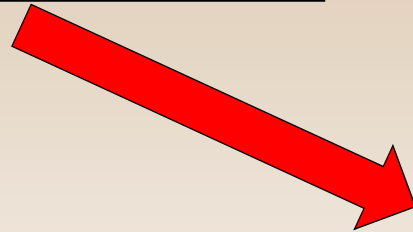
- **An “ugly” product offers no benefits of any sort to the producer, just to the person that peddles it! It can be considered a “miracle” product. Normally, the market takes care of it, unfortunately though at the expense of a few producers, who have the desire to find new opportunities. It meets no particular criteria!**

# Conclusion

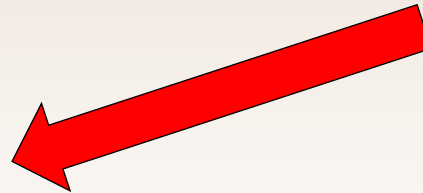
- **Select only fertilizer products that result in maximum economic return.**
- **Adhere to the same fundamental principles that guided crop fertilization when times were more... certain and avoid the “search-for-the-silver-lining” mentality. Simply, there is none!**
- **Use available tools to assess the necessary adjustments to fertilization rates, so that maximum economic returns are achieved.**

**and remember....**

**No Science**



**No Evidence**



**No Truth**

# **Thank you**

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