Optimizing Fertilizer Economics on the Prairies

Rigas Karamanos

Types of Operating Costs

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

Reducing Risks With Proper Fertilization

- Assess the risks of what you are going to fertilize for
- Assess the risks of what you are going to fertilize with

Reducing Risks With Proper Fertilization

- **Assess the risks of what you are going to fertilize for**

Reducing Risks With Proper Fertilization

- First step in managing the soil is knowing what's in it!
  - Alleviate misconceptions about soil testing. It's only a tool and part of the overall assessment.
  - Chose a nutrient application philosophy that suits your style of management.

Soil Testing Is

A TOOL (yes, a tool not an absolute science) that allows producers to make more qualified fertility management decisions based on soil nutrient inventory and interpretive criteria based on a specific philosophy.

Reducing Risks With Proper Fertilization

- Assess the risks of what you are going to fertilize with

Fundamental Principles: Fertilization

2 classes of nutrients to consider

- Fertilizer affects the current crop only
  - Fertilizer has little effect on subsequent crops
  - Example: N applications
- Fertilizer affects current and subsequent crops
  - Fertilizer has a residual effect
  - Examples : P, K and S

Types of Operating Costs

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Nitrogen is the single most important nutrient and provides a response almost always when a soil is Nitrogen deficient.

Nitrogen #1 Nutrient in 8 Experiments in 2000

	Percentage of yield changes explained by Nitrogen	
Location	**Wheat**	**Canola**
Allan, SK	No response	97
Irricana, AB	84	43
Ft. Saskatchewan, AB	90	61
Rosser, MB	99.7	98

Probability of a Yield Increase due to Nitrogen Fertilizer Application on N deficient soils

Crop	Probability of Overall positive Response	Probability of response by a yield increase of:		
		>10 bushels	>20 bushels	>30 bushels
Wheat	98.6%	70%	40%	<10%
Barley	99.3%	90%	80%	60%
Canola	100%	70%	25%	<10%

Average Yield Increases due to Nitrogen Fertilizer Application on N deficient soils

	Optimum Nitrogen fertilizer rate, lb N/acre				
Crop	<40	40-60	60-80	80-100	>100
Barley	18	22	38	45	53
Wheat	7	15	19	25	32
Canola	9	12	15	18	23

What determines Maximum Yield?

Crop genetics

Solar radiation

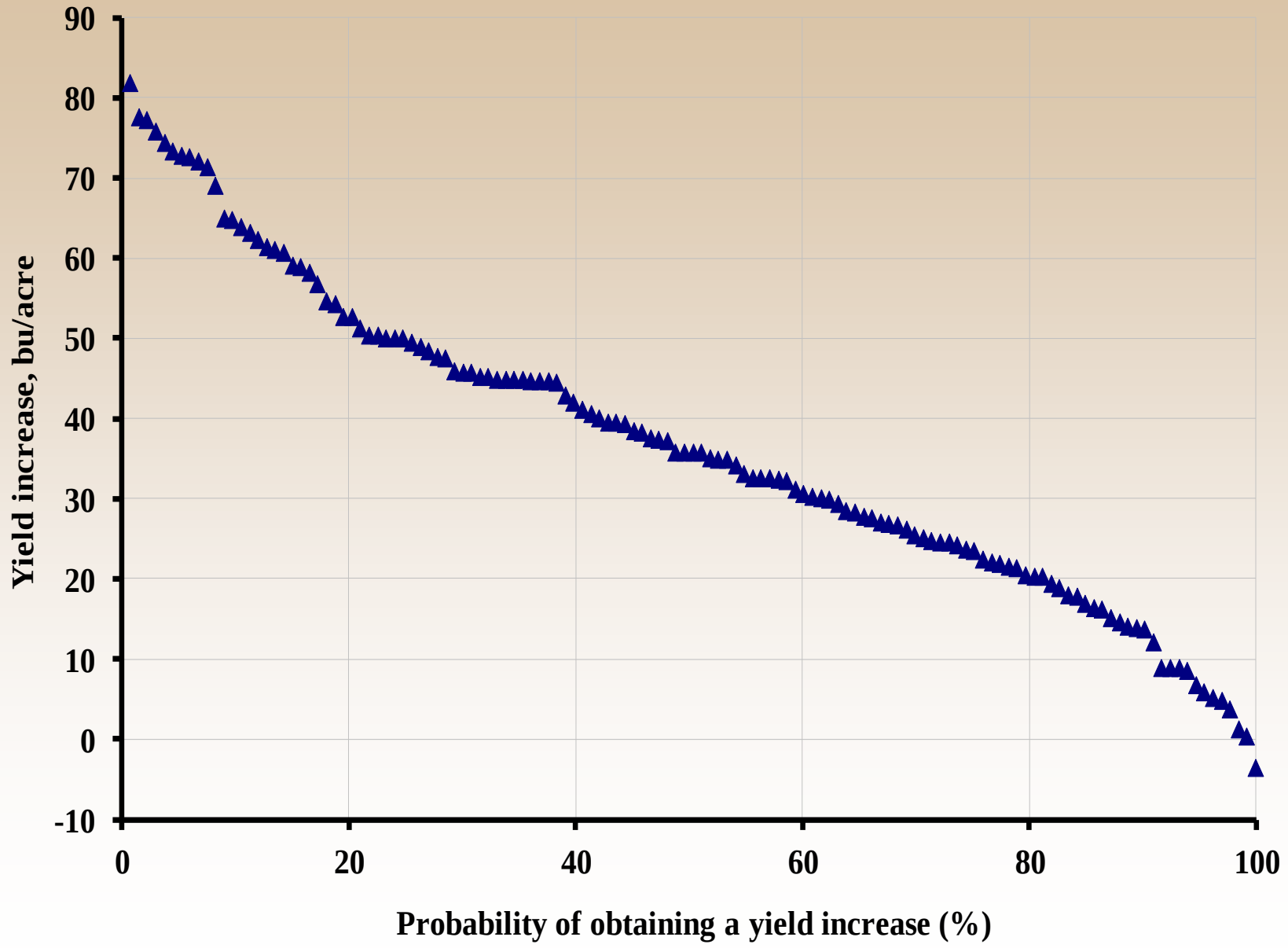
WATER

Nutrients

Let’s go a bit back in time!

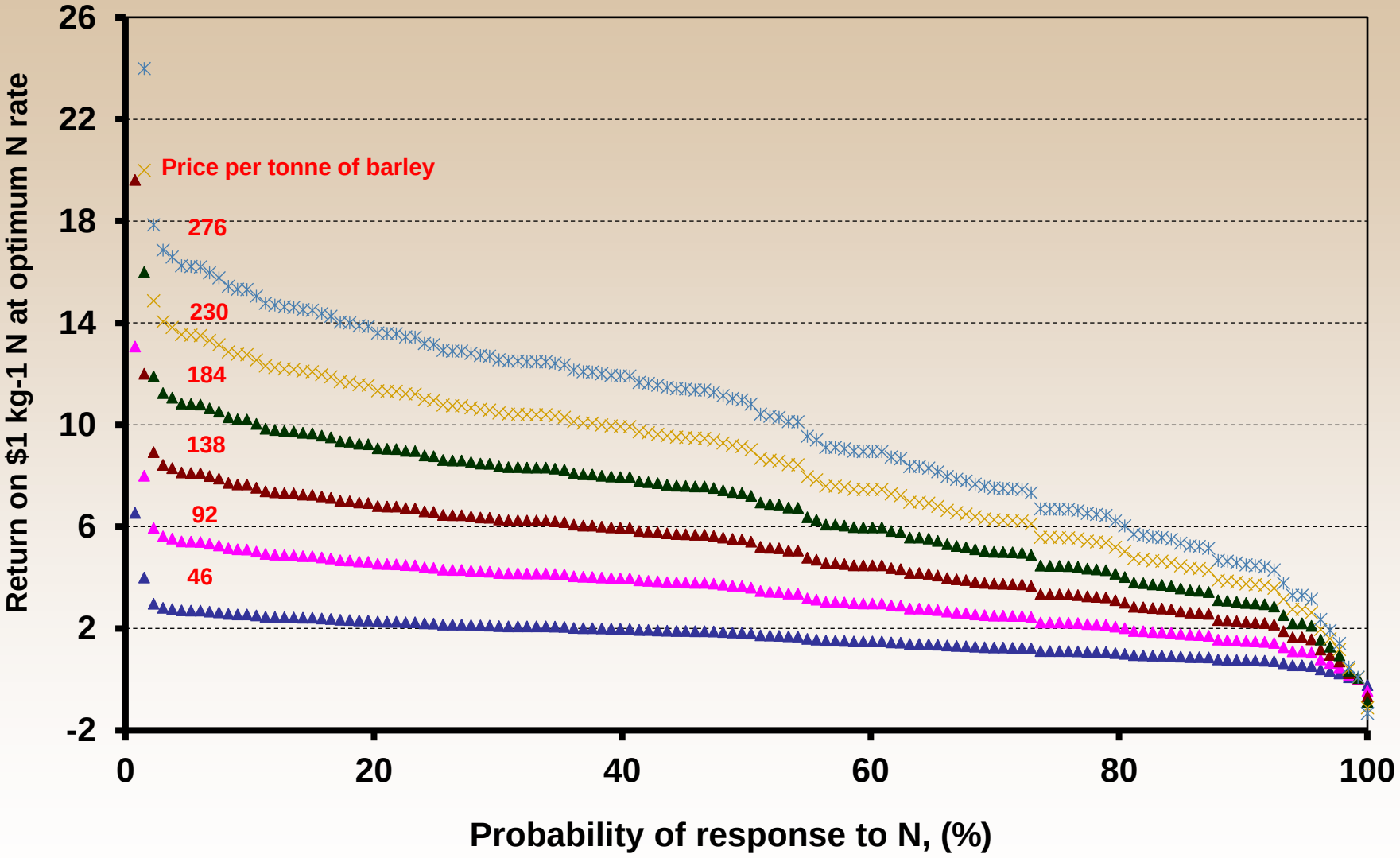
Probability of barley response to N

Source: Westco 133 site years



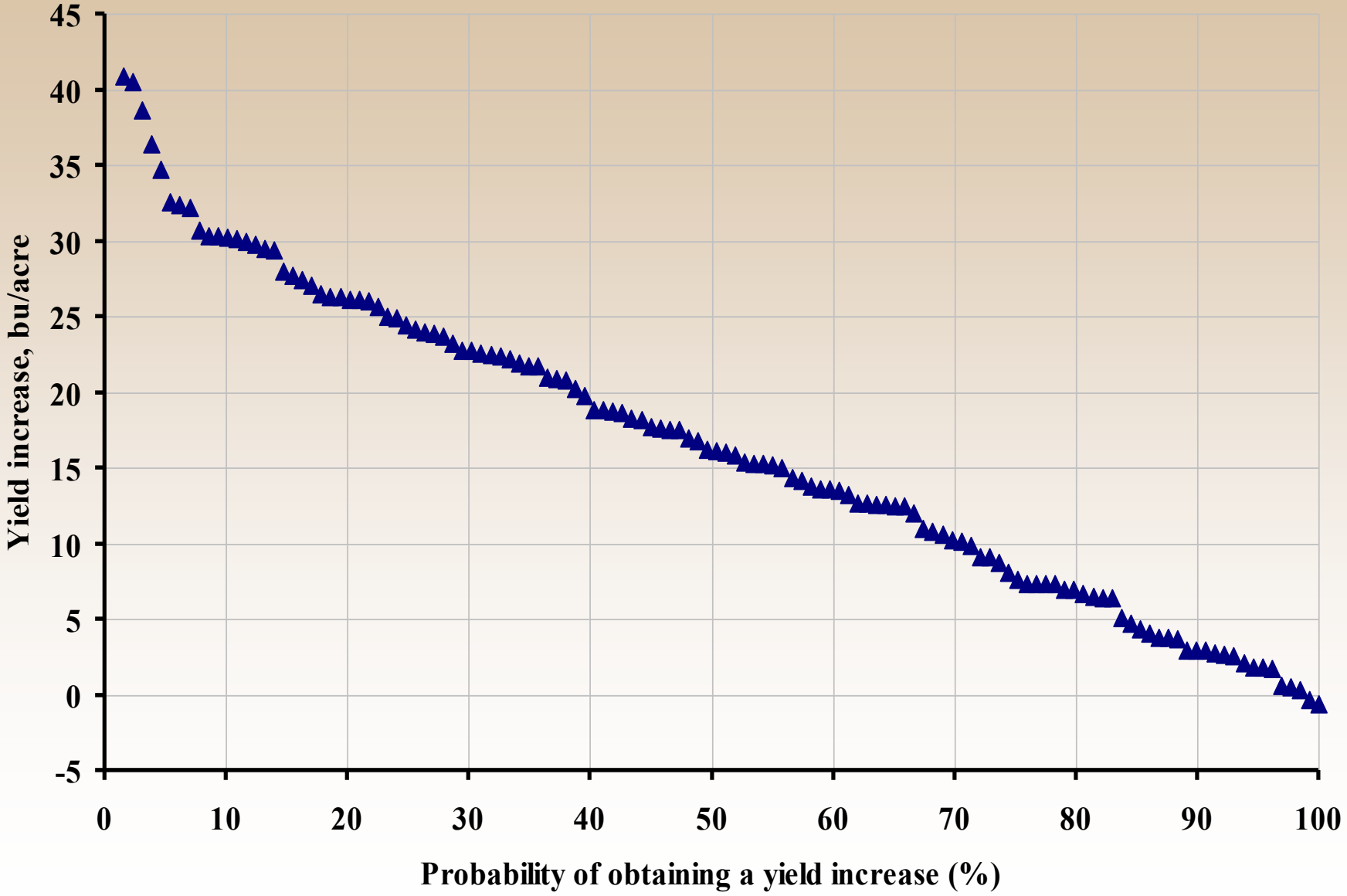
Return on 66¢/ lb N for Barley

Source: Westco 133 site years



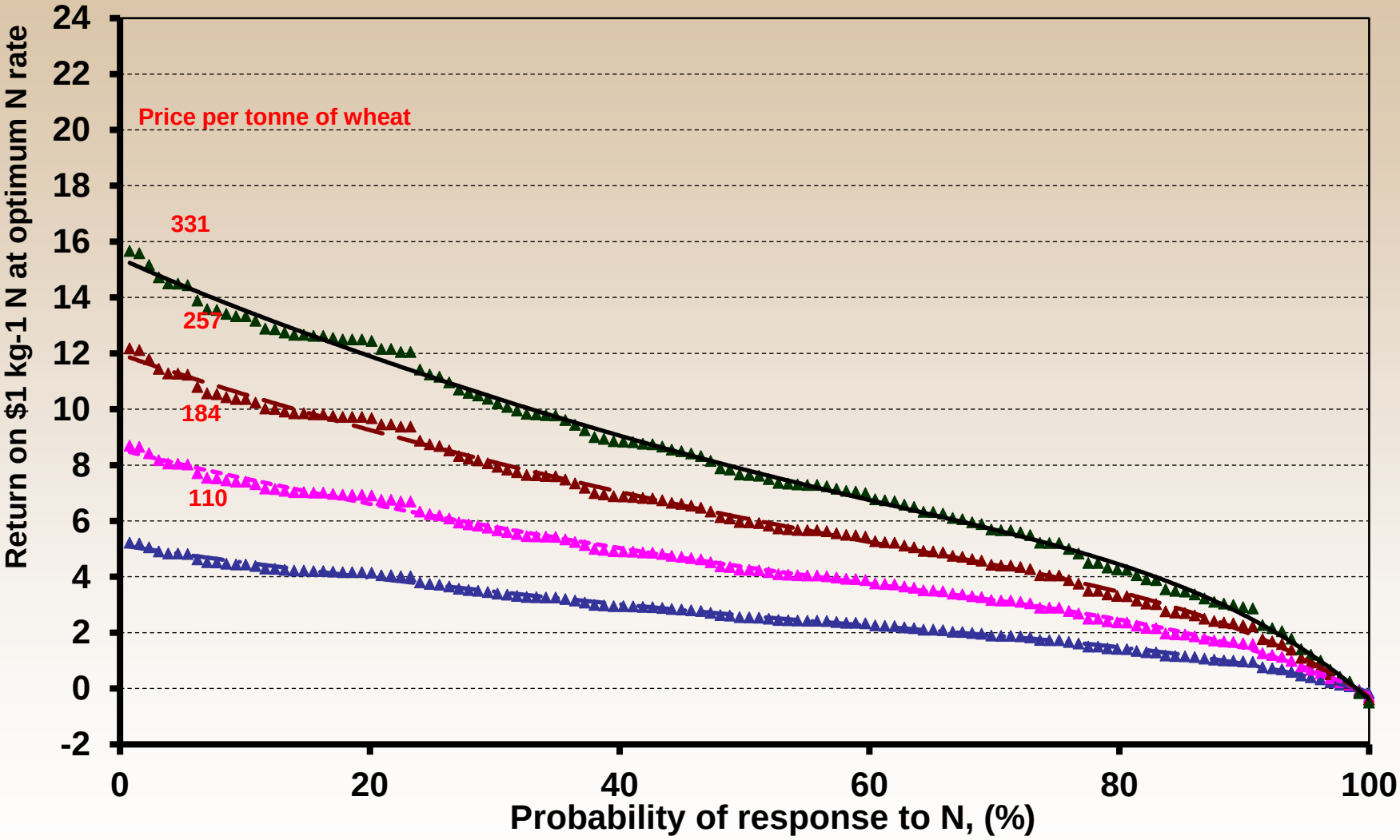
Probability of wheat response to N

Source: Westco 129 site years



Return on 66¢/ lb N for Wheat

Source: Westco 129 site years



Do not forget the N power of your soil!

Nitrogen Mineralization

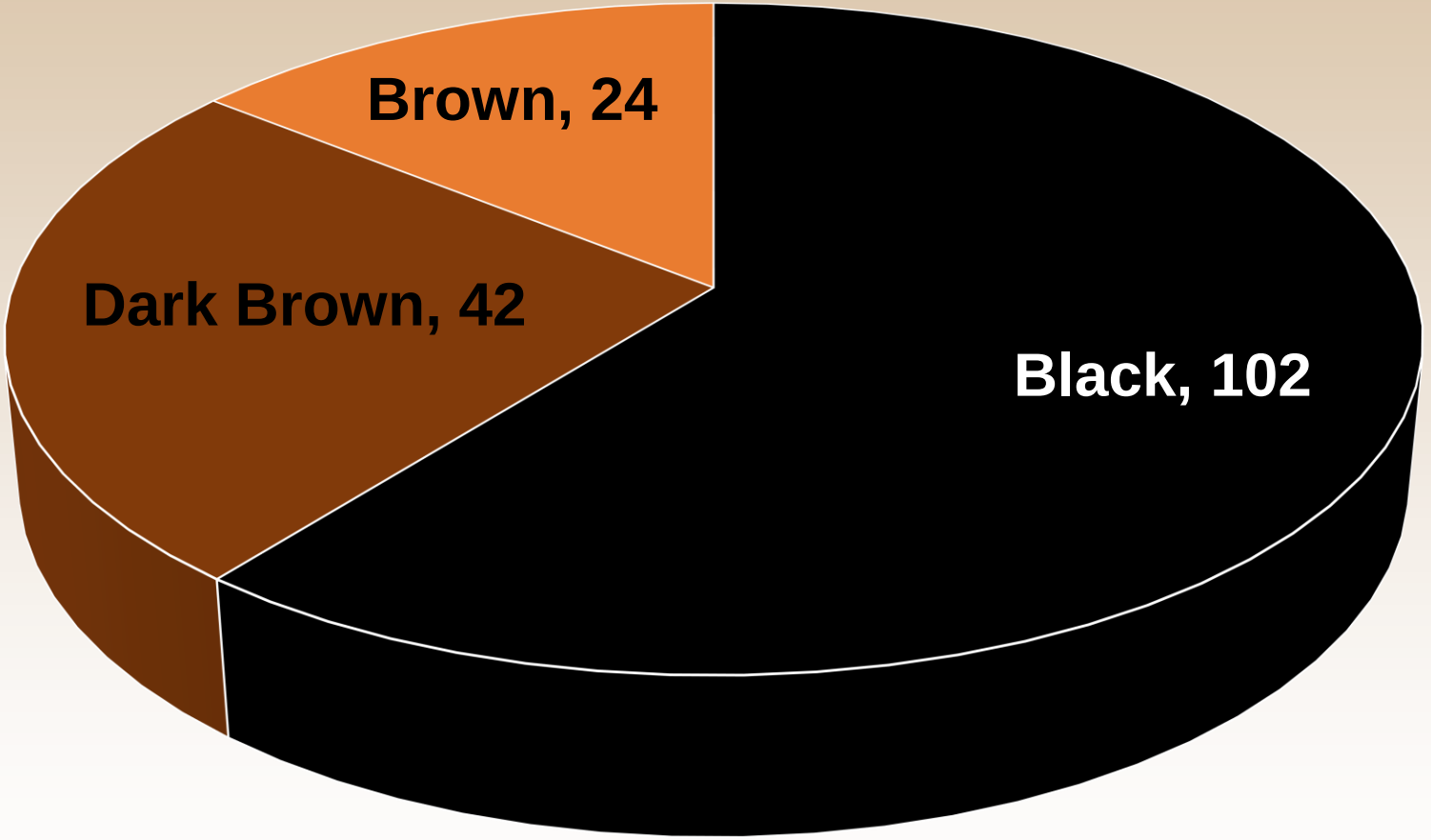
Organic Matter, %	N Pool	Mineralization Maximum	Mineralization "Normal"
2	116	84	37
3	174	145	64
4	232	193	85
5	290	242	106

Nitrogen Rate of Return Calculators for Brown, Dark Brown and Black soils

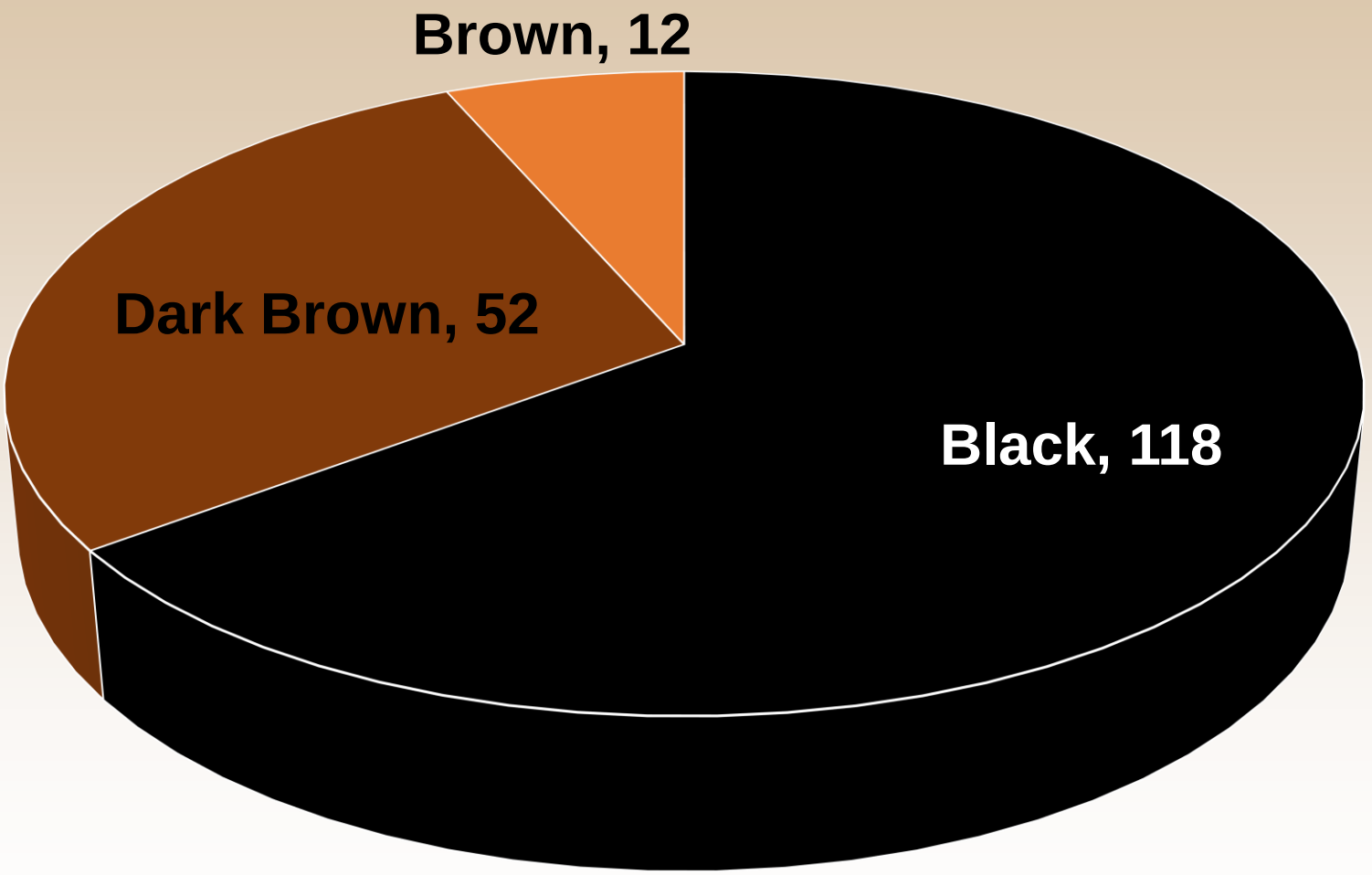
Net Return Parameters

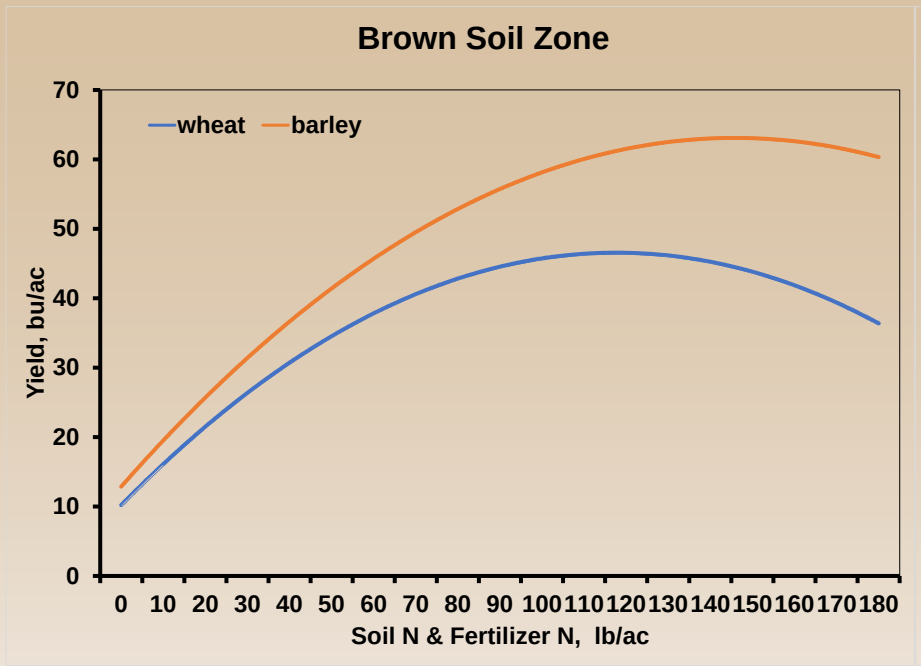
- Net Return = (crop price x yield increase) - (Nutrient price x Nutrient rate)
- Specific to Nitrogen
  - Calculations are based on the premise that an "ideal" fertilization program results in 30 lb N/acre residual N in 0-24" depth
  - Current N rate from the soil test report or common practice
  - Net return in blue represents maximum for the CWRS Wheat/Barley:N Price Ratio range in the tables and in Orange/Brown within $1.00 of maximum

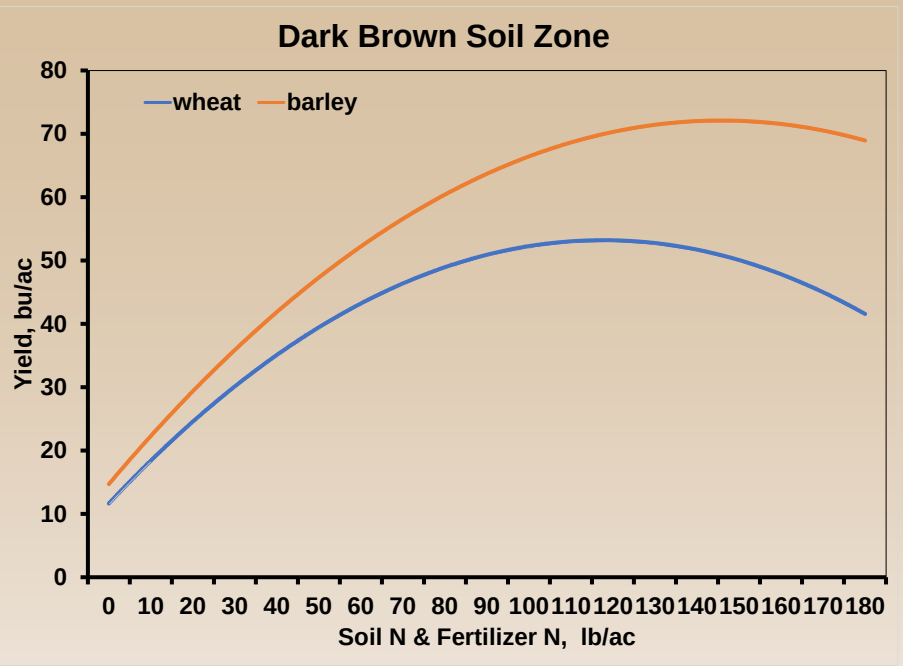
No. of sites for Wheat

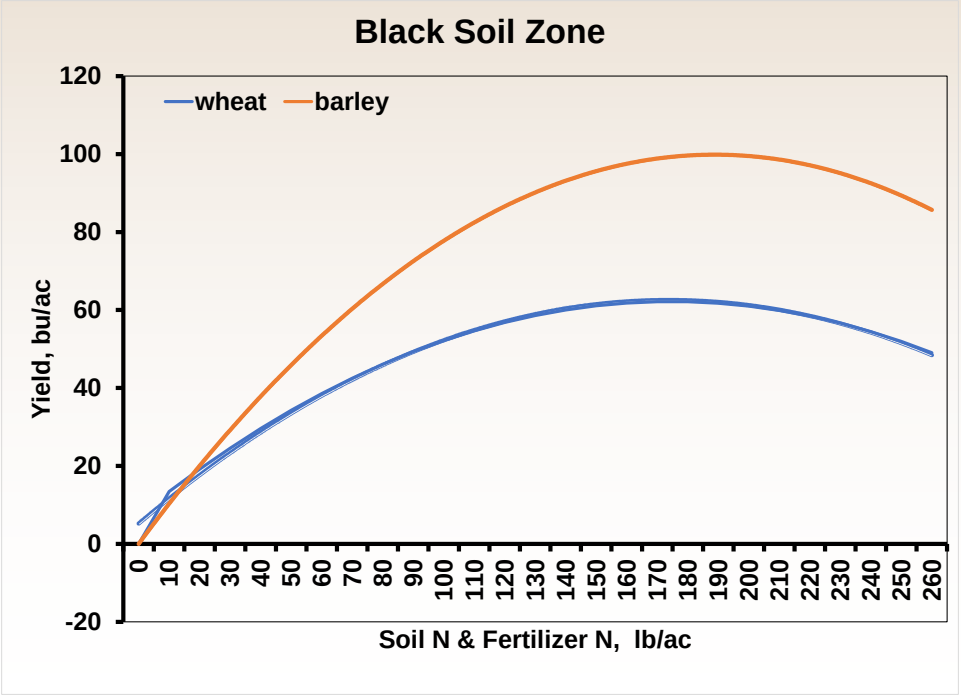


No. of sites for Barley




Brown Soil Zone
wheat
barley
Yield, bu/ac
0
10
20
30
40
50
60
70
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180
Soil N & Fertilizer N, lb/ac


Dark Brown Soil Zone
wheat
barley
Yield, bu/ac
0
10
20
30
40
50
60
70
80
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180
Soil N & Fertilizer N, lb/ac


Black Soil Zone
wheat
barley
Yield, bu/ac
-20
0
20
40
60
80
100
120
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260
Soil N & Fertilizer N, lb/ac

Basic concepts

- Economic return comparisons to N fertilization are based on the principle of net return* as described by University of Wisconsin Professor M. Rankin (Rankin, 2005)

* Net Return = (crop price x yield increase) - (N price x N rate)

*Rankin, M. 2005. Nitrogen $ Rate of Return Calculator Version 3. University of Wisconsin - Extension

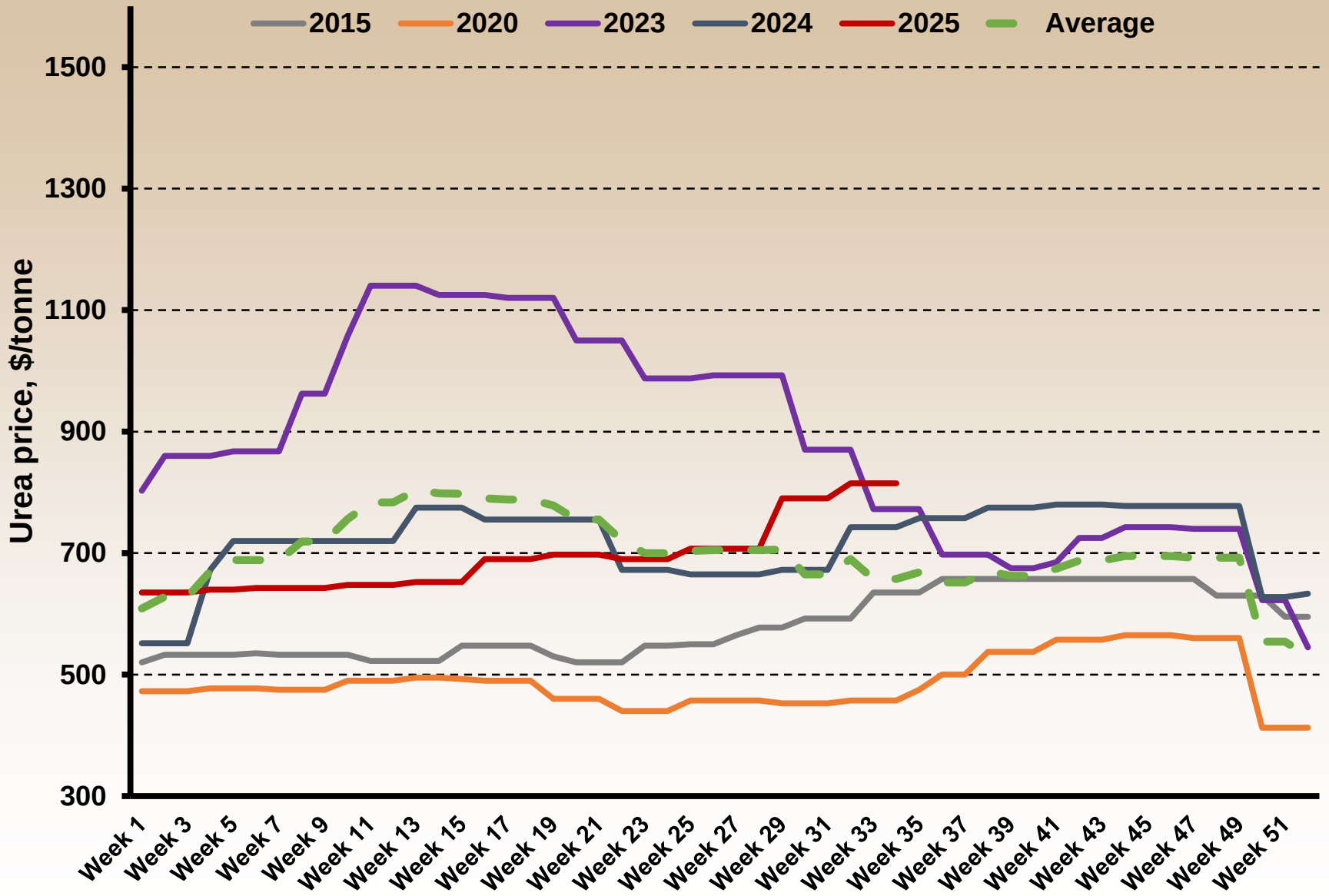
Basic concepts

- The grower does not set a yield goal, but selects their soil type. The maximum economical return to N is not based on yield goal, but is determined from the yield increase above where no N is applied. The total return is also supplied for reference and comparison purposes.

Basic concepts

- In order to reduce the financial risk of fertilizing with high rates of N and not achieving these returns, you can demand a greater return on the last dollar spent on N fertilizer. This is determined by the marginal revenue which equals the marginal return: marginal cost. Maximum economic N rate occurs when the last increment (or dollar) spent on N returns a dollar value of crop.

Trends in urea price



Nitrogen $ Rate of Return Calculator for the Brown Soil Zone

Fertilizer N data	
Fertilizer Type	**UREA**
Cost/tonne	$1,350.00
%N	46
Cost/Unit of N	**$1.334**
Fertilizer N incremement	**10**
Commodity price increment, $	**$0.40**
Soil test N (0-24") lb N/acre	**65**
Yellow Cells Can be Modified	

Crop and Soil data	
Current N Rate (lb N/acre):	
CWRS Wheat	**50**
Barley	**60**
Expected prices ($/bushel):	
CWRS Wheat	**$12.70**
Barley	**$9.00**

Nitrogen $ Rate of Return Calculator for the Dark Brown Soil Zone

Fertilizer N data	
Fertilizer Type	**UREA**
Cost/tonne	$1,350.00
%N	46
Cost/Unit of N	**$1.334**
Fertilizer N incremement	**10**
Commodity price increment, $	**$0.40**
Soil test N (0-24") lb N/acre	**65**
Yellow Cells Can be Modified	

Crop and Soil data	
Current N Rate (lb N/acre):	
CWRS Wheat	**50**
Barley	**60**
Expected prices ($/bushel):	
CWRS Wheat	**$12.70**
Barley	**$9.00**

Nitrogen Rate of Return Calculator

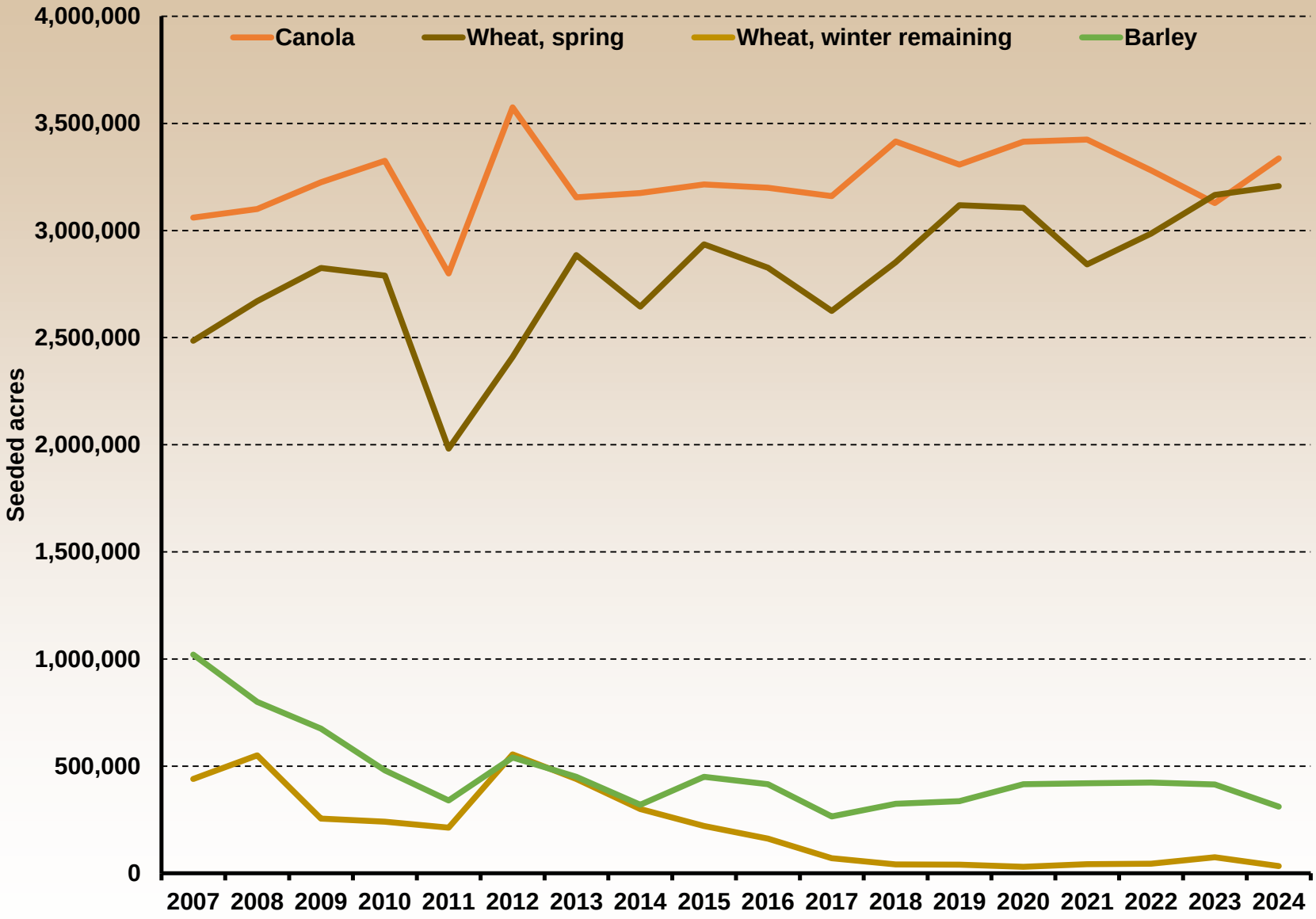
Black Soil Zone

Fertilizer N data	
Fertilizer Type	**UREA**
Cost/tonne	$1,350.00
%N	46
Cost/Unit of N	**$1.334**
Fertilizer N incremement	**10**
Commodity price increment, $	**$0.5**
Soil test N (0-24") lb N/acre	**30**
Yellow Cells Can be Modified	

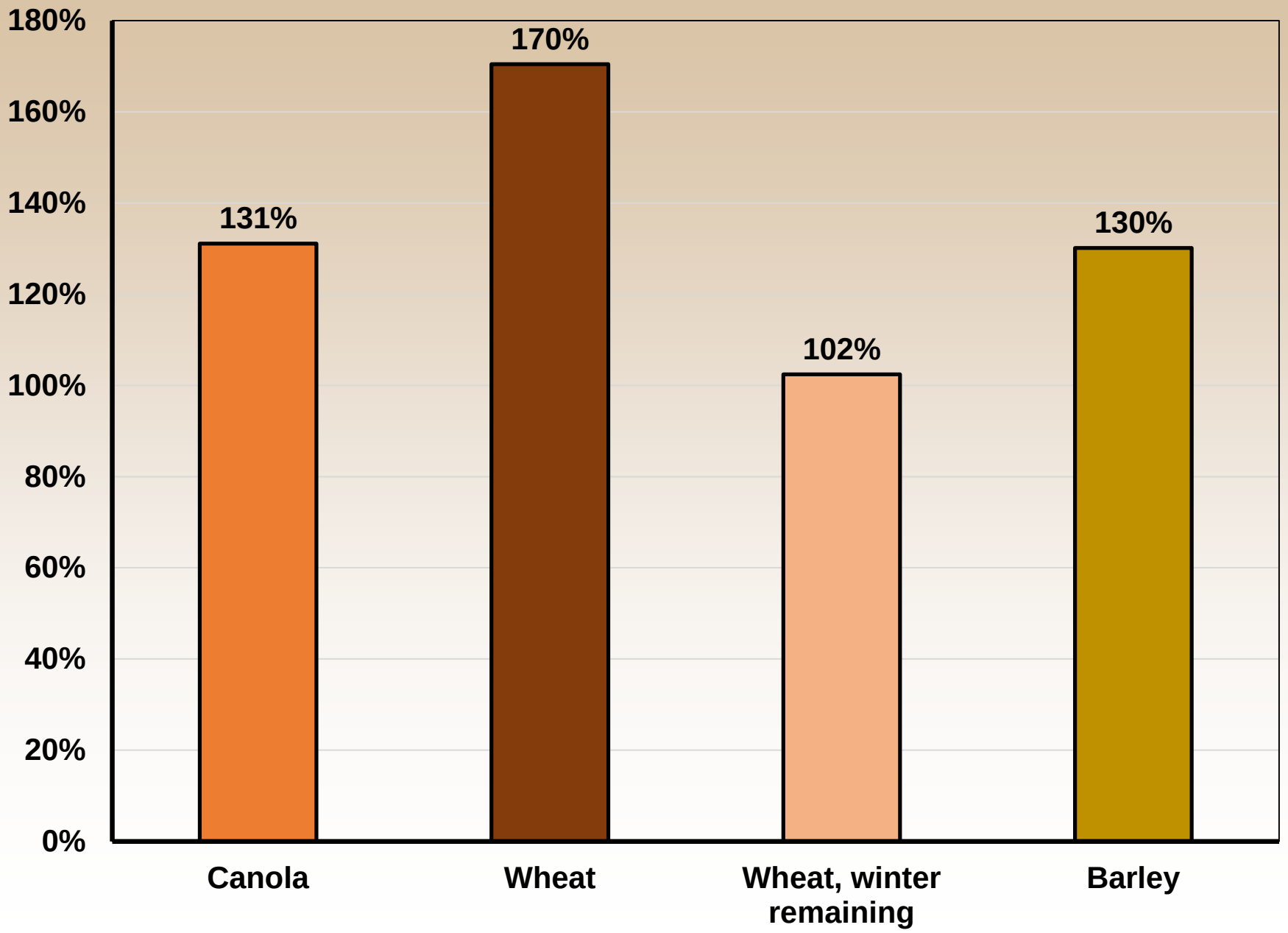
Crop and Soil data	
Current N Rate (lb N/acre):	
CWRS Wheat	**110**
Barley	**100**

Expected prices ($/bushel):	
CWRS Wheat	**$11.00**
Barley	**$8.50**

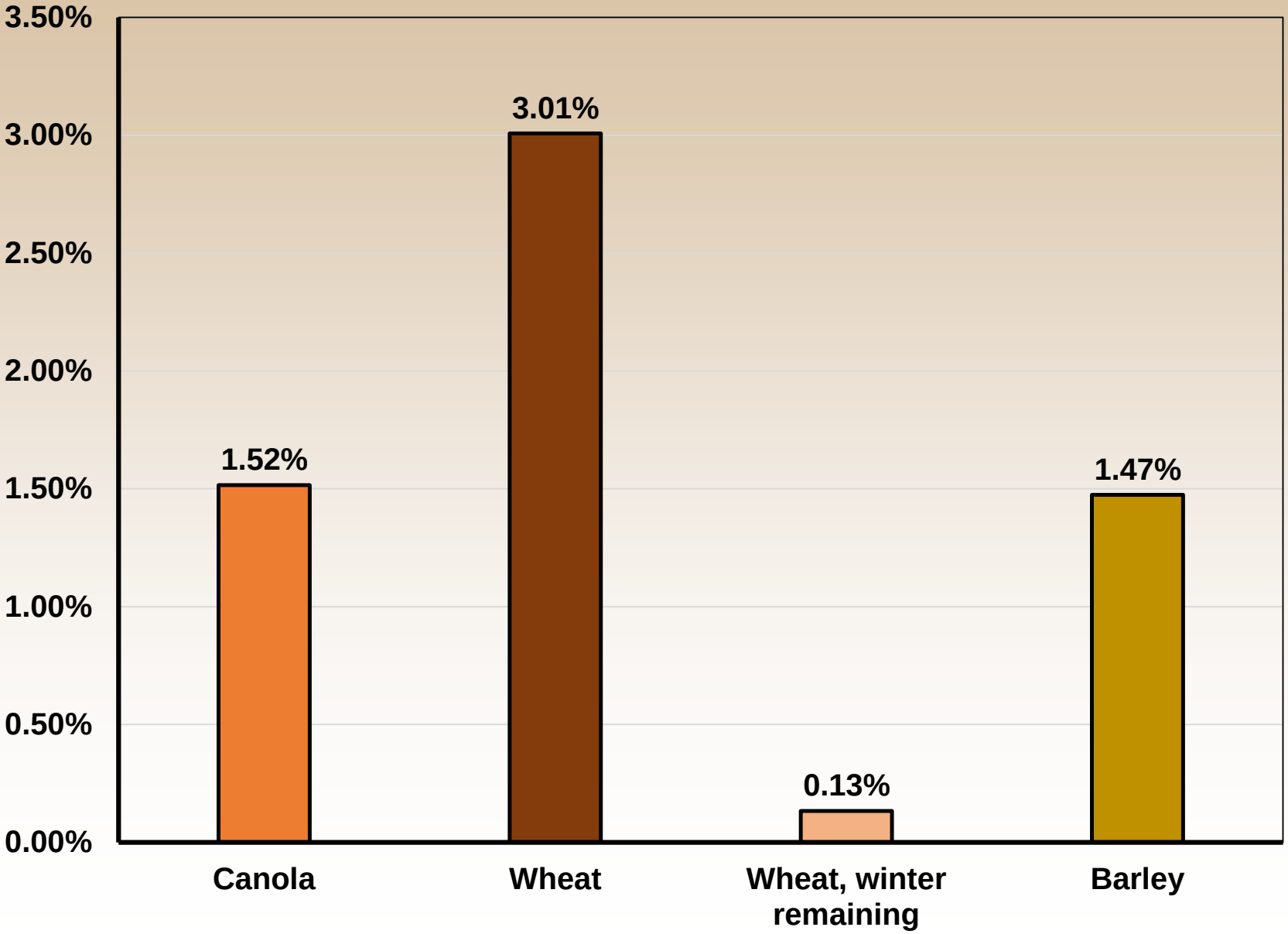
Seeded acres in Manitoba



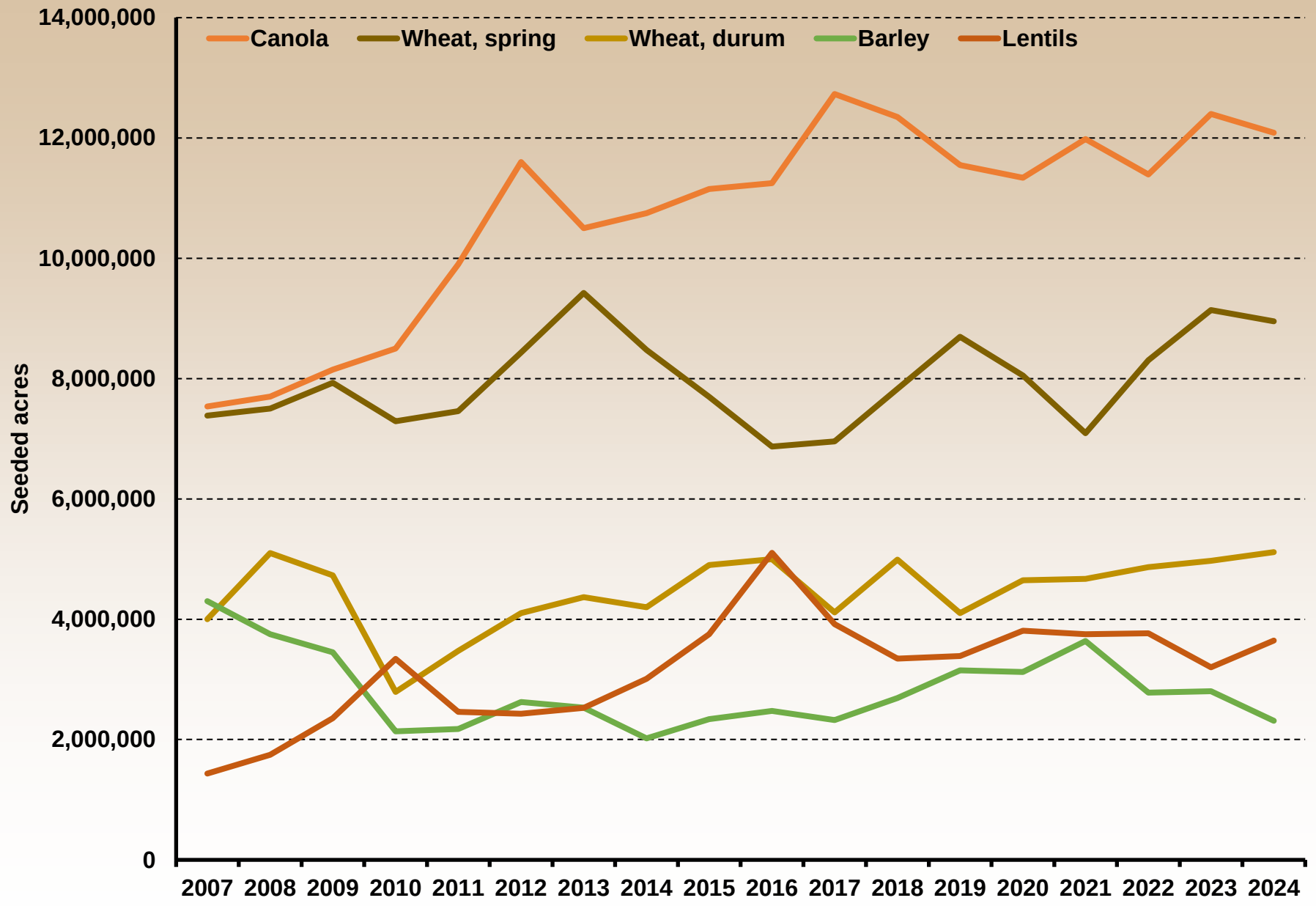
18 year % Change in yield in Manitoba



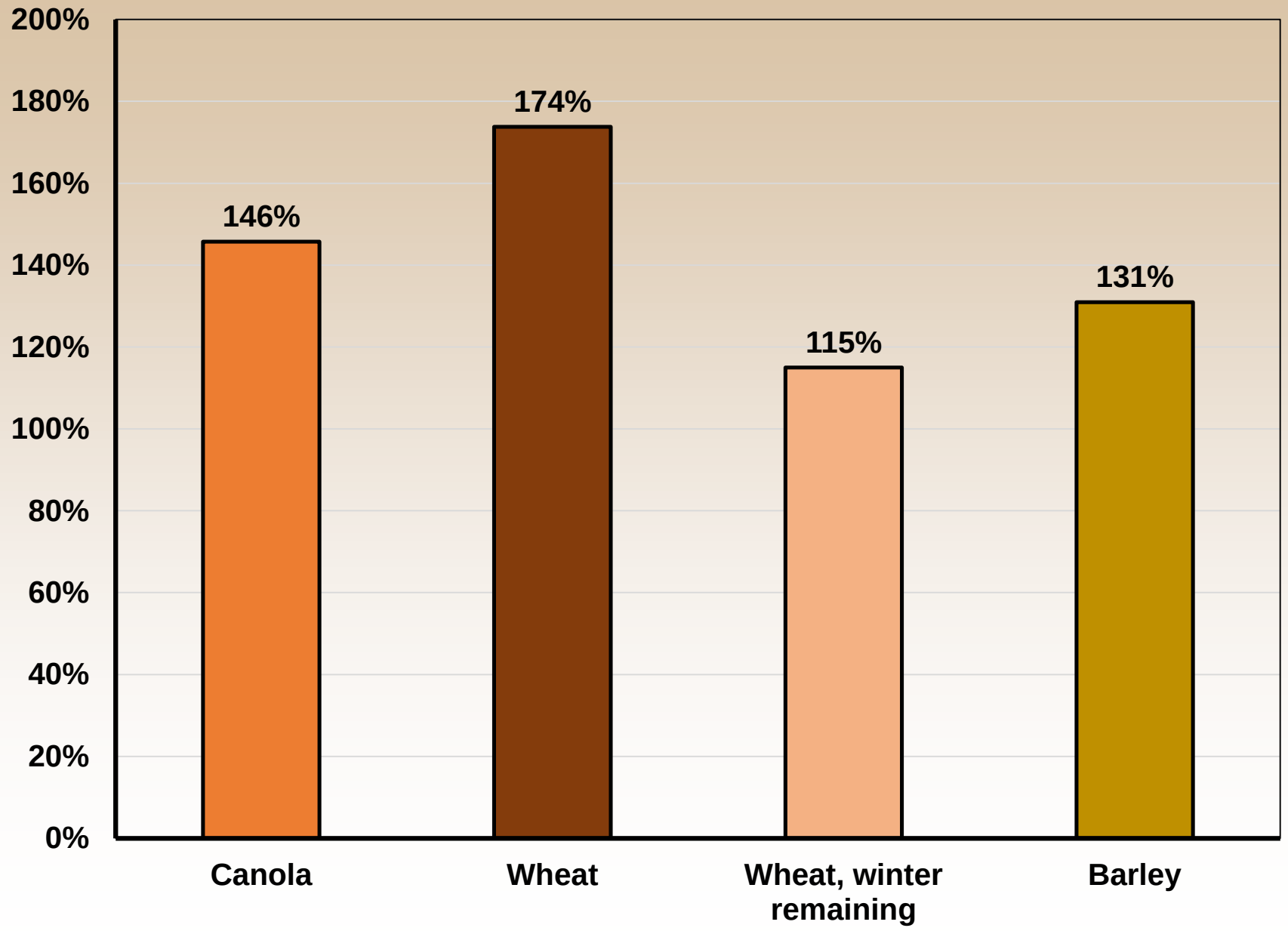
18 year Compound Annual Growth Rate in Manitoba



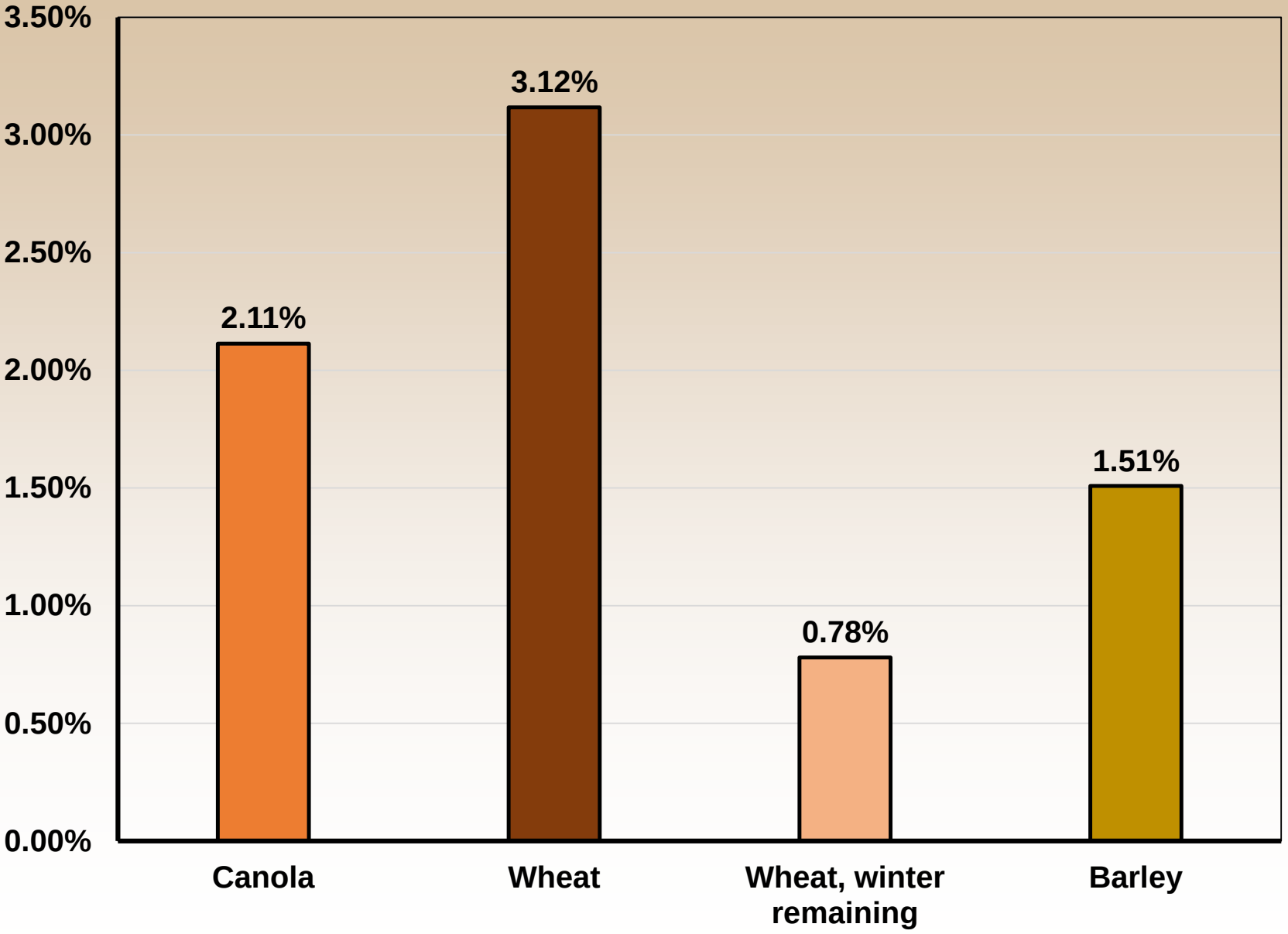
Seeded acres in Saskatchewan



18 year % Change in yield in Saskatchewan

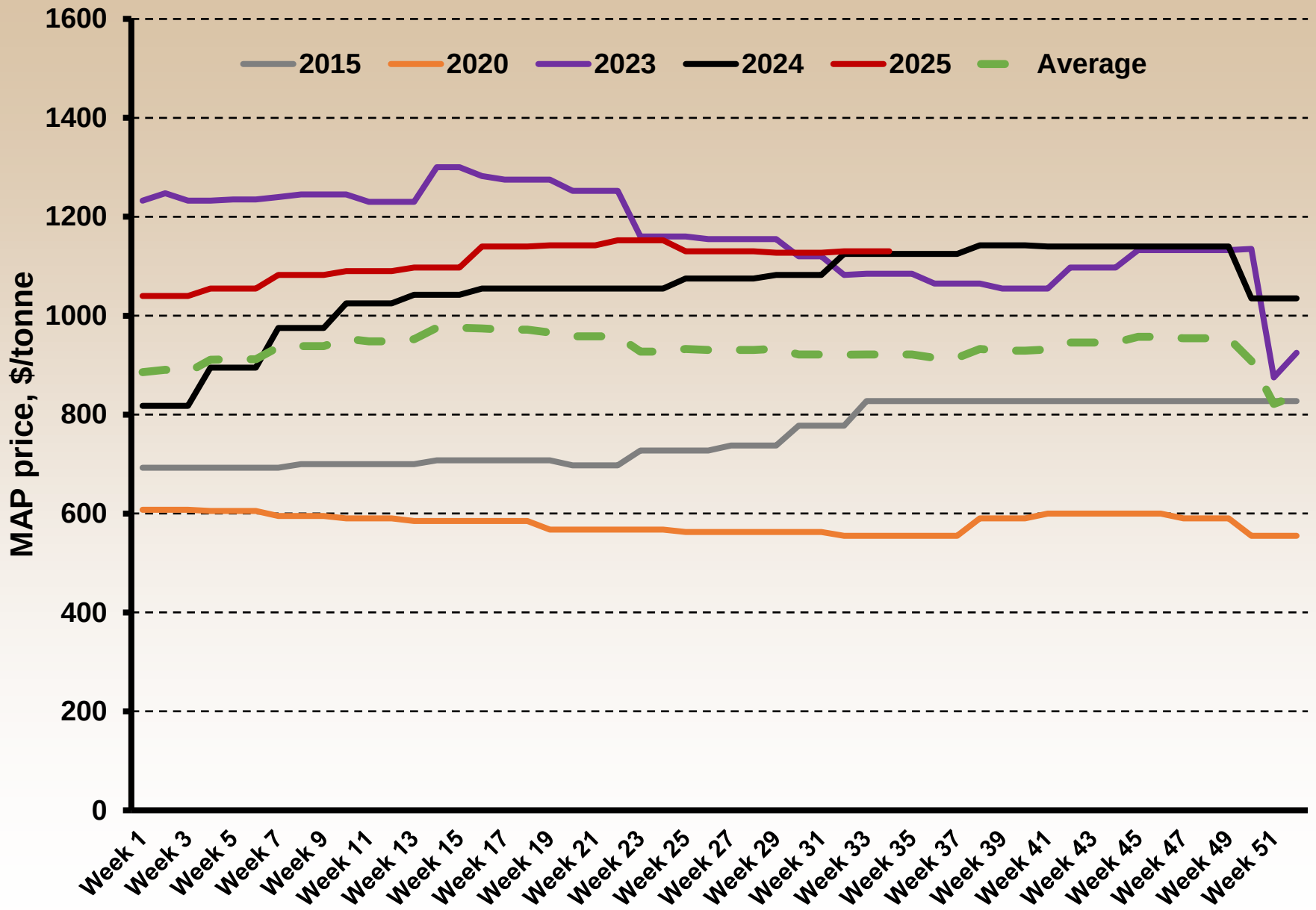


18 year Compound Annual Growth Rate in Saskatchewan

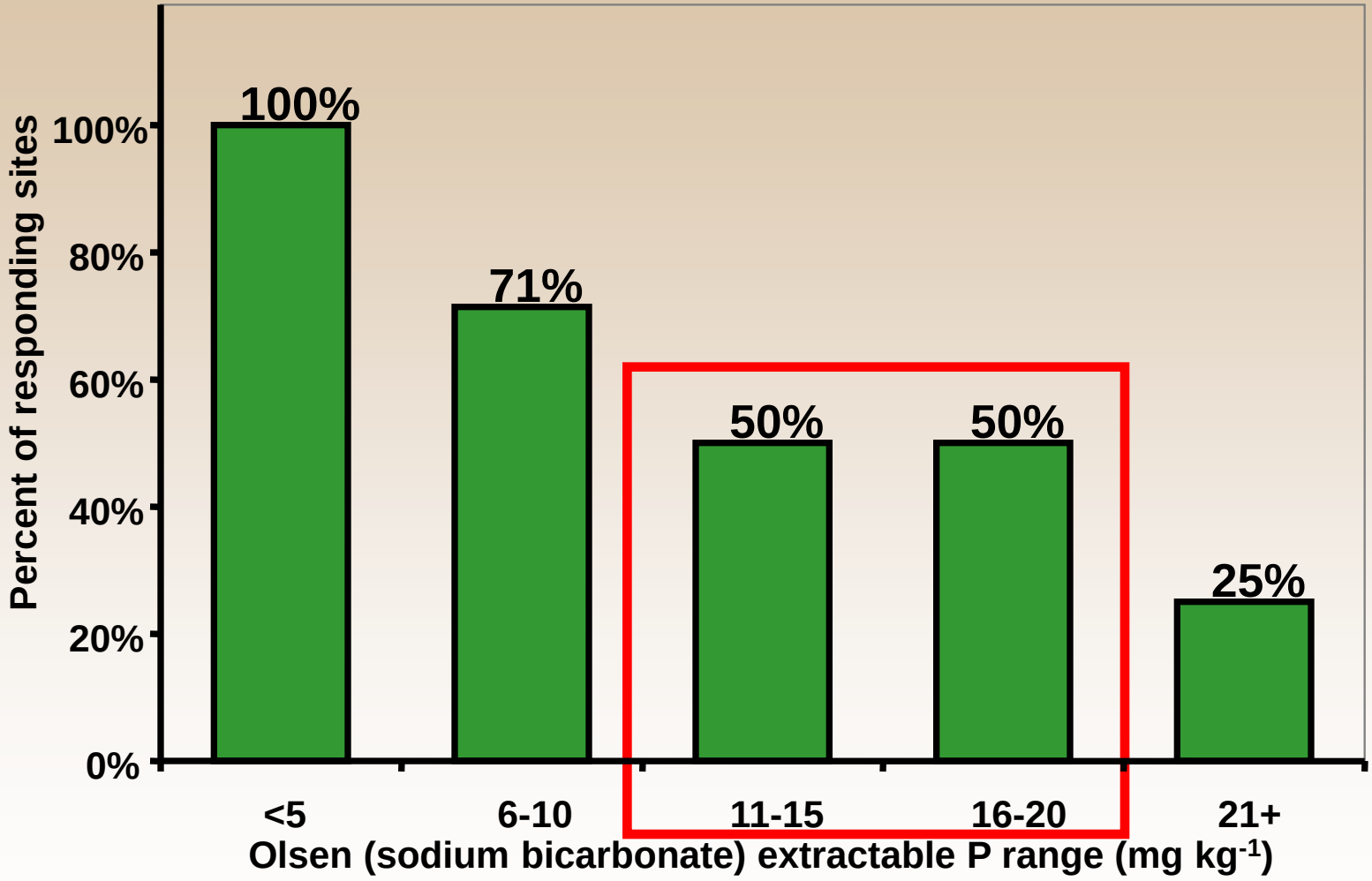


Phosphorus

Trends in MAP price



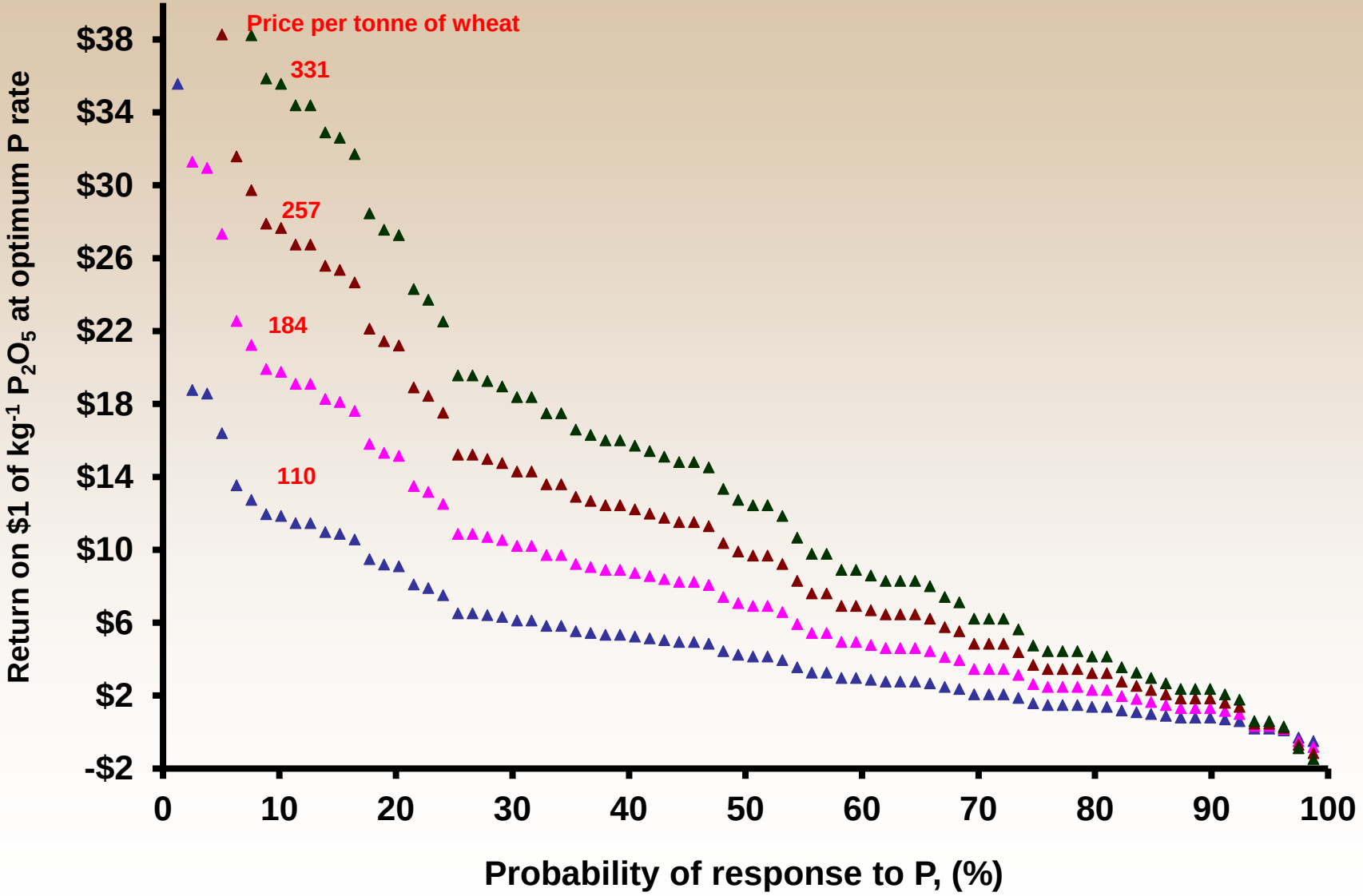
Percentage of wheat responding sites to application of P as a function of Olsen soil test P*



*33 site years in AB, SK, MB

Return on 55¢/ lb P_2O_5 for Wheat

Source: Westco 78 site years



Fertilization with Phosphorus

Soil P Checkbook

Name:	Farmer
Field:	Home quarter
Legal Location:	Anywhere on the prairies
NFRZ:	**Moist Parkland**
Texture:	**Loam**
Irrigation:	**No**
Soil test (lb/ac) 0 - 6" ONLY:	**77**
Crop	Canola, Hybrid
Crop Yield (bu/ac):	65

FIELD IDENTIFICATION:

Name: **Farmer** Legal Location: **Anywhere on the prairies**

Field: **Home quarter** Irrigation: **No**

FERTILIZER RECOMMENDATIONS

Target yield **65** bu/acre of **Canola, Hybrid**

B&I **59** **lb P_2O_5/ac**

15 lb/ac towards sufficiency

44 lb/ac towards maintenance

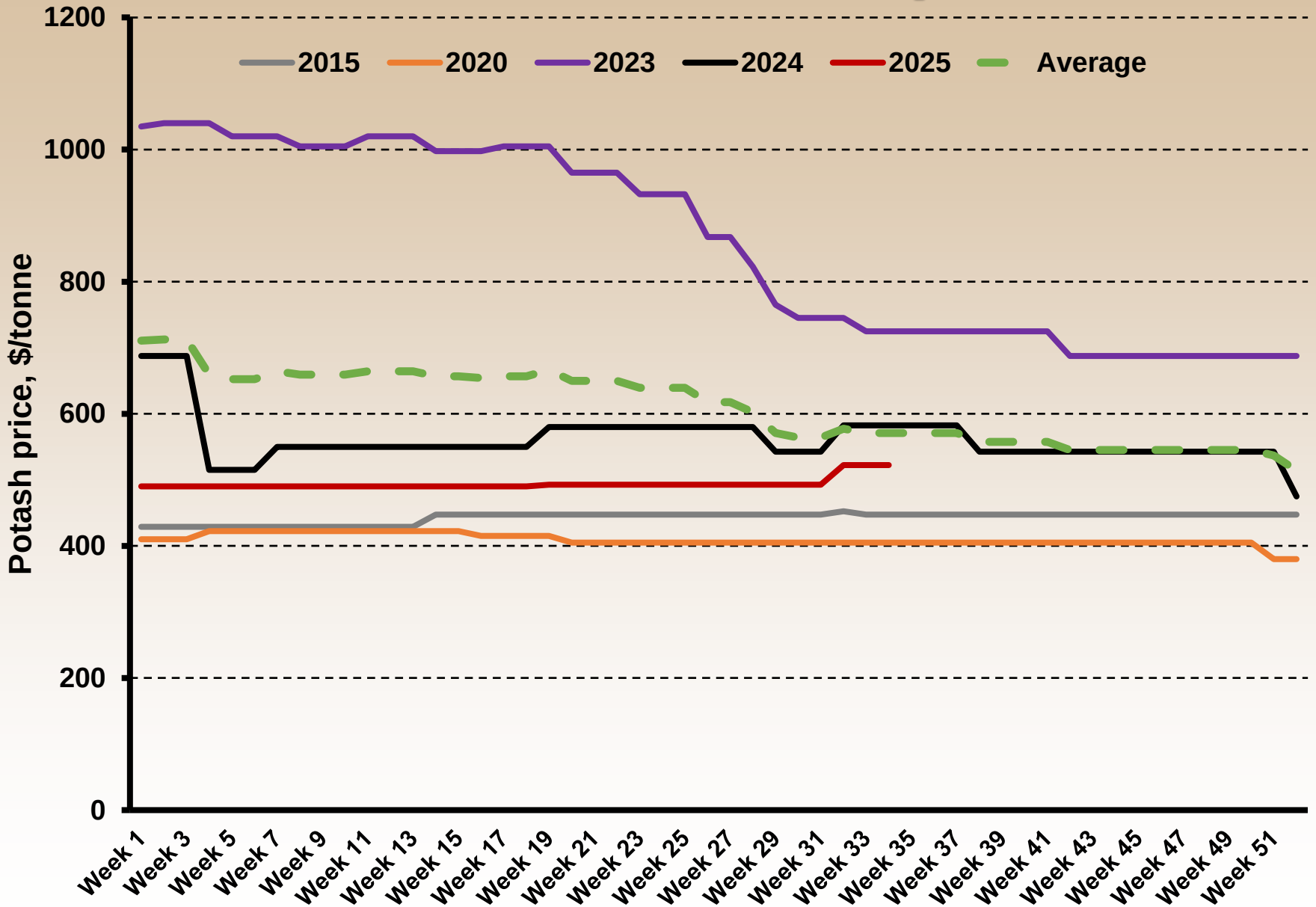
Phosphate Rate of Return Calculator
Wheat, Barley & Canola

Crop and Soil data	
Expected prices ($/bushel):	
CWRS wheat	$6.50
Barley	$3.50
Canola	$9.50
Soil Test, ppm (0-6")	10
Texture*	Loam
*CAUTION: these entries are drop down lists	
Yellow Cells Can be Modified	

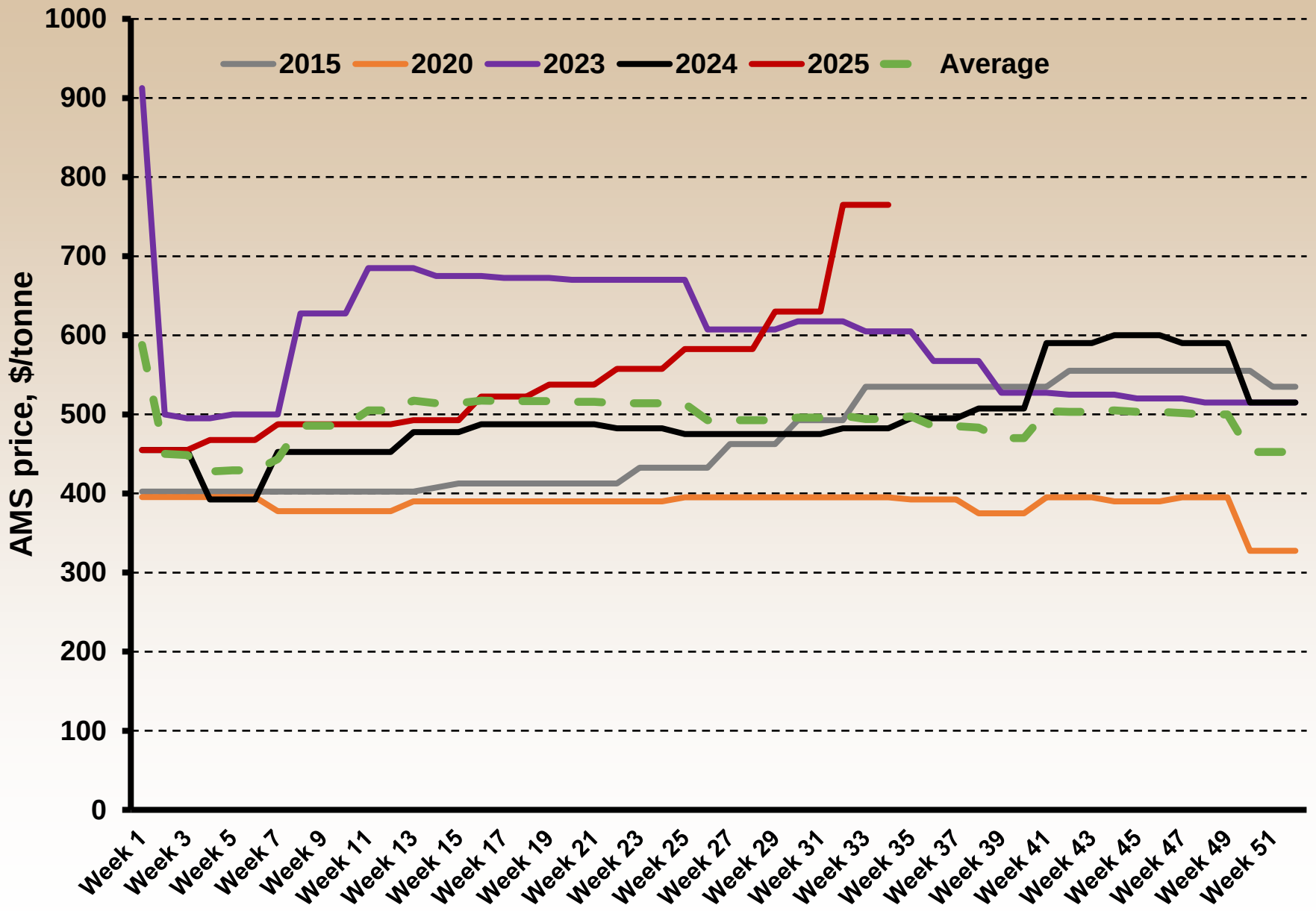
Fertilizer P_2O_5 data	
Fertilizer Type	MAP
Cost/tonne	$1,200
% P_2O_5	52
Price of UREA	$900
Cost/Unit of P_2O_5	$0.86
Fertilizer P_2O_5 increment	5
Crop price increment, $	$0.5
Fertilizer price increment, $	$100

Potassium and Sulphur

Trends in Potash price



Trends in Ammonium Sulphate price



Micronutrients

- Use micronutrients only if the crops need them!
- No time now for use for insurance purposes!

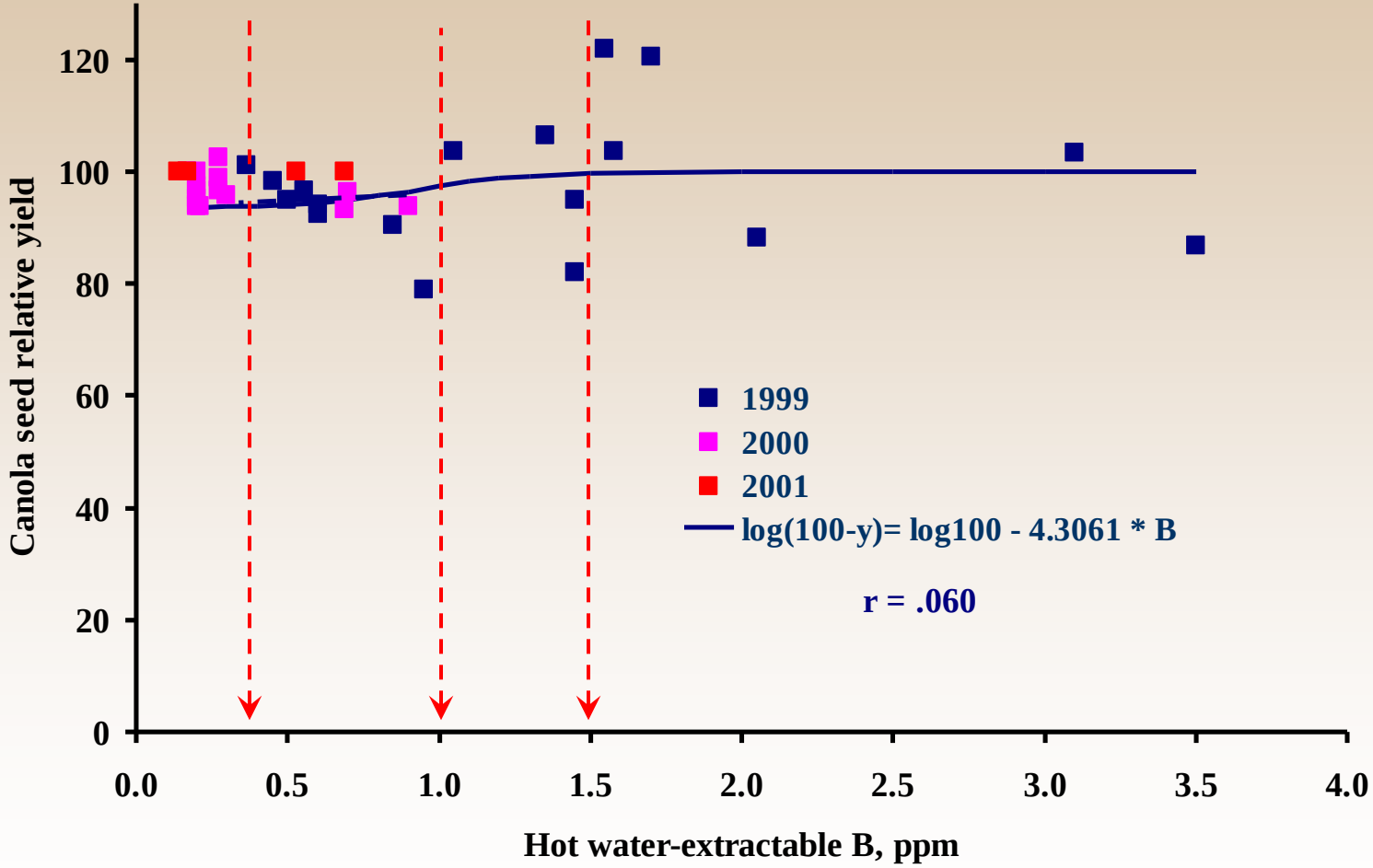
How is the Economic Benefit Measured?

- Increased yield
- Improved quality (mostly perception)

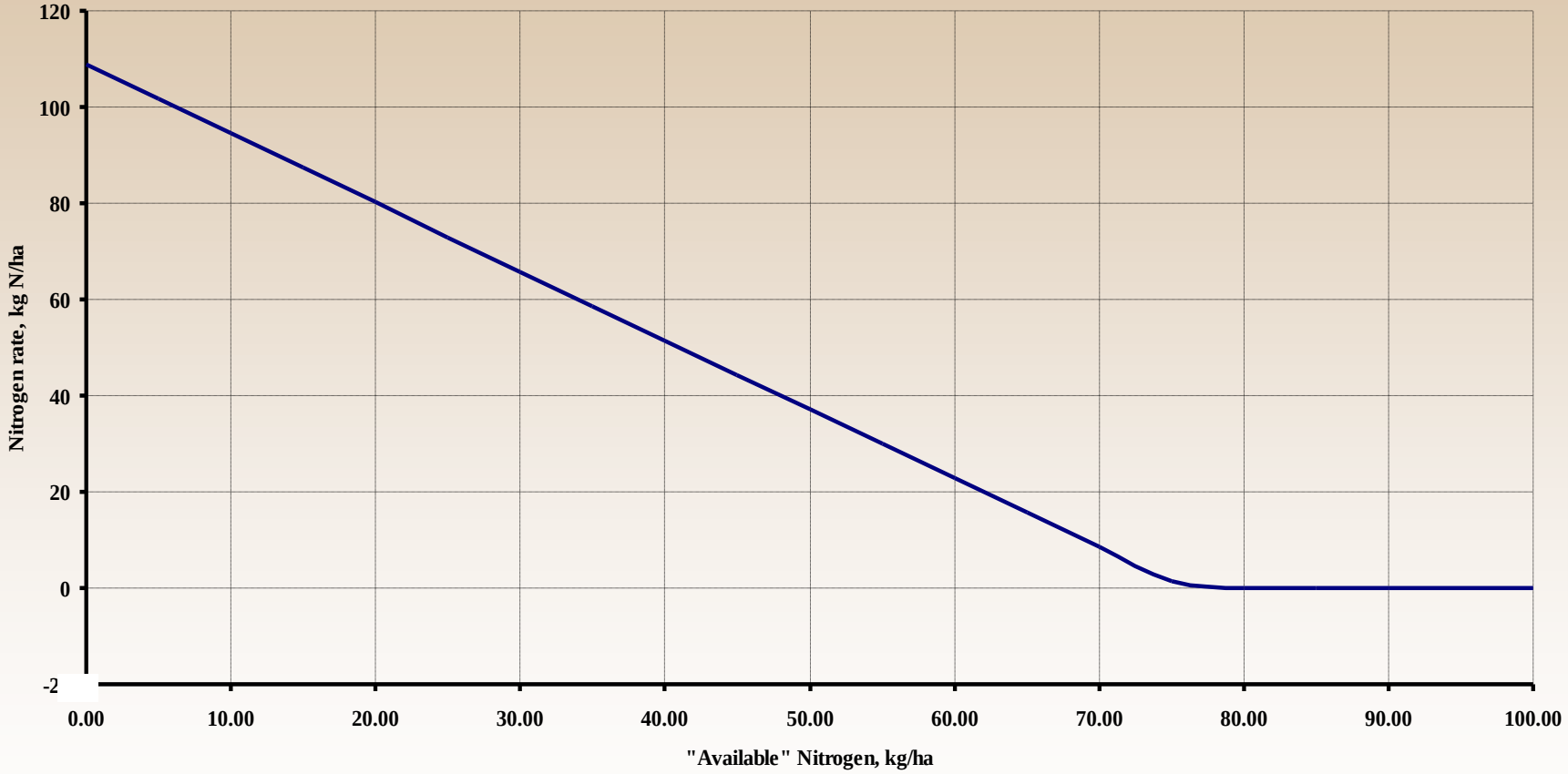
How is the Economic Benefit Not Measured?

- In most cases when soil test value above critical level – “marginal” range
- Increased tissue level as a result of a micronutrient application

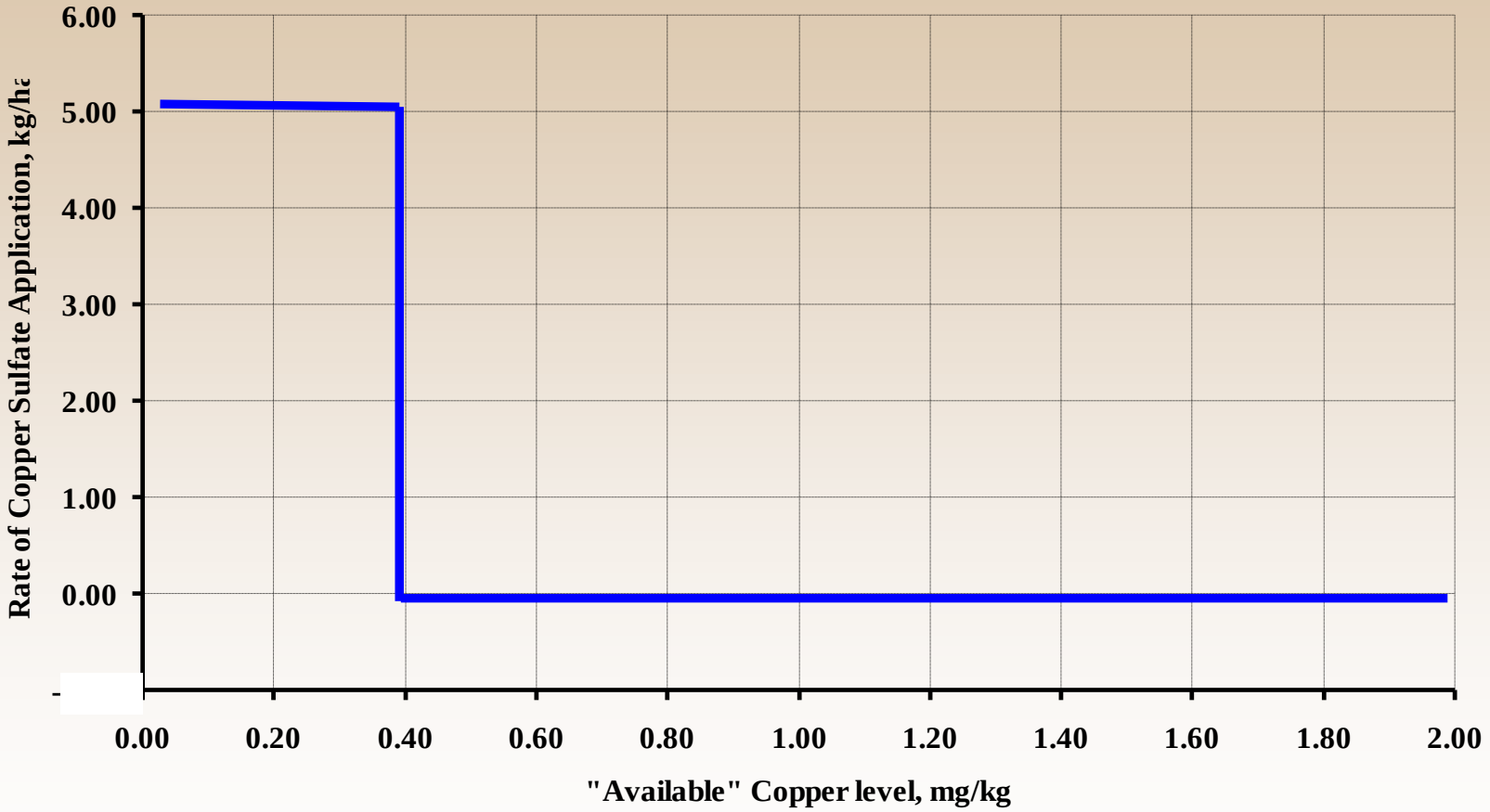
Interpretation of Boron Soil Tests w. Canada 40 sites; yield 18-63 bu/ac



Mean Nitrogen Application Rate as a Function of Soil Test Levels



Copper Application Rate as a Function of Soil Test Levels



Cu calculator

Add Crop and Soil Testing Information in this Section:

Soil test level	Texture	Crop	Organic matter	pH
0.2	loam	wheat	<1.5	<8.0

Select Time of Placement

Options **spring**

Select Method of Placement

Options **broadcast**

Select Type of Product and Rate of Application

Product type **sulphate**

Rate of application **3**

Comments:

Chance of getting a yield increase

using the most suitable product and placement is:

between 50 and 75% 53%

using the chosen product and placement:

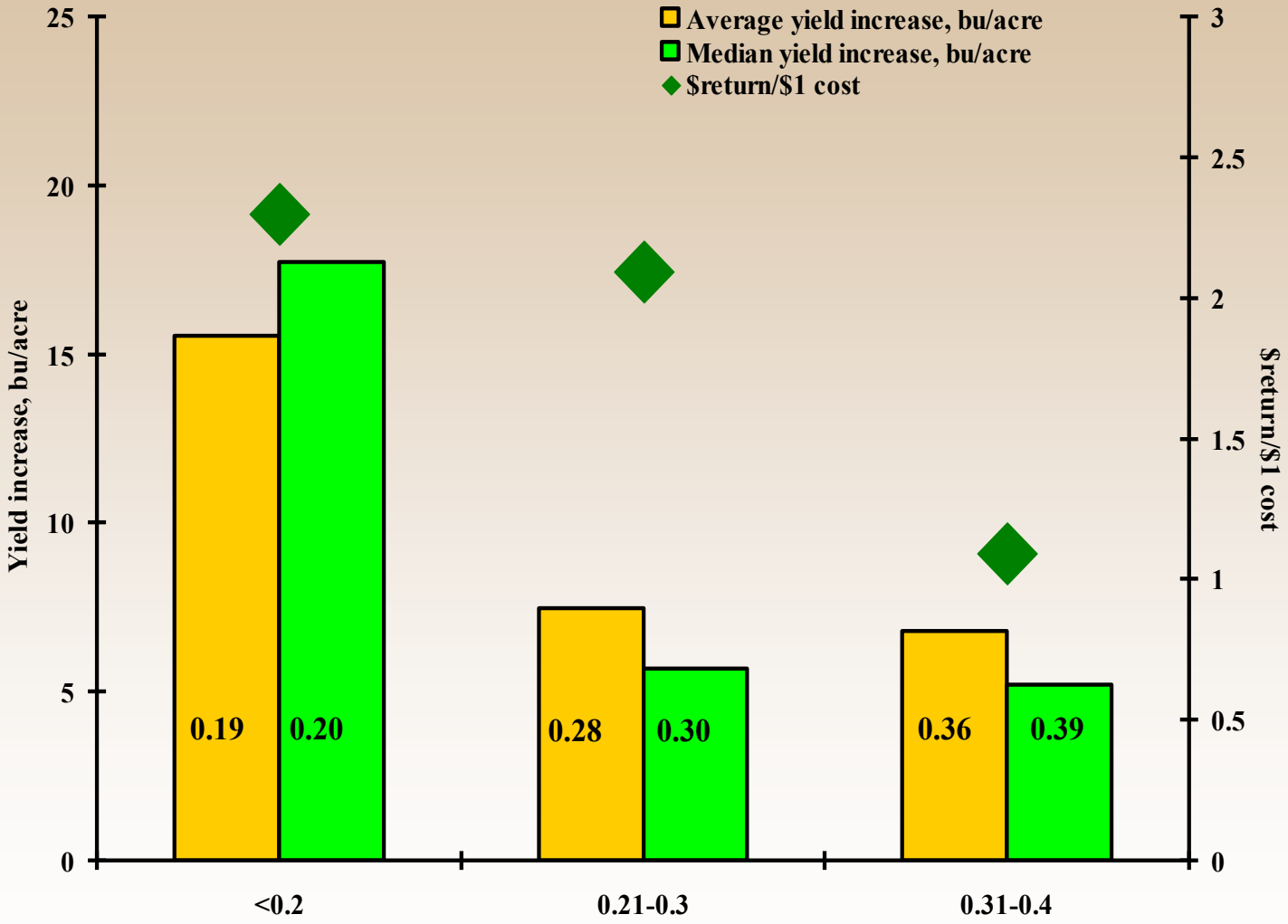
between 50 and 75% 53%

between 50 a CAUT
between 50
CAUTION:
Rate can be
toxic at

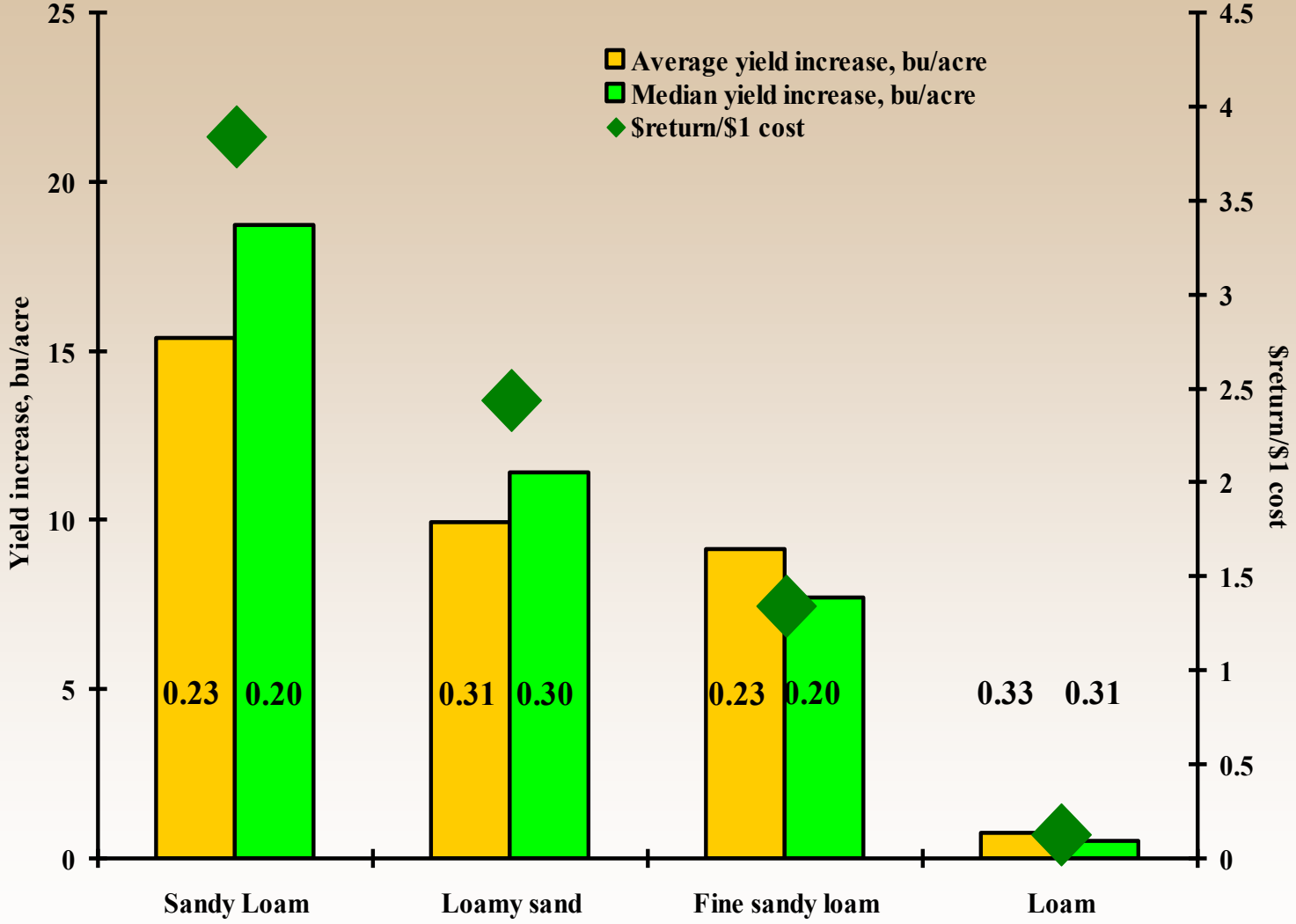
Interpretation of Soil Tests for Copper

- **Based on 102 tests with spring wheat in western Canada**
  - **Deficient < 0.4 ppm (52 tests):**
    - **Average Cu test 0.24±0.09 ppm**
    - **94% probability of obtaining an agronomic response**
    - **62% probability of obtaining an economic response**
  - **Marginal 0.4 –0.6 ppm (50 tests)**
    - **Average Cu test 0.68±0.24 ppm**
    - **16% probability of obtaining an agronomic response**
    - **2% probability of obtaining an economic response**

Statistical and Economic Characteristics for Deficient



Statistical and Economic Characteristics for Deficient



Summary

- Micronutrient deficiencies not a widespread problem
- Copper is certainly the one to worry about for cereals and Zinc for dry beans and corn
- $$ Economics$$ should dictate application

Thank you

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