

# **Agronomic Research**

William May

AAFC

Indian Head



# Questions of Interest

- **Can we go beyond 12"?**
- **What are the implications for side-banded nitrogen fertilizers?**



# Experimental Design

- **Split plot design with 4 reps**
- **Main plot: Row width**
  - 10", 12", 14" and 16"
- **Sub-plot: Nitrogen rates**
  - 20, 40, 80, 120 and 160 kg N/ha



# Experimental Design

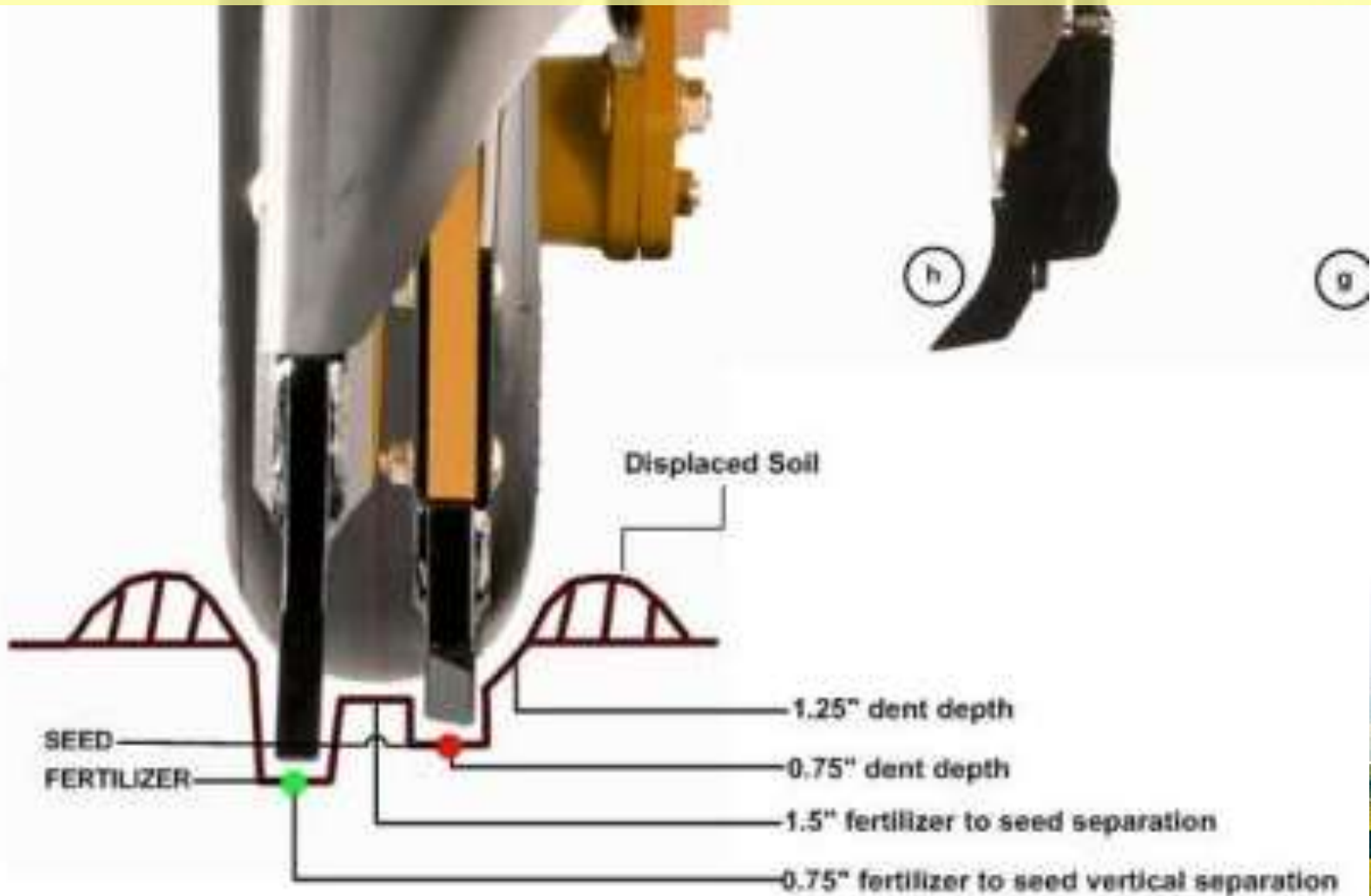
- **4 Years: 2013 to 2016**
- **Crop: wheat** (target plant population **300** plants per meter square)
- **One blend of 14-20-10-10**  
– **142 kg /ha (127 lbs/acre)**





**8 SeedMaster Openers on Two Ranks**

## 2. Relative Seed-Fertilizer Placement



# Fertilizer Products (lbs/acre)

<b>N rate kg N/ha</b>	<b>14-20-10-10 lbs/acre</b>	<b>Urea lbs/acre</b>	<b>Total lbs/acre</b>
<b>20</b>	<b>127</b>	<b>0</b>	<b>127</b>
<b>40</b>	<b>127</b>	<b>39</b>	<b>166</b>
<b>80</b>	<b>127</b>	<b>116</b>	<b>243</b>
<b>120</b>	<b>127</b>	<b>193</b>	<b>320</b>
<b>160</b>	<b>127</b>	<b>271</b>	<b>398</b>

Row Spacing

46-0-0

60 kg N/ha

Actual Urea Product per foot of Row

10"  
(25 cm)



12"  
(30 cm)



14"  
(36 cm)



16"  
(41cm)





46-0-0

120 kg N/ha

Row Spacing

Actual Urea Product per foot of row

10"  
(25 cm)



12"  
(30 cm)



14"  
(36 cm)



16"  
(41cm)

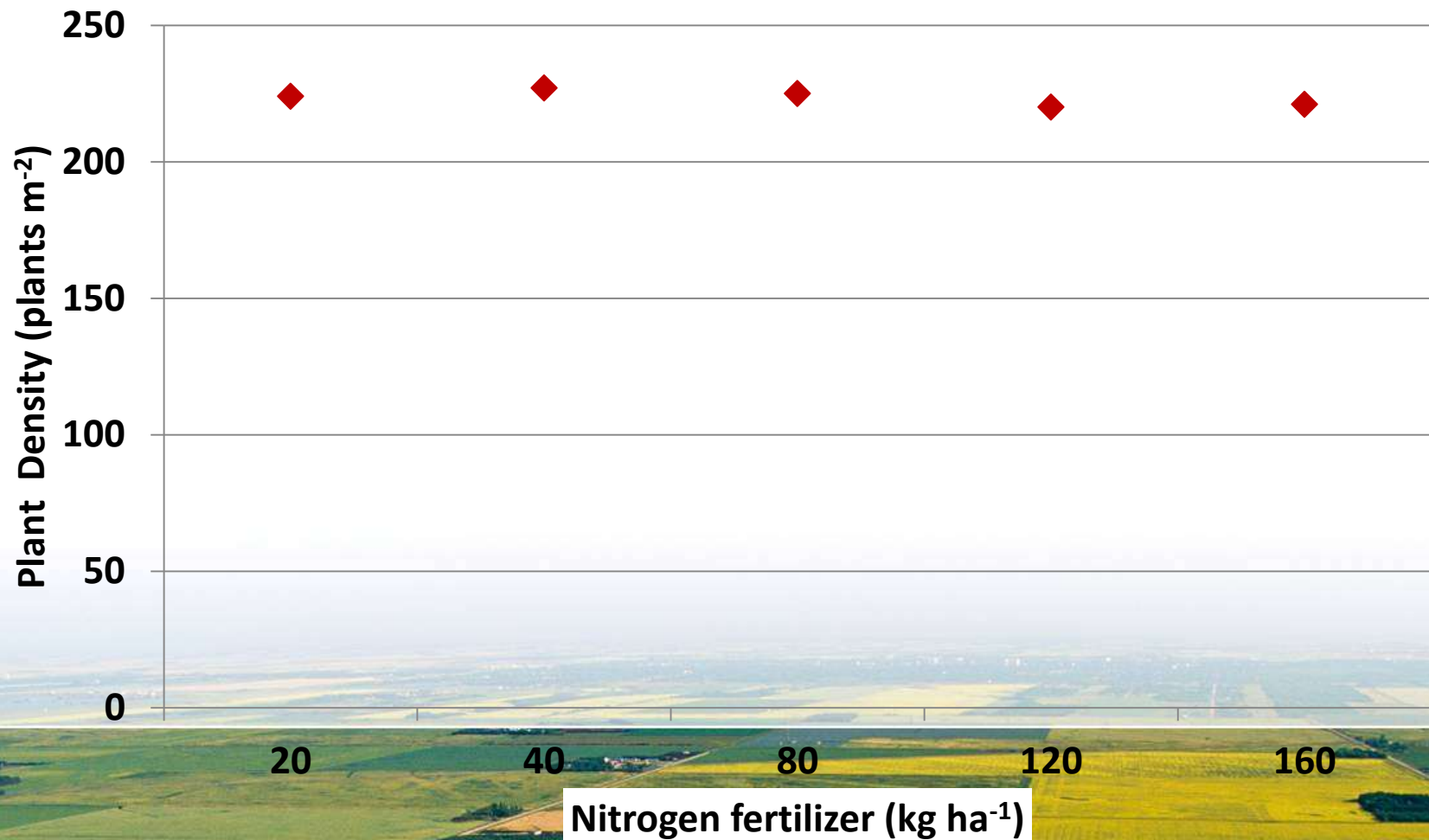


# Results

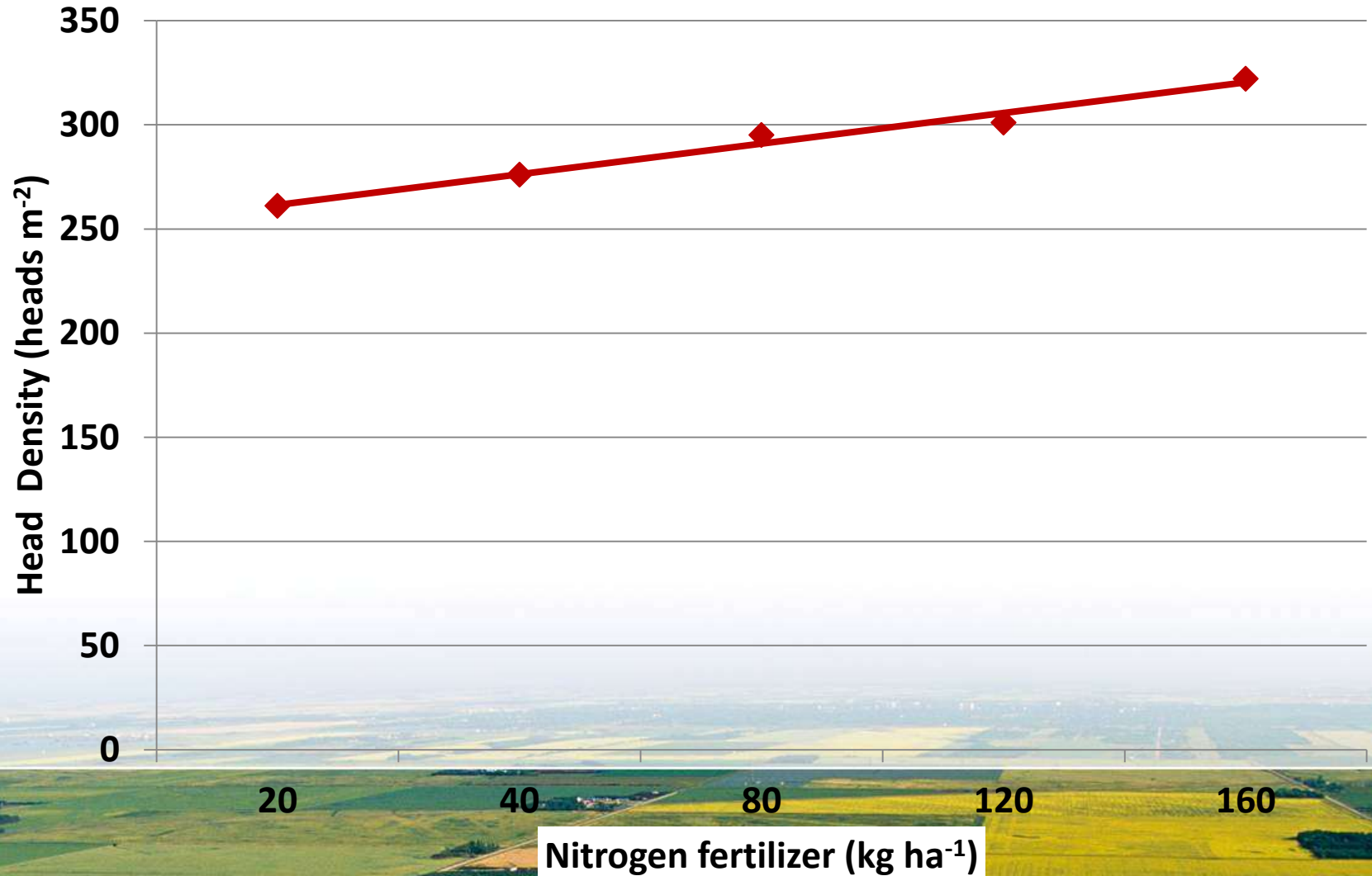


# Nitrogen Rate Effects on Plant Density

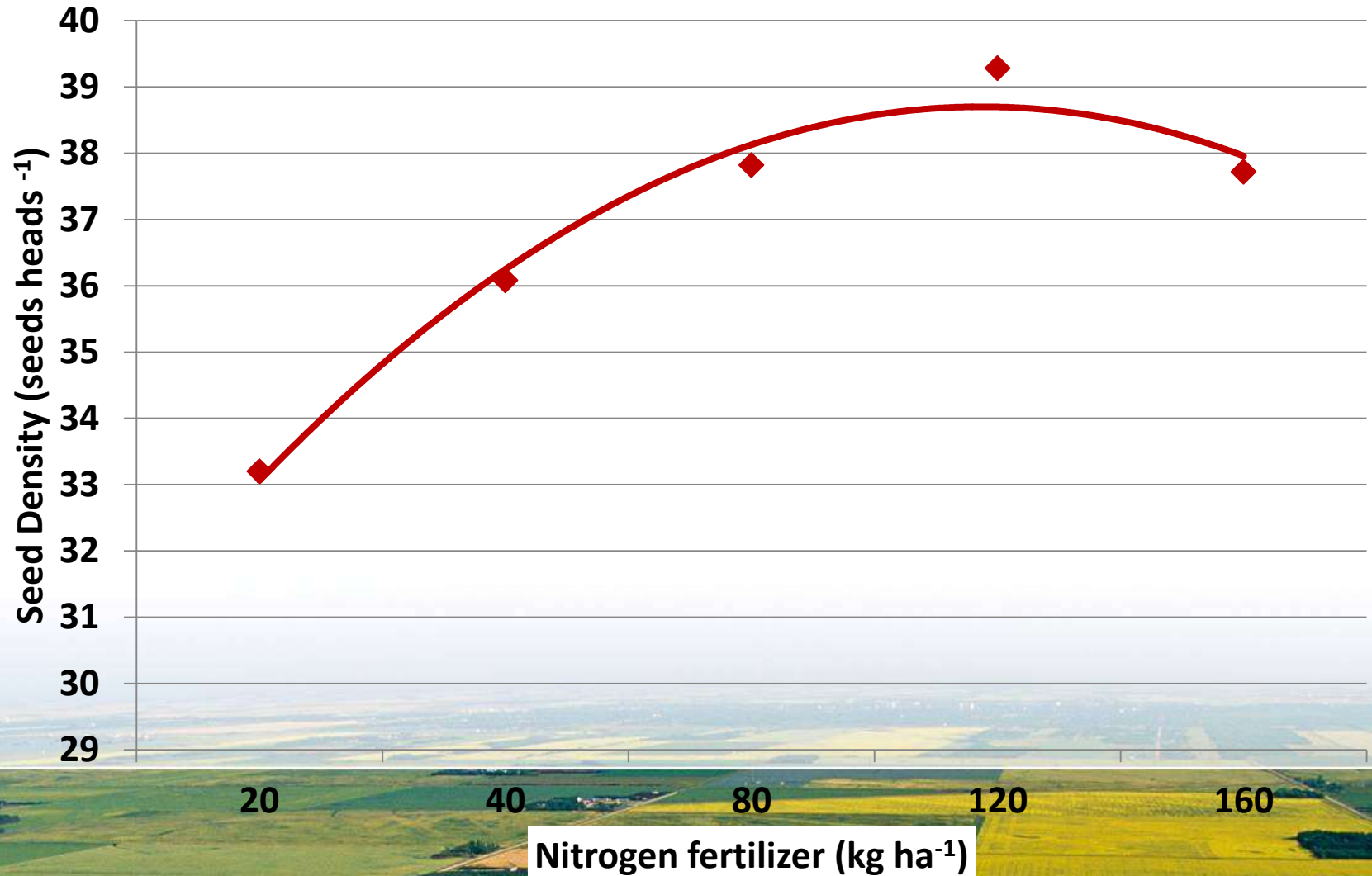
Chart Title



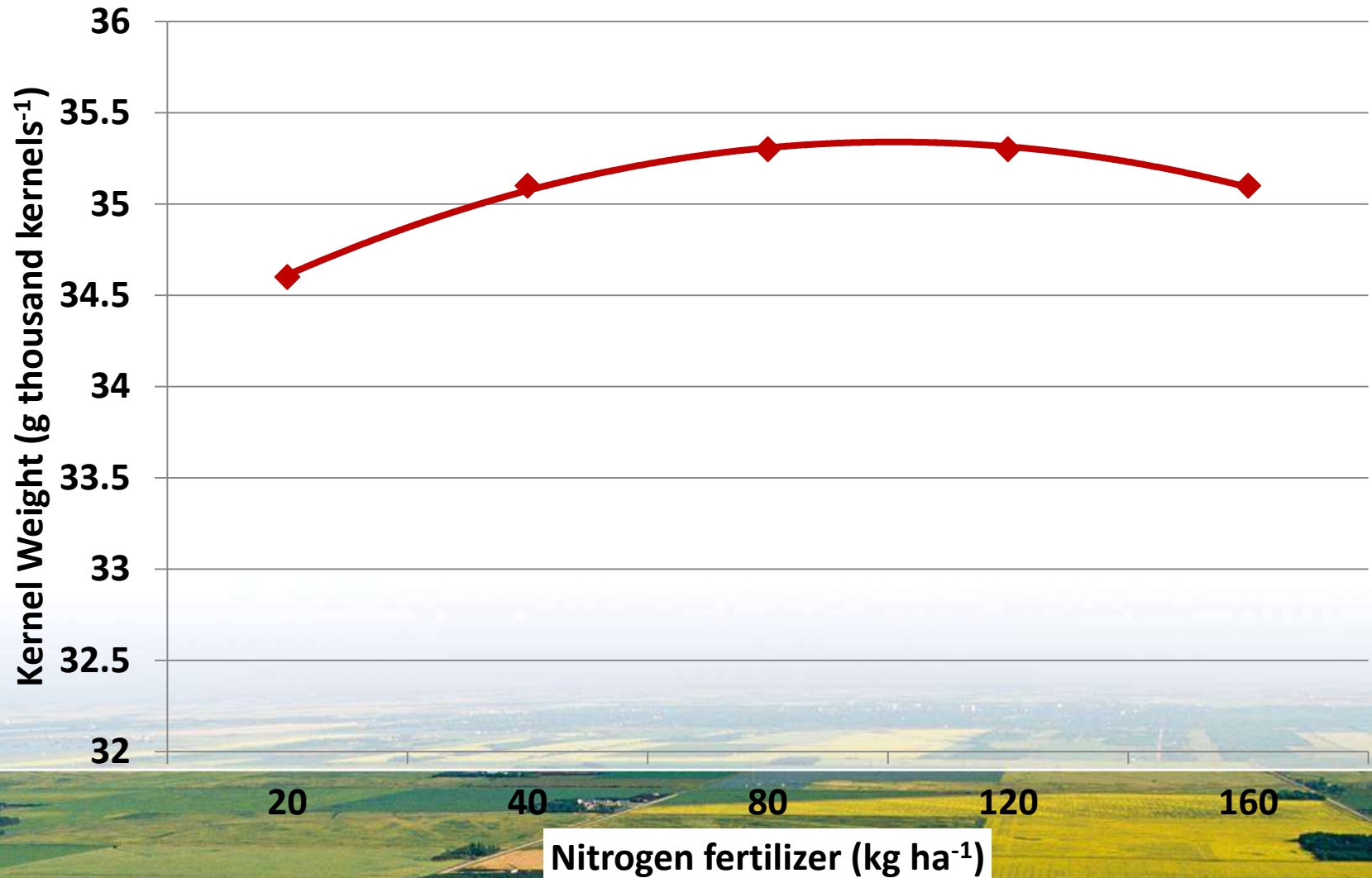
# Nitrogen Rate Effects on Head Density



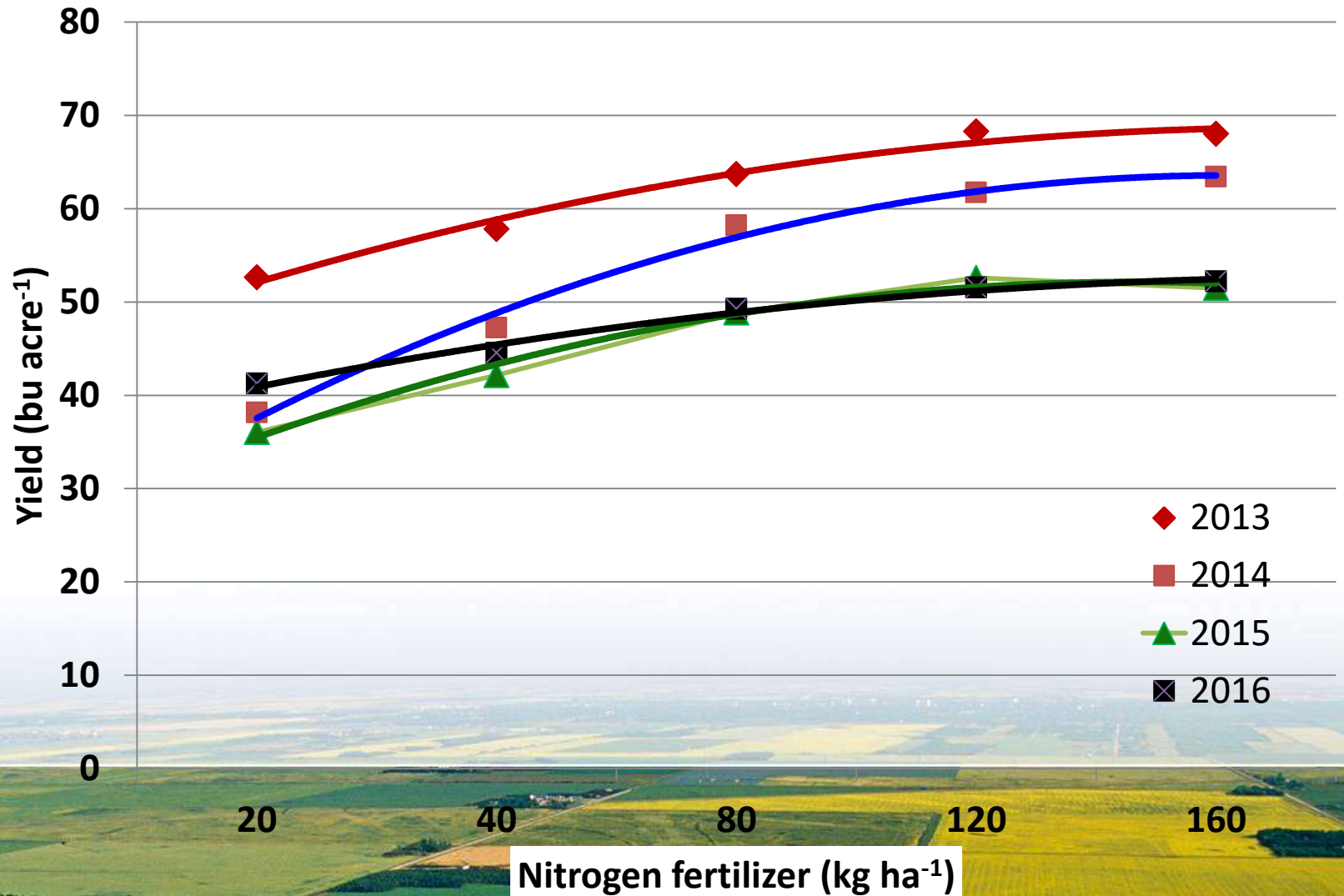
# Nitrogen Rate Effects on Seed Density



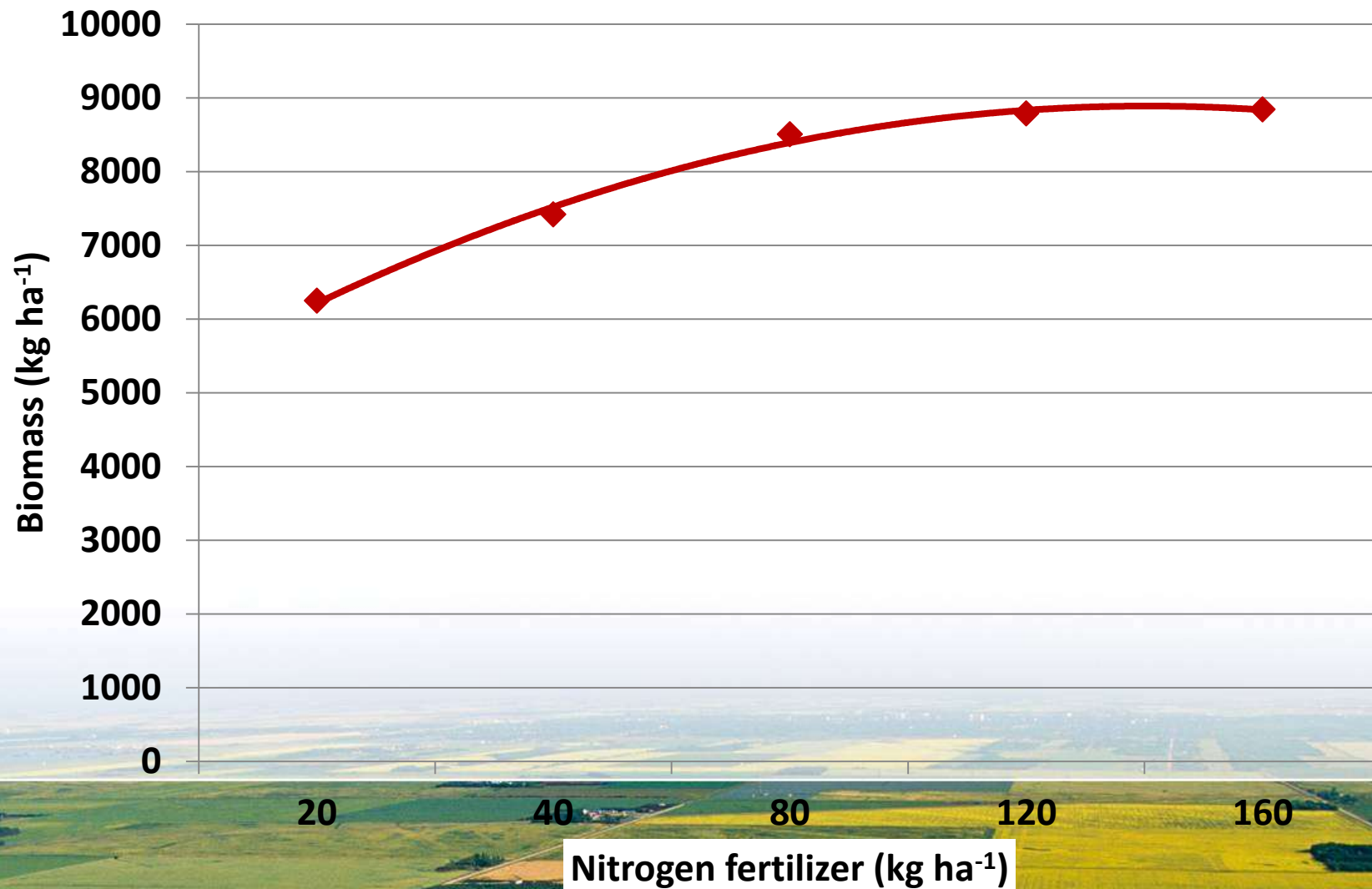
# Nitrogen Rate Effects on Kernel Weight



# Nitrogen Rate Effects on Grain Yield

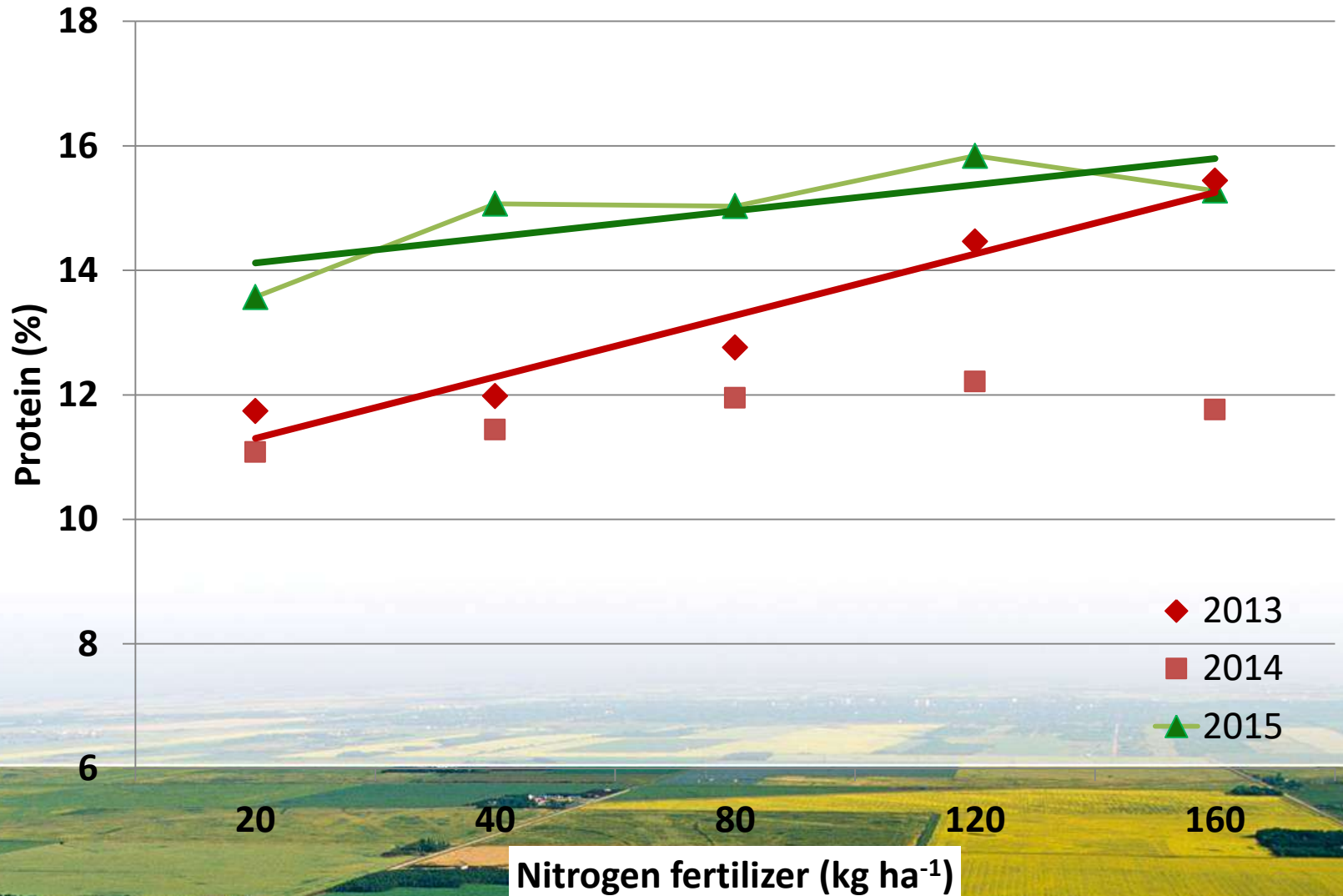


# Nitrogen Rate Effects on Biomass

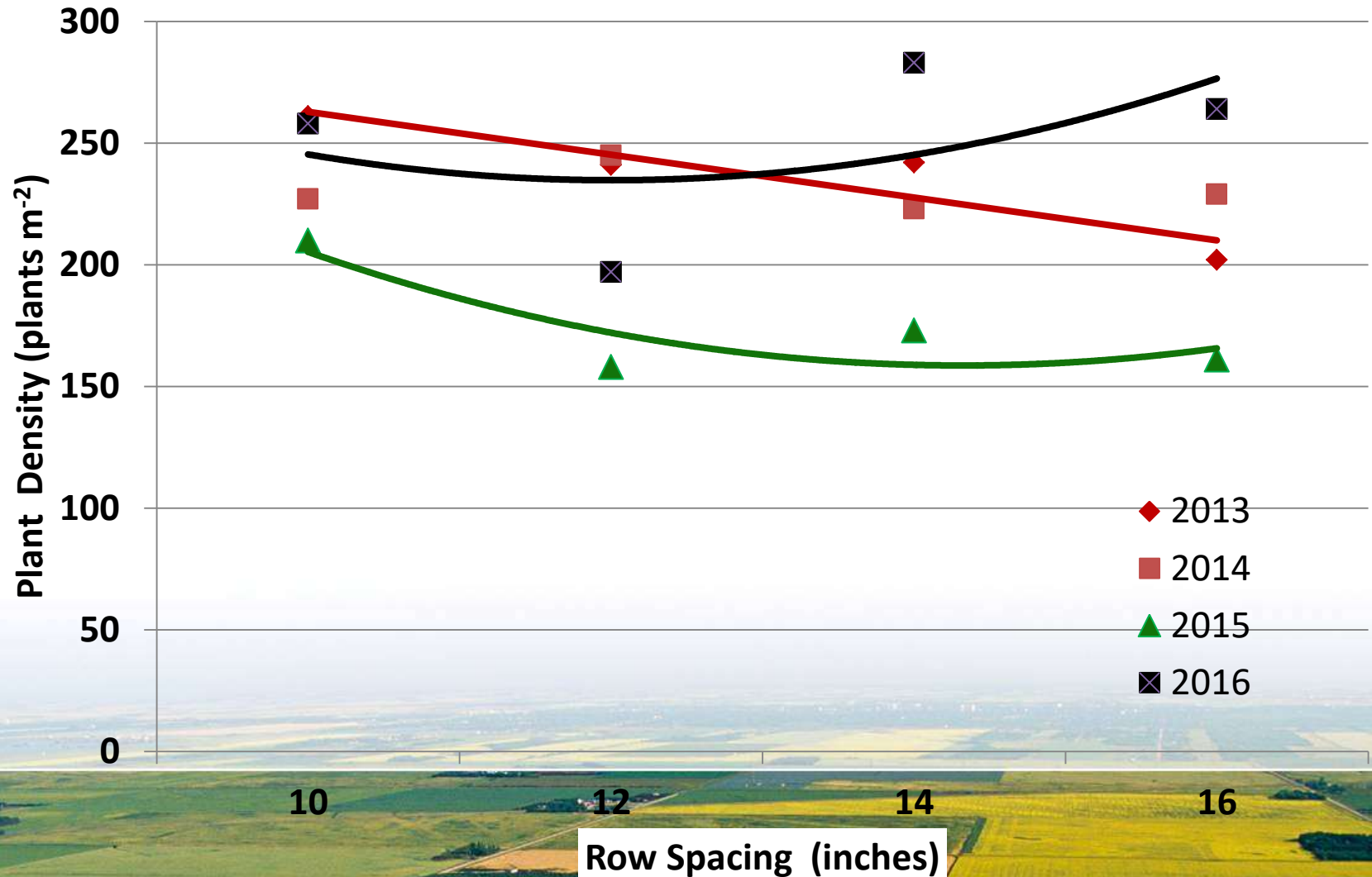




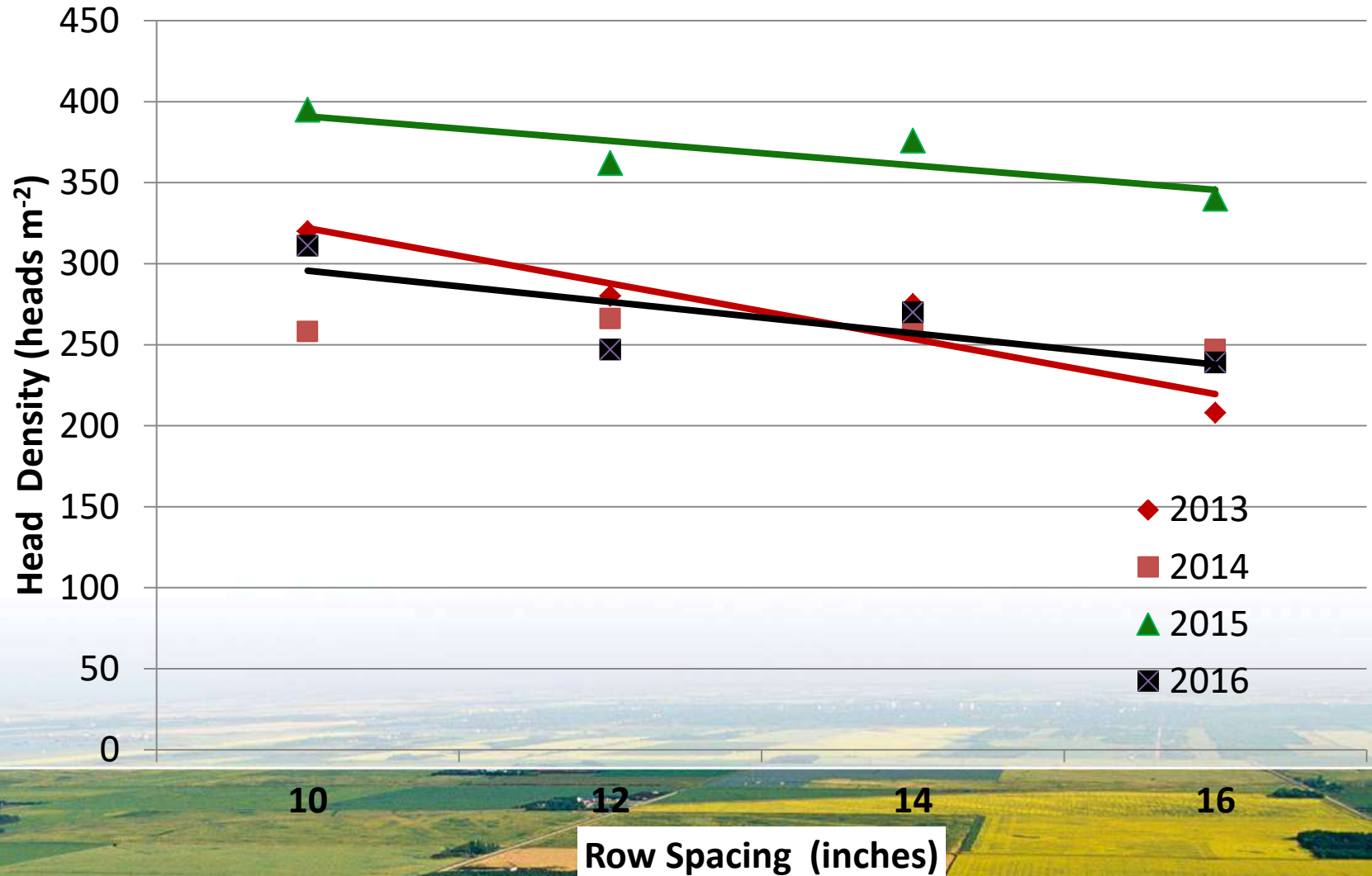
# Nitrogen Rate Effects on Grain Protein



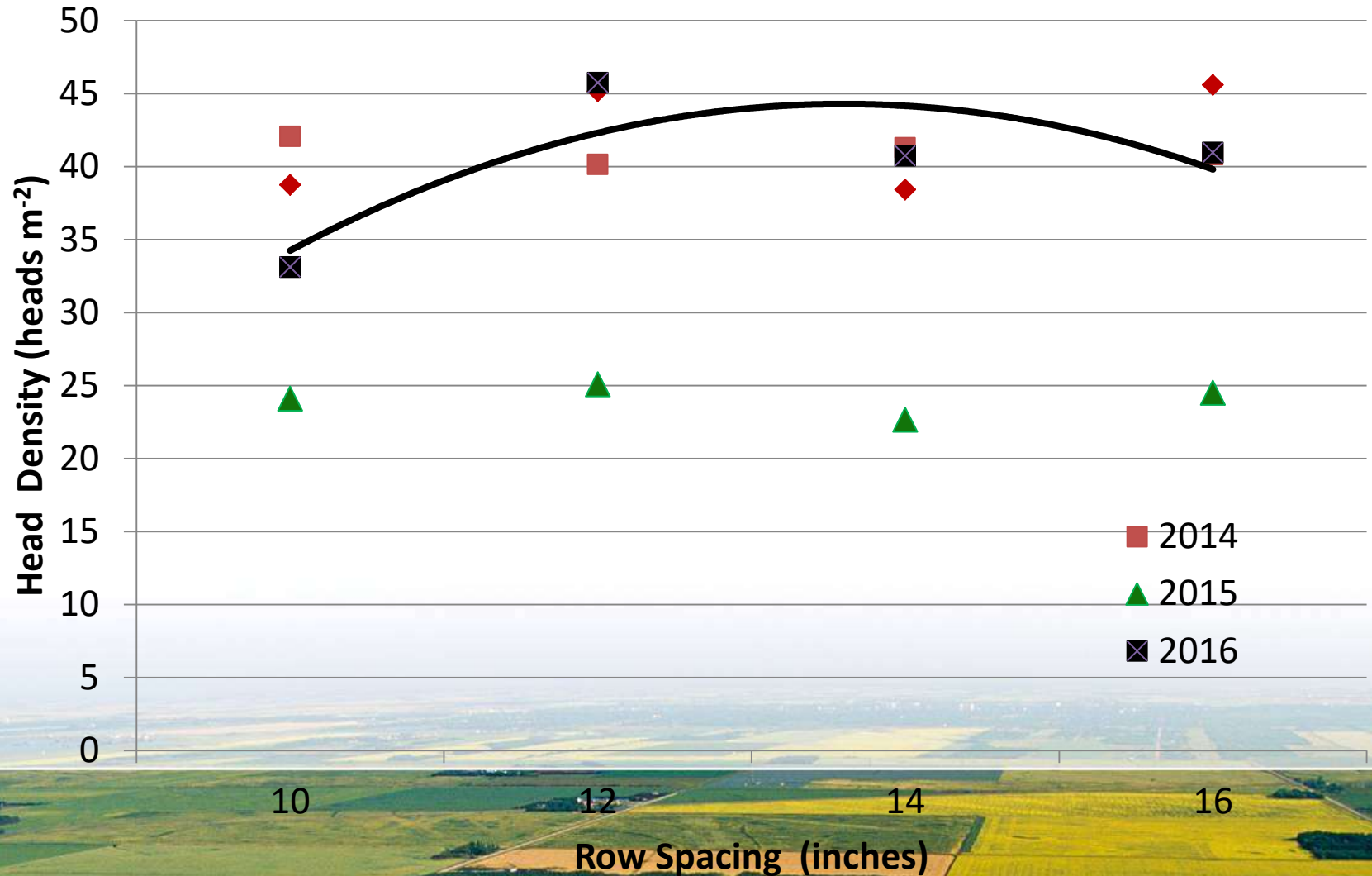
# Row Spacing Effects on Plant Density



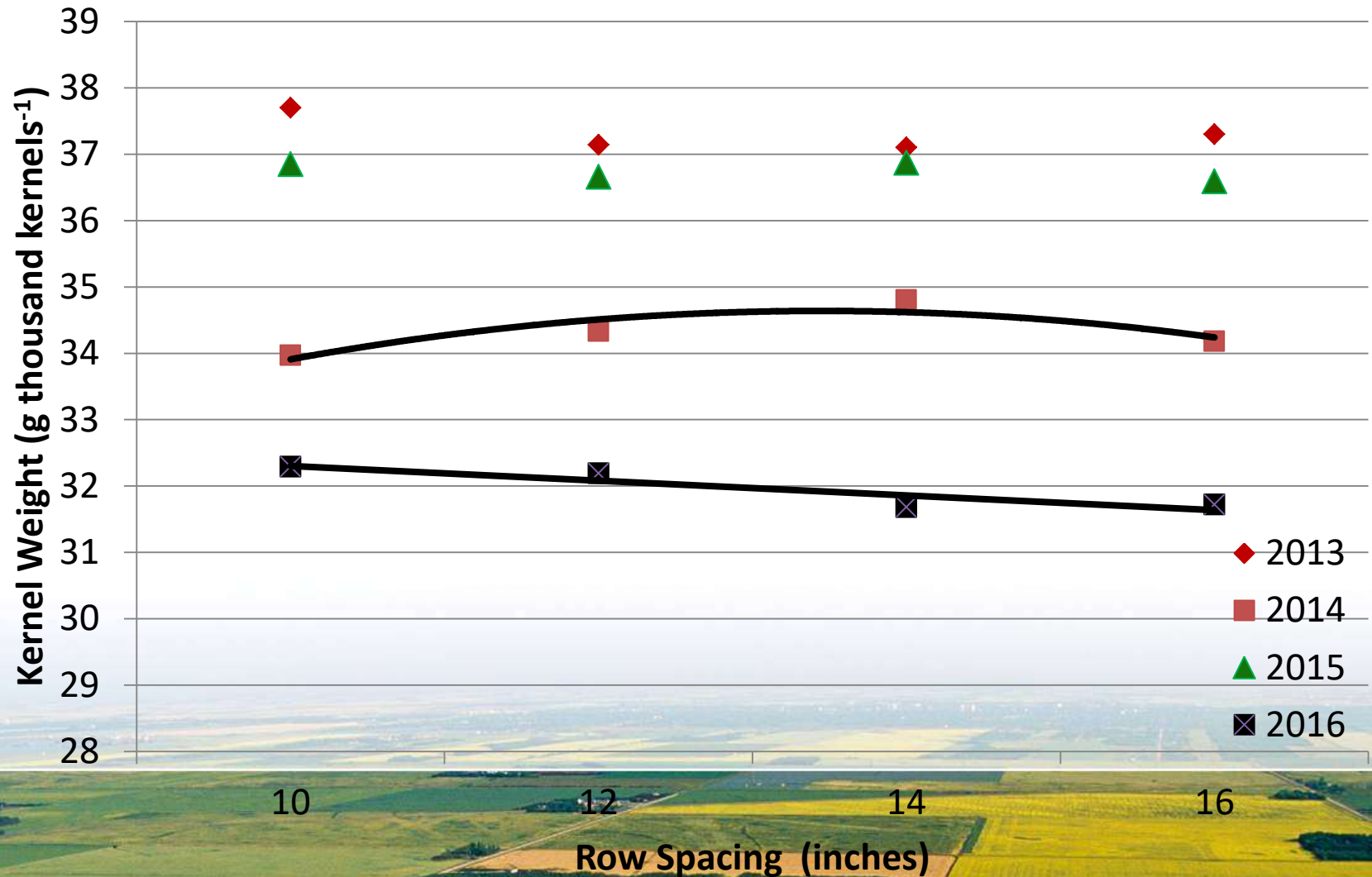
# Row Spacing Effects on Head Density



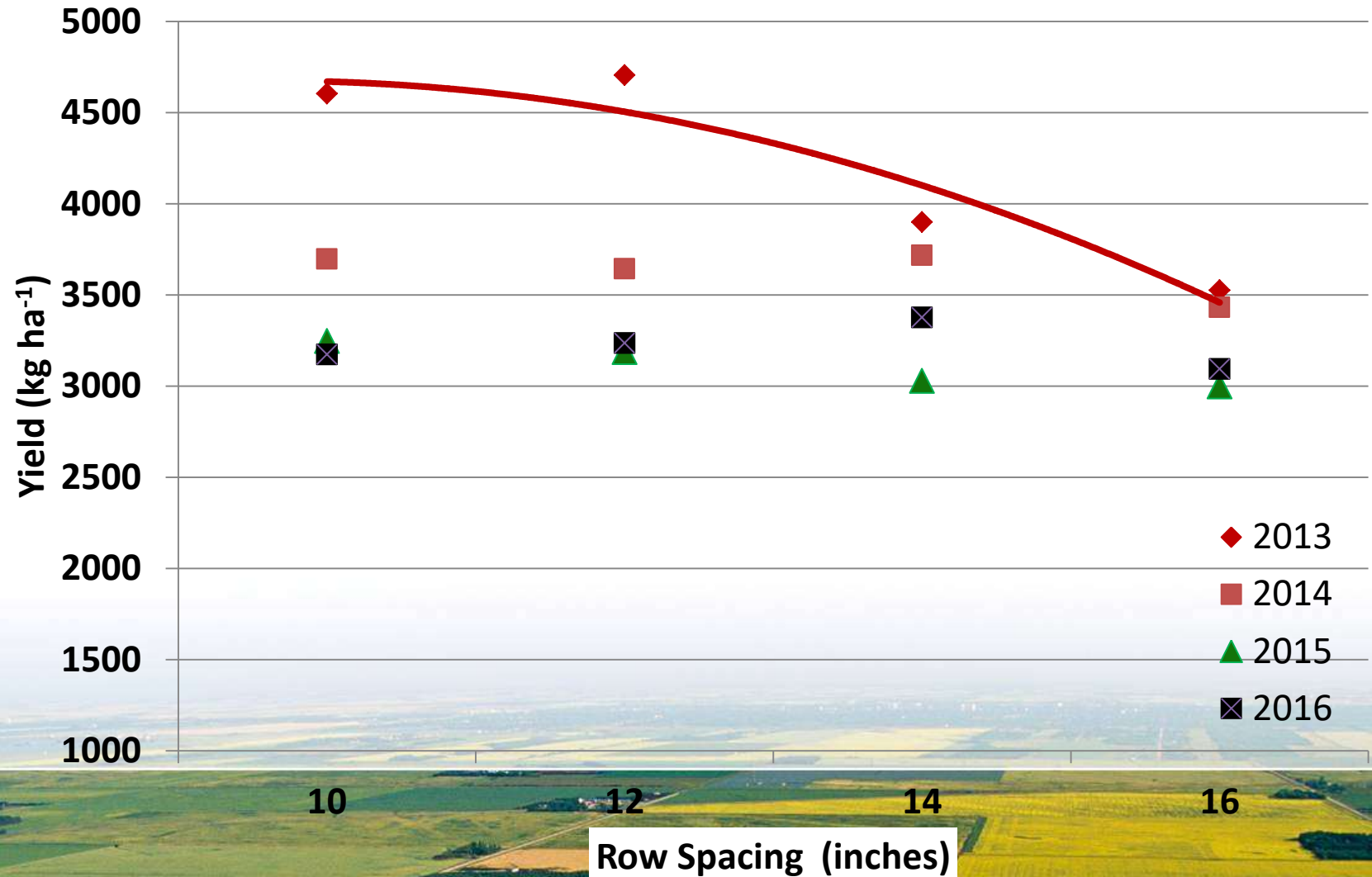
# Row Spacing Effects on Head Density



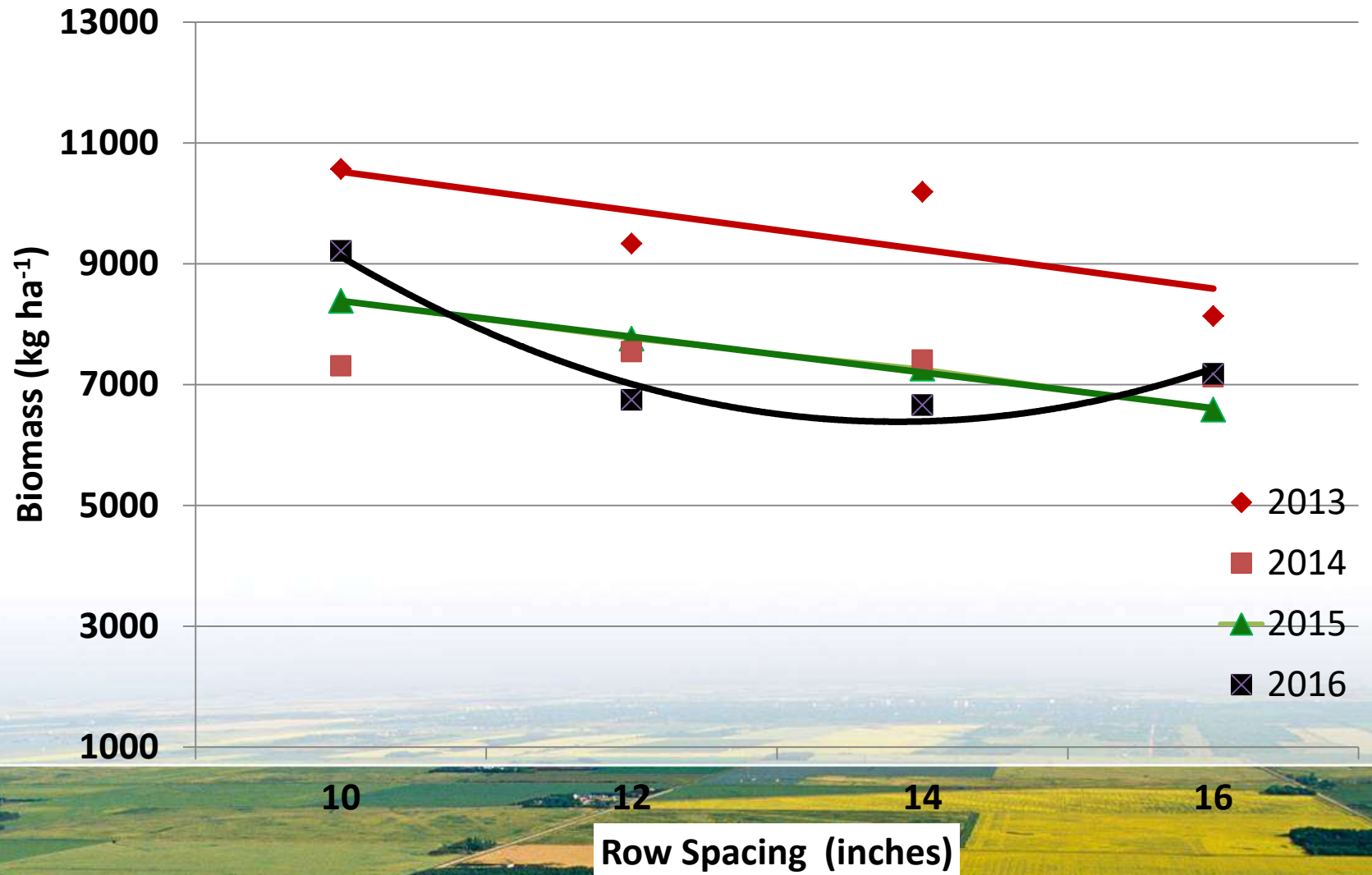
# Row Spacing Effects on Kernel Weight



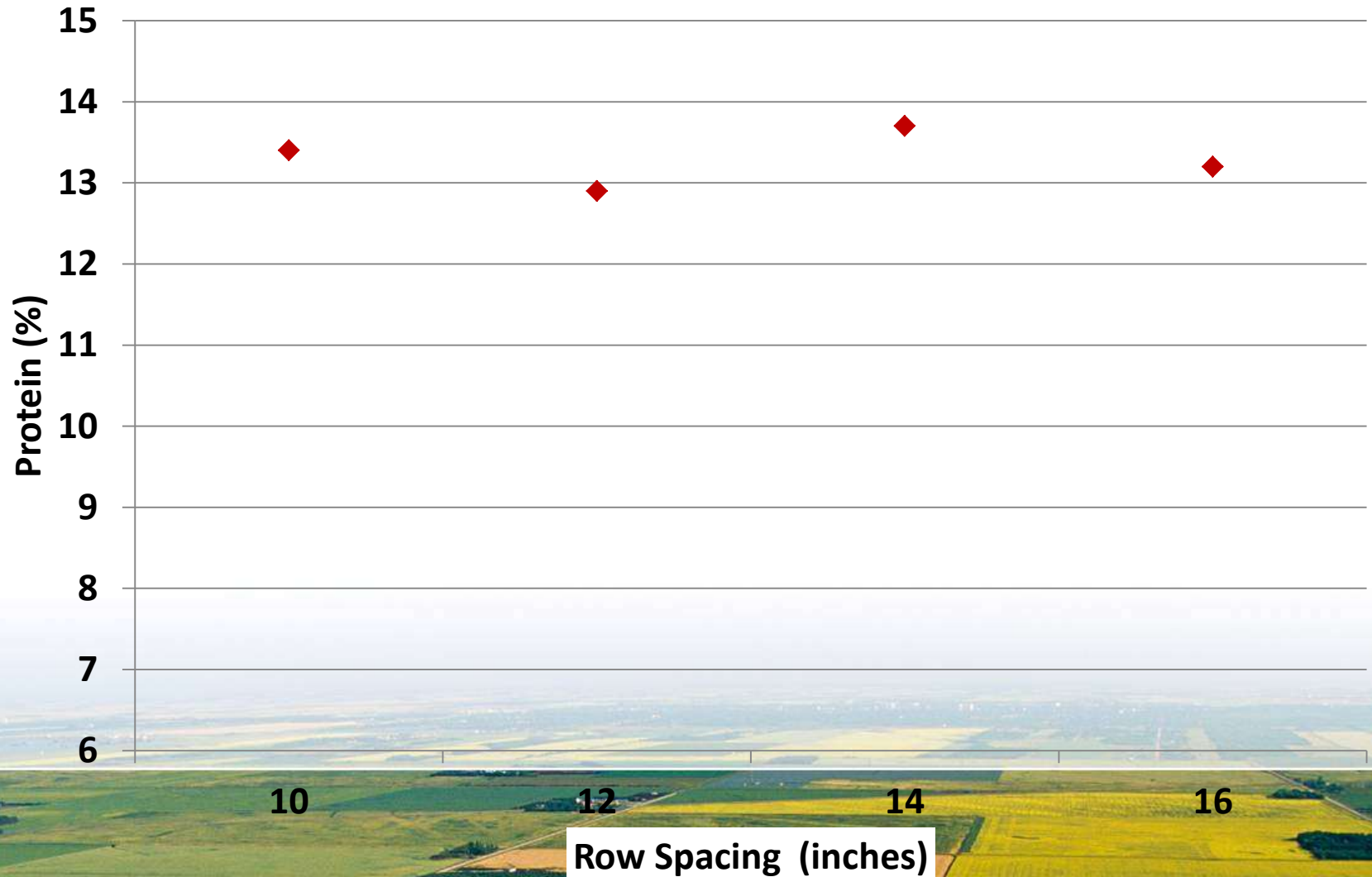
# Row Spacing Effects on Grain Yield



# Row Spacing Effects on Biomass



# Row Spacing Effects on Protein





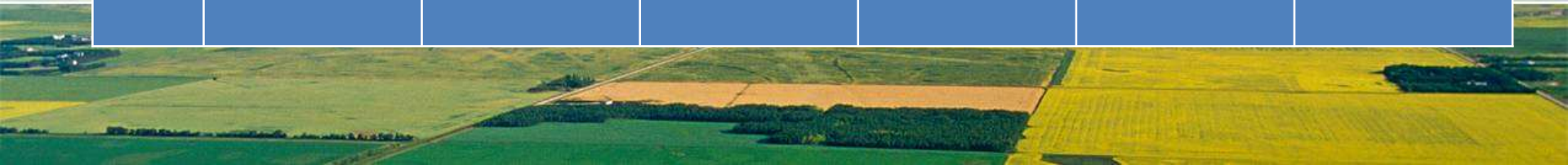
# Conclusions

- **N rate had no effect on plant population indicating that fertilizer placed 1.5" to the side and  $\frac{3}{4}$ " below the seed is a safe configuration**
- **No interaction between N and row spacing**
- **Row spacing – one year strong decrease in yield as the row width increased past 12 inches**

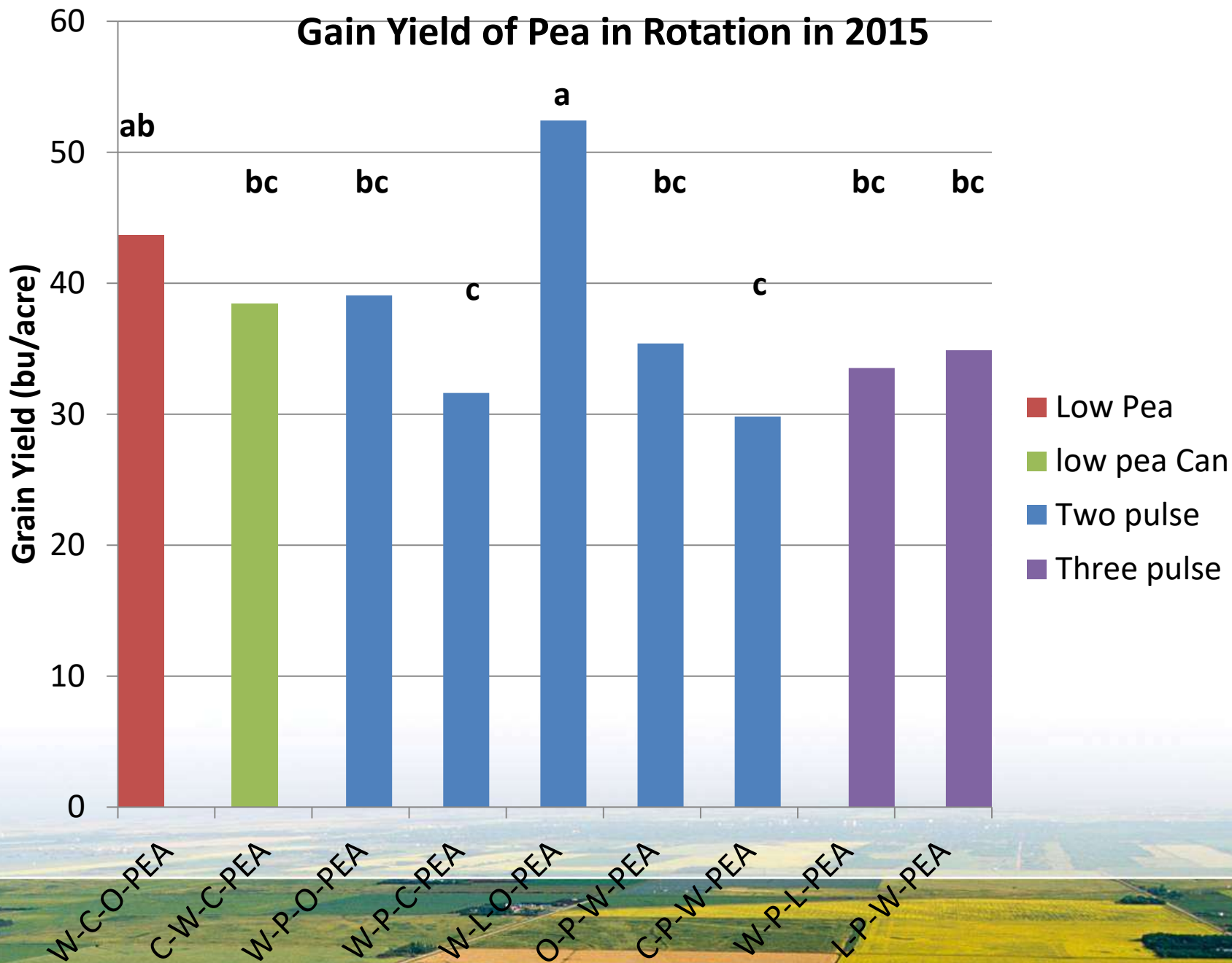


# Pulse Intensity in Rotation

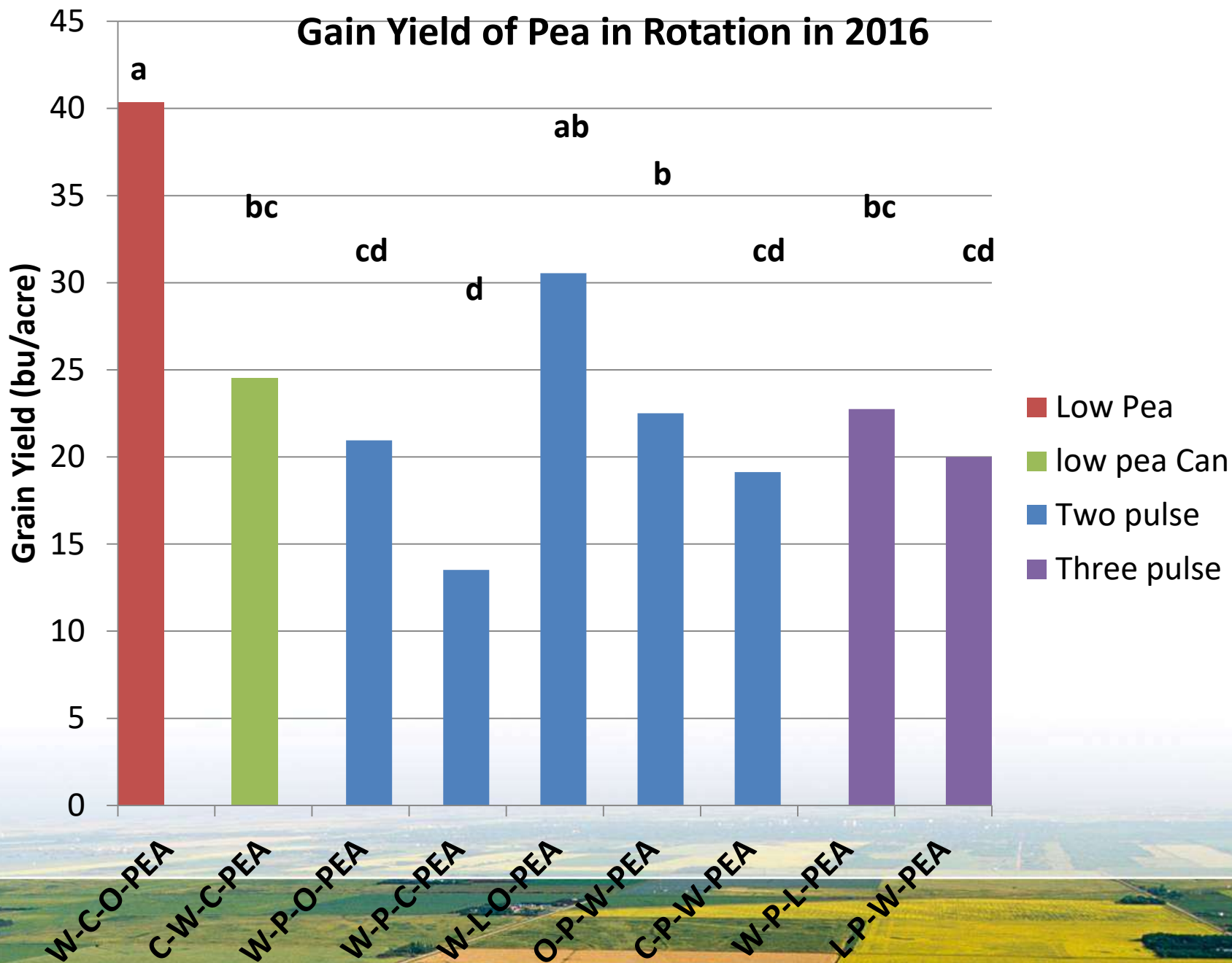
Rotations All phases of the rotation are grown in each year 24 treatments 4 reps						
	1	2	3	4	5	6
A	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat
B	Canola	Pea	Pea	Pea	Lentil	Canola
C	oat	oat	Canola	Lentil	oat	Pea
D	Pea	Pea	Pea	Pea	Pea	Canola
Justification	Cereal-oilseed-pulse in a rotation	Intensified pea-based rotation with cereal as a break crop	Intensified broadleaf crop with 1 cereal as a break crop	Intensified pulse-based rotation, 2 species with 1 cereal as a break crop	Intensified pulse-based rotation, 2 species with cereal as a break crop	Intensified canola-based rotation with cereal and pulse between



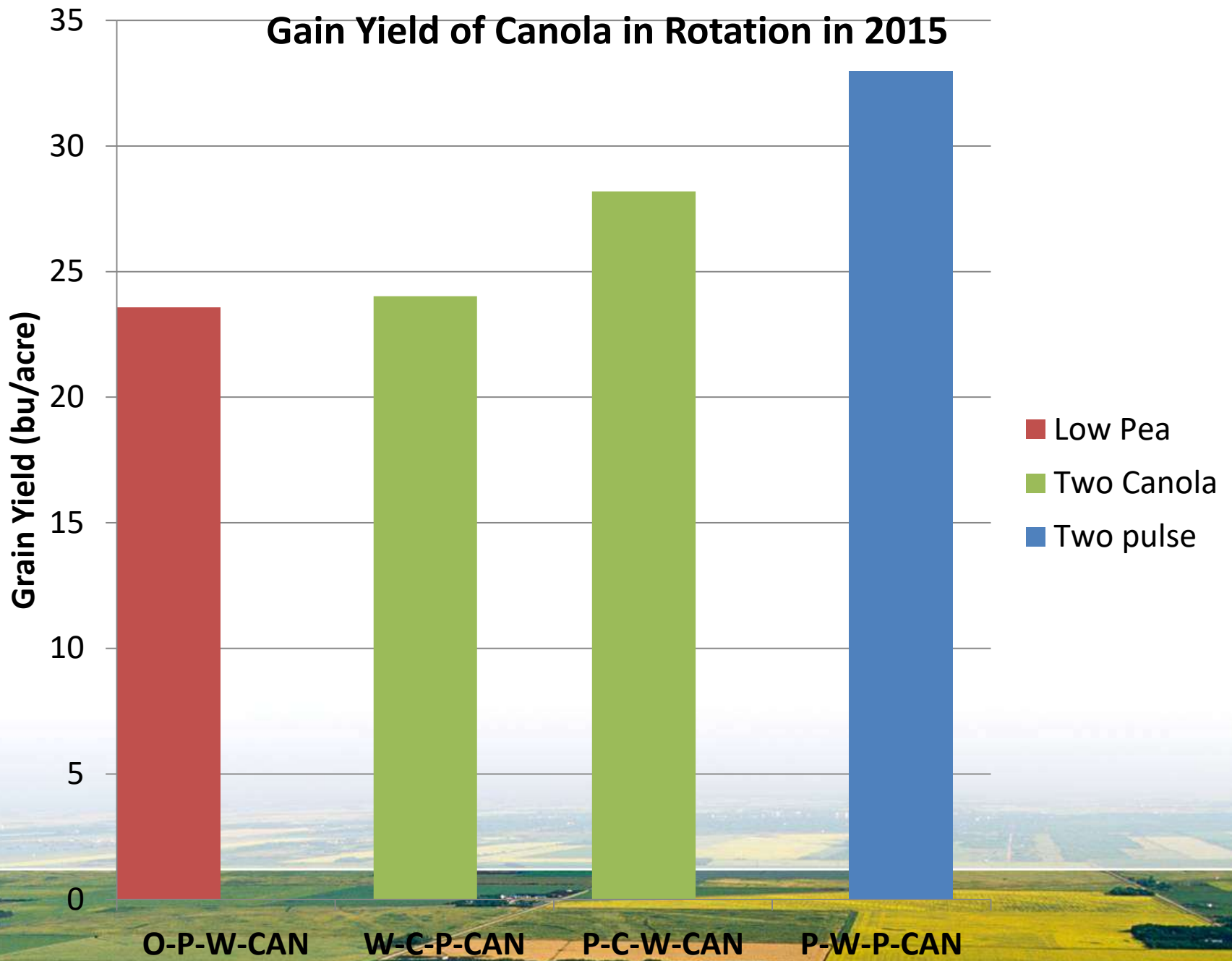
# Gain Yield of Pea in Rotation in 2015



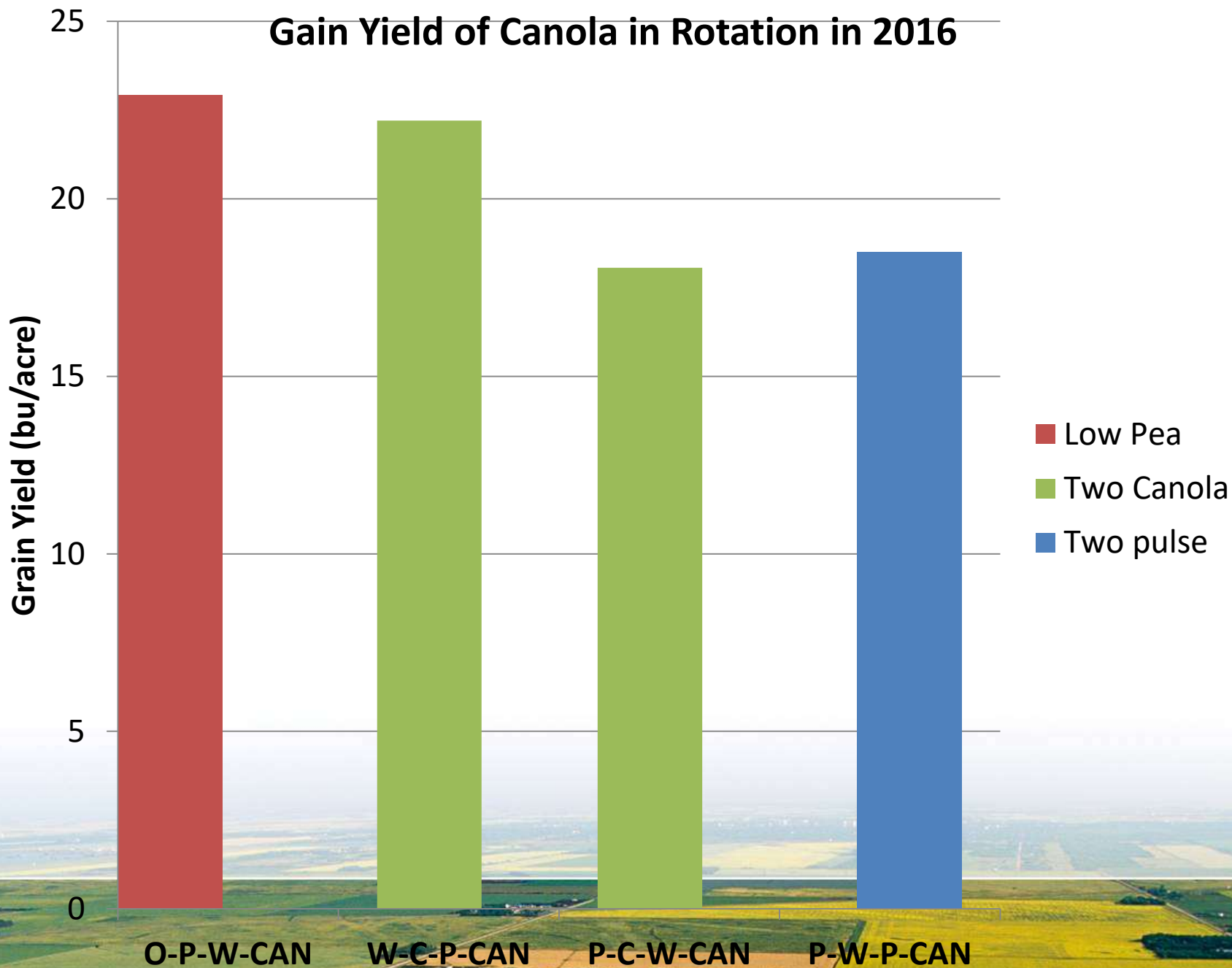
# Gain Yield of Pea in Rotation in 2016



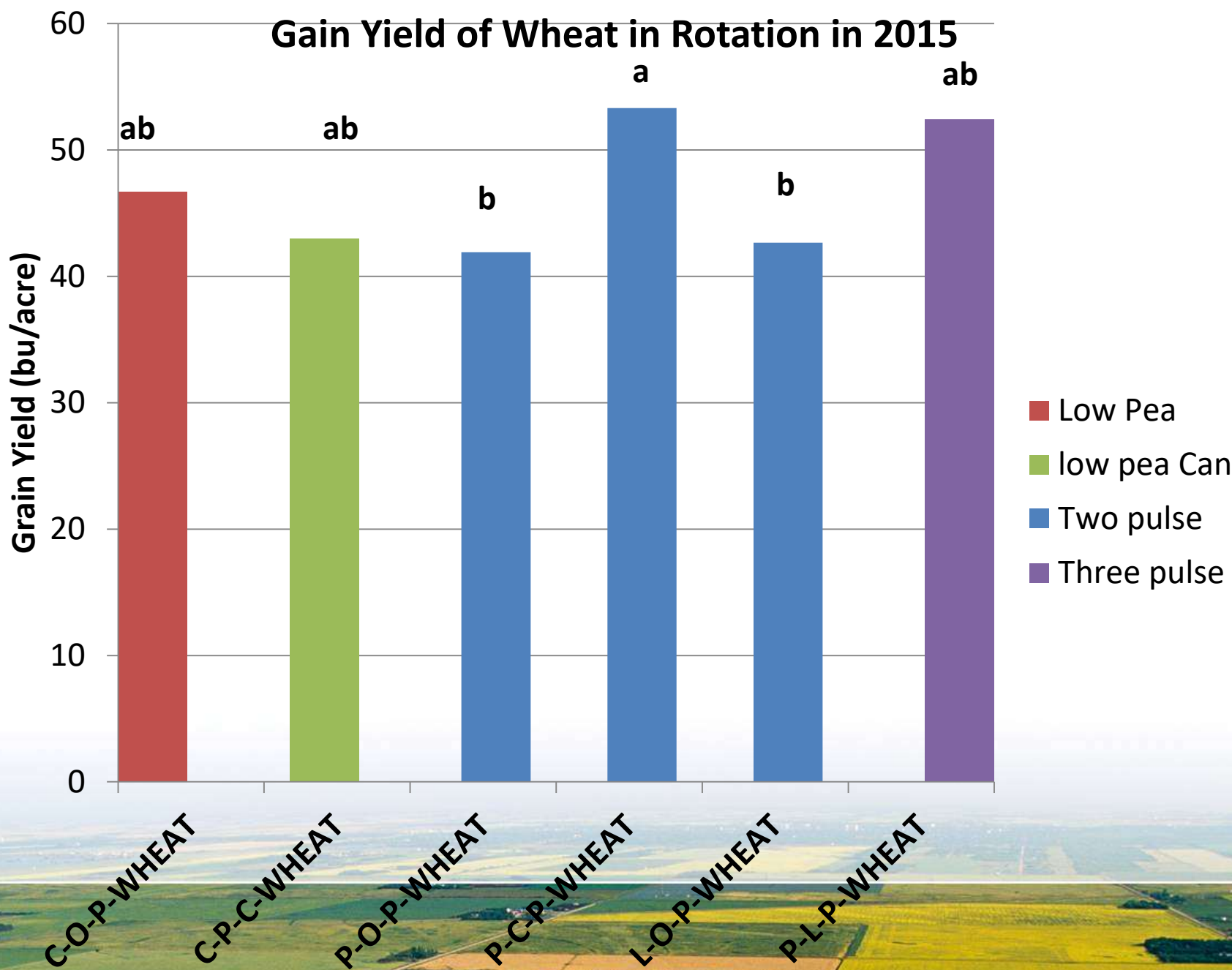
# Gain Yield of Canola in Rotation in 2015



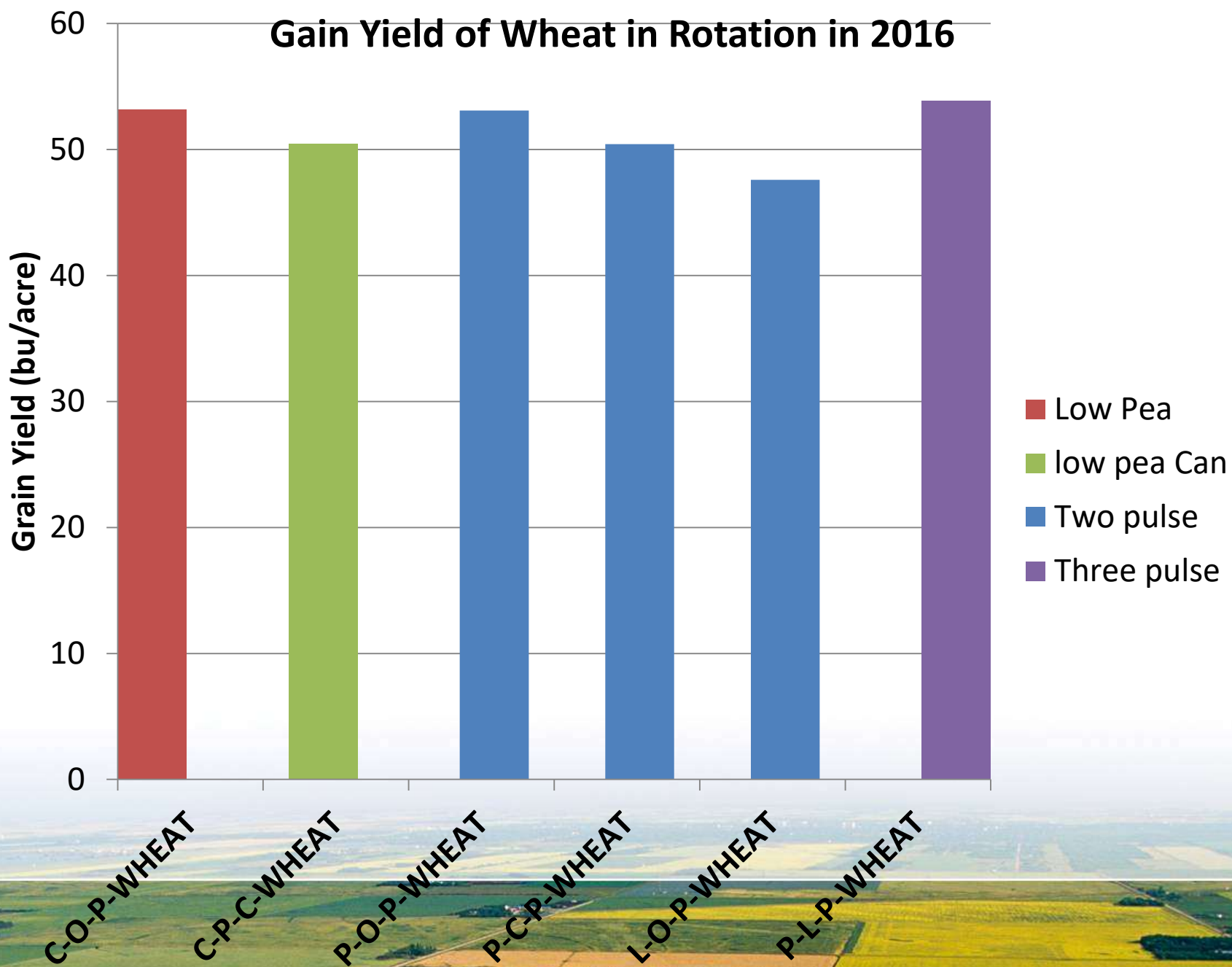
# Gain Yield of Canola in Rotation in 2016



# Gain Yield of Wheat in Rotation in 2015

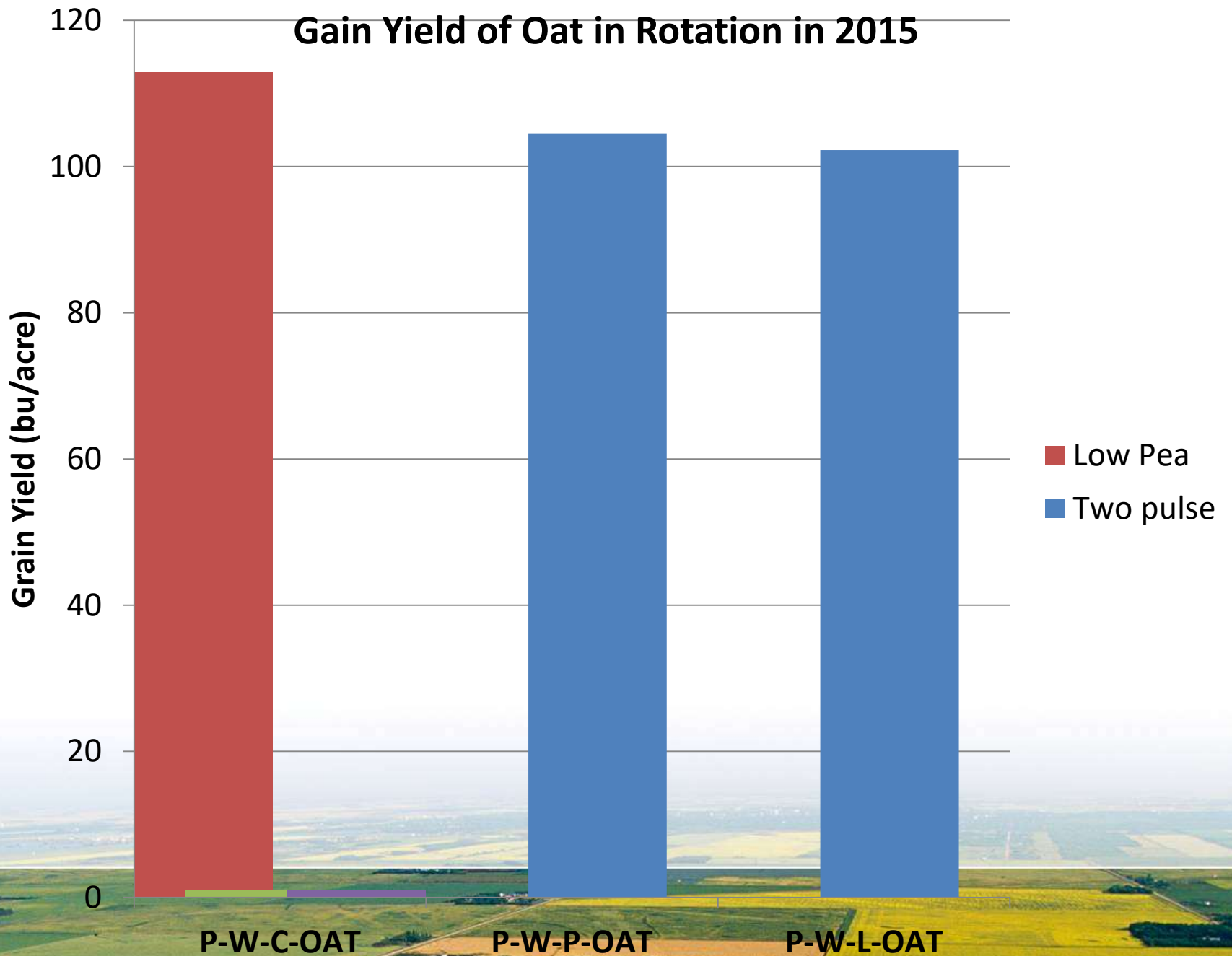


# Gain Yield of Wheat in Rotation in 2016

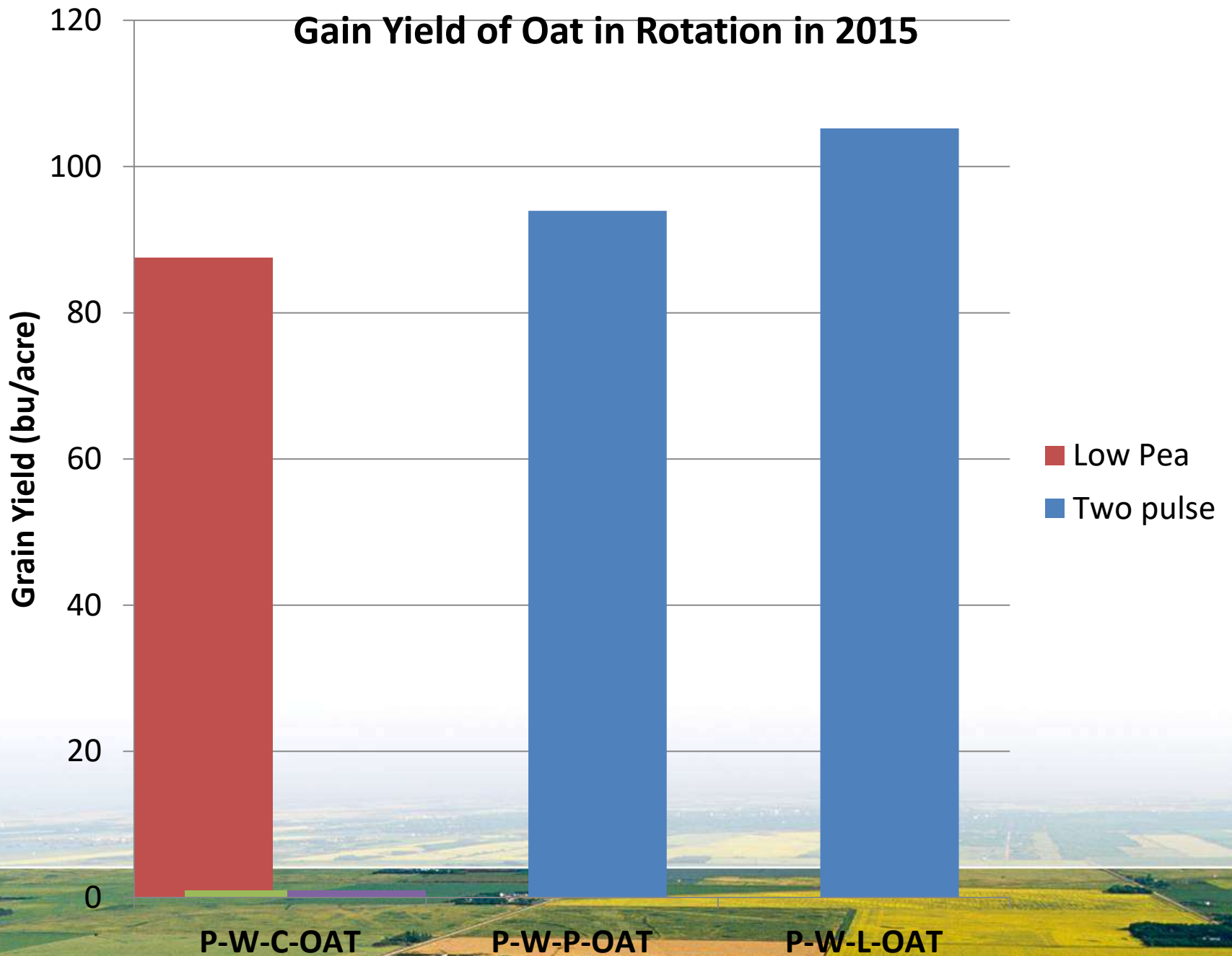




# Gain Yield of Oat in Rotation in 2015



# Gain Yield of Oat in Rotation in 2015



# Sunflower Hybrids (Oilseed)

Variety	Years Tested	Yield as % of 63A21	Average Maturity (days)	Harvest Moisture %
63A21	7	100	110	18.5
Honeycomb NS	3	111	106	13.3
AC Sierra	7	68	105	16.1
8N 270*	7	92	115	23.6
Talon*	2	92	113	30.1
Cobalt II*	3	76	115	30.4
* has herbicide tolerance.				



# Macro and Micro Nutrient Trial

Nutrients	Treatments										
	1	2	3	4	5	6	7	8	9	10	11
N	0	15	30	30	30	60	60	60	60	60	90
P	0	0	0	30	30	30	30	30	30	30	30
CL		18	18	18	18	18	0	18	18	18	18
S					15	15	15	15	15	15	15
Cu								3			
Zinc									3		
Cu, Z, Mn, B										Yes	Yes



# Locations

- **Indian Head – Indian Head Agricultural Research Foundation**
- **Swift Current - Wheatland Conservation Association**  
**Redvers – South East Research Farm**
- **Yorkton – East Central Research Foundation**
- **Melfort – Melfort Research Farm**
- **Scott – Scott Research Farm**



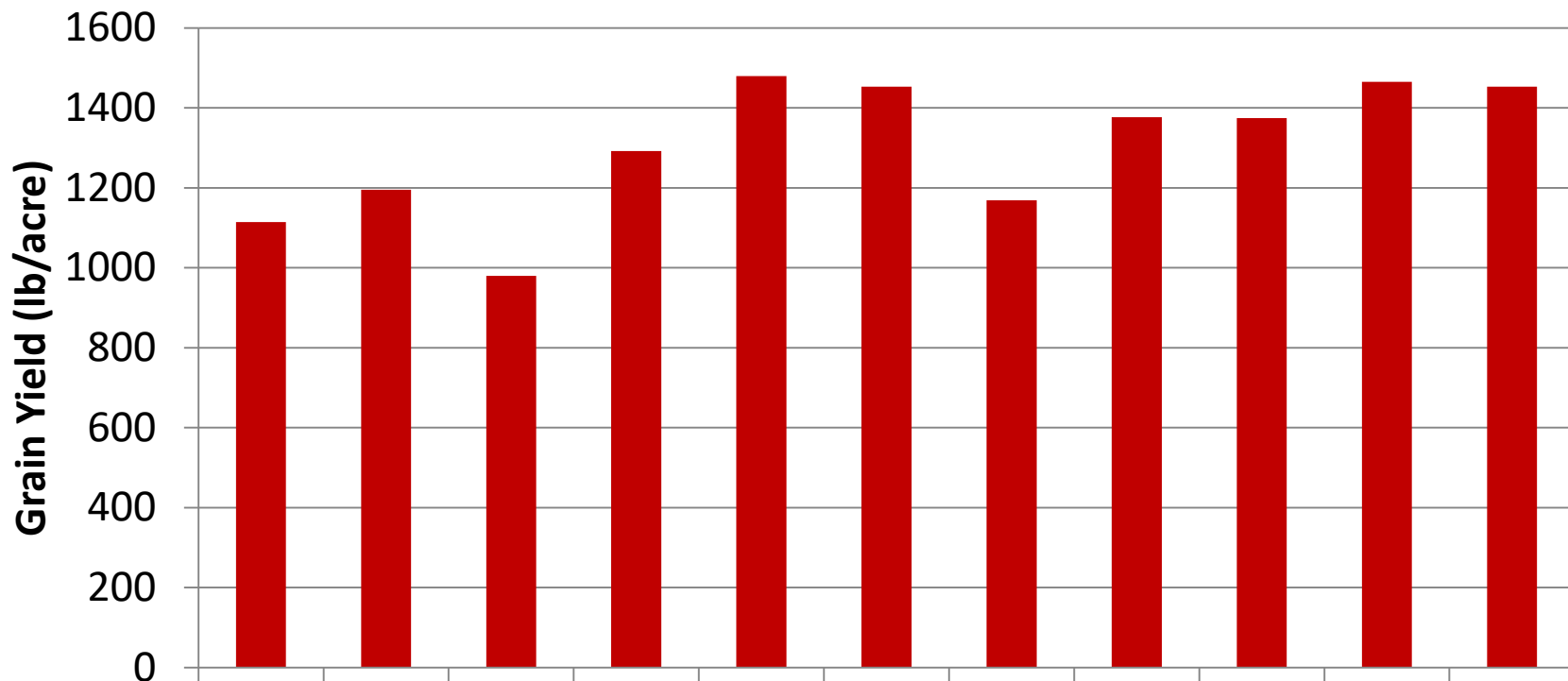
# Funding

**ADF** – Saskatchewan Ministry of Agriculture

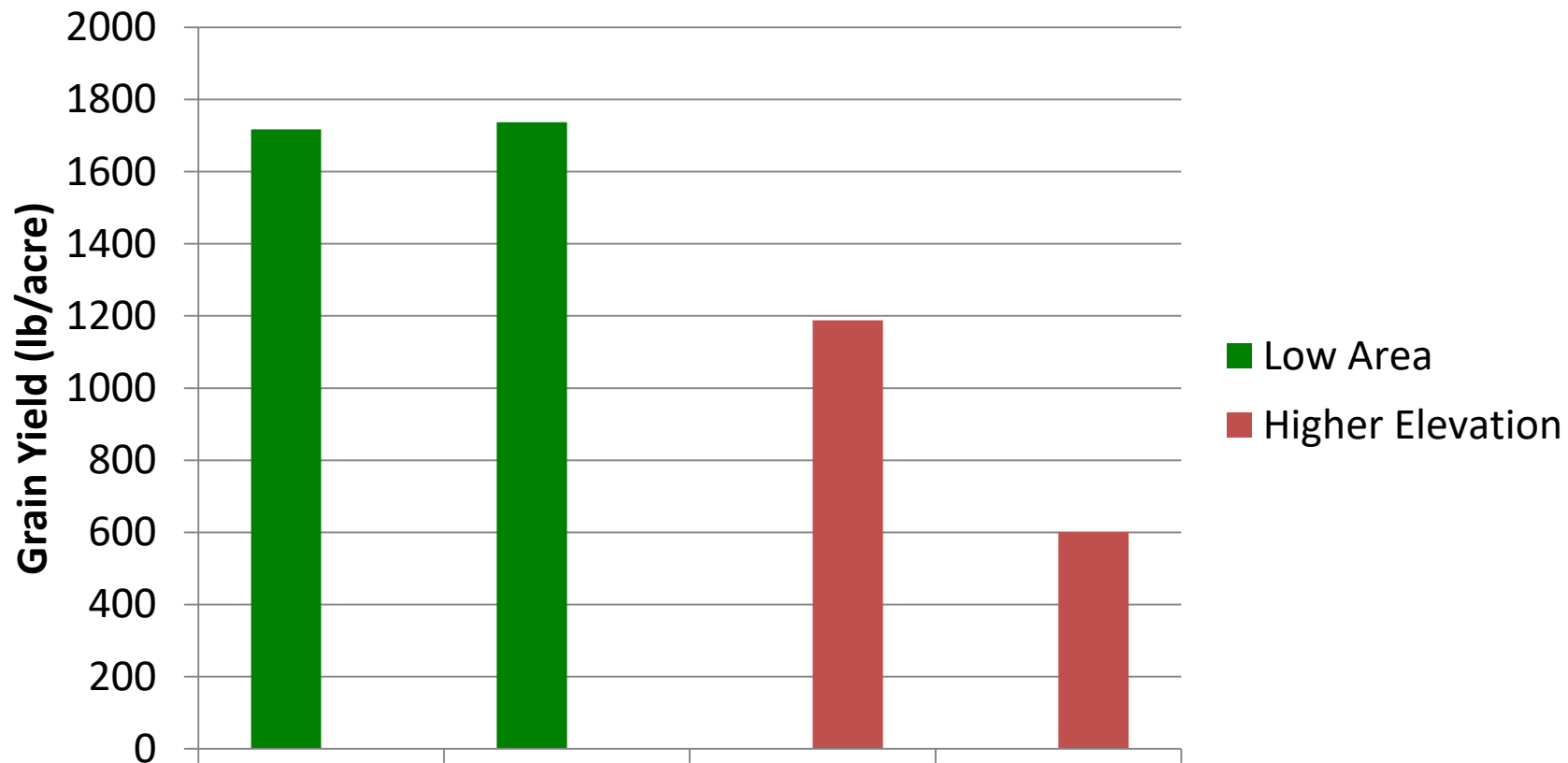
Canaryseed Development Commission of  
Saskatchewan



# Indian Head - 2014



<b>N</b>	<b>0</b>	<b>15</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>90</b>
<b>P</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>
<b>CL</b>		<b>18</b>	<b>18</b>	<b>18</b>	<b>18</b>	<b>18</b>	<b>0</b>	<b>18</b>	<b>18</b>	<b>18</b>	<b>18</b>
<b>S</b>				<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>
<b>Cu</b>							<b>3</b>				
<b>Zinc</b>								<b>3</b>			
<b>Cu, Z, Mn, B</b>									<b>Yes</b>	<b>Yes</b>	



<b>N</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>
<b>P</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>
<b>CL</b>	<b>18</b>	<b>0</b>	<b>18</b>	<b>0</b>
<b>S</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>





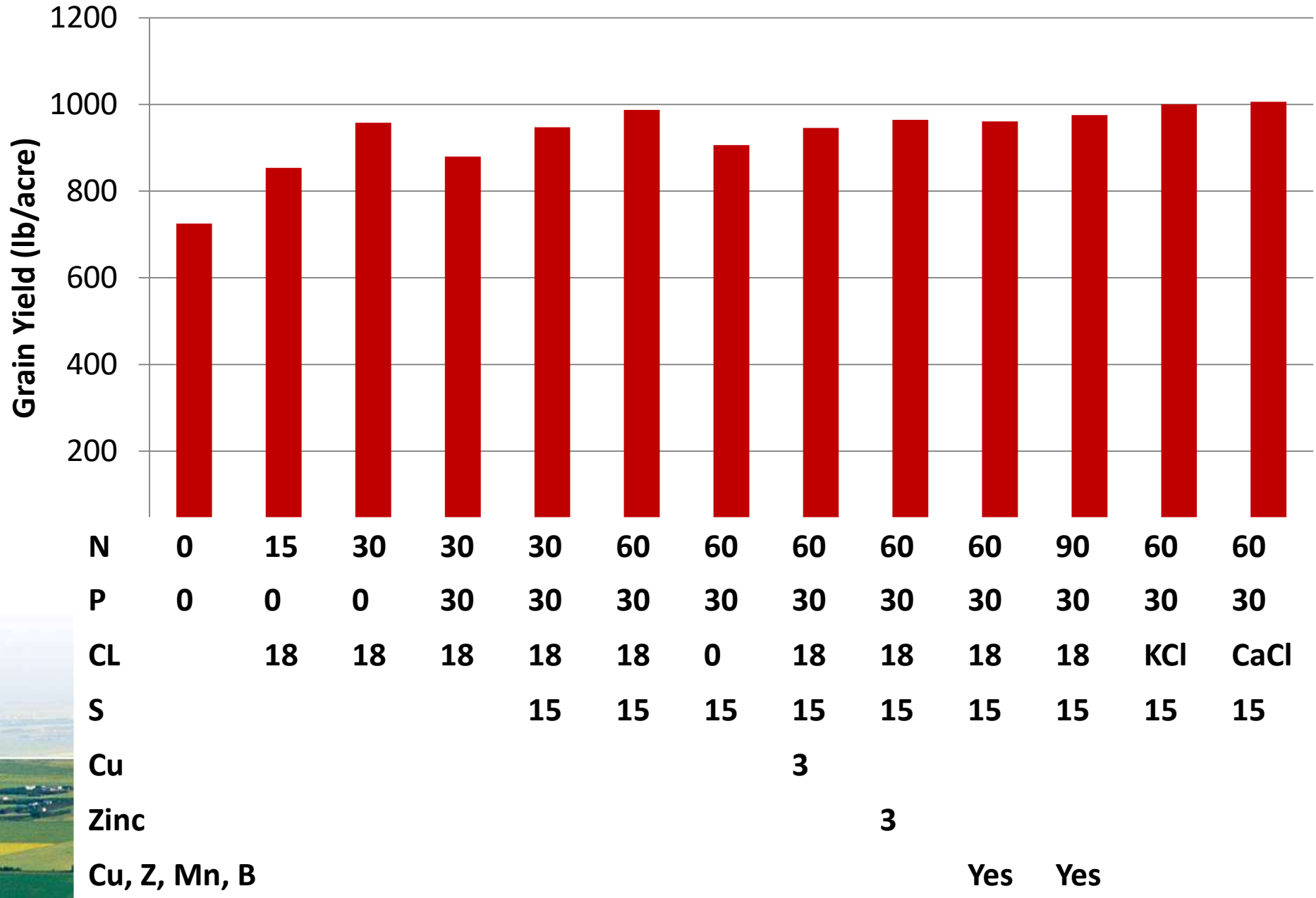


Nitrogen 0 kg/ha  
Phosphorus 0 kg/ha  
Chloride 0 kg/ha  
Micro 0 kg/ha

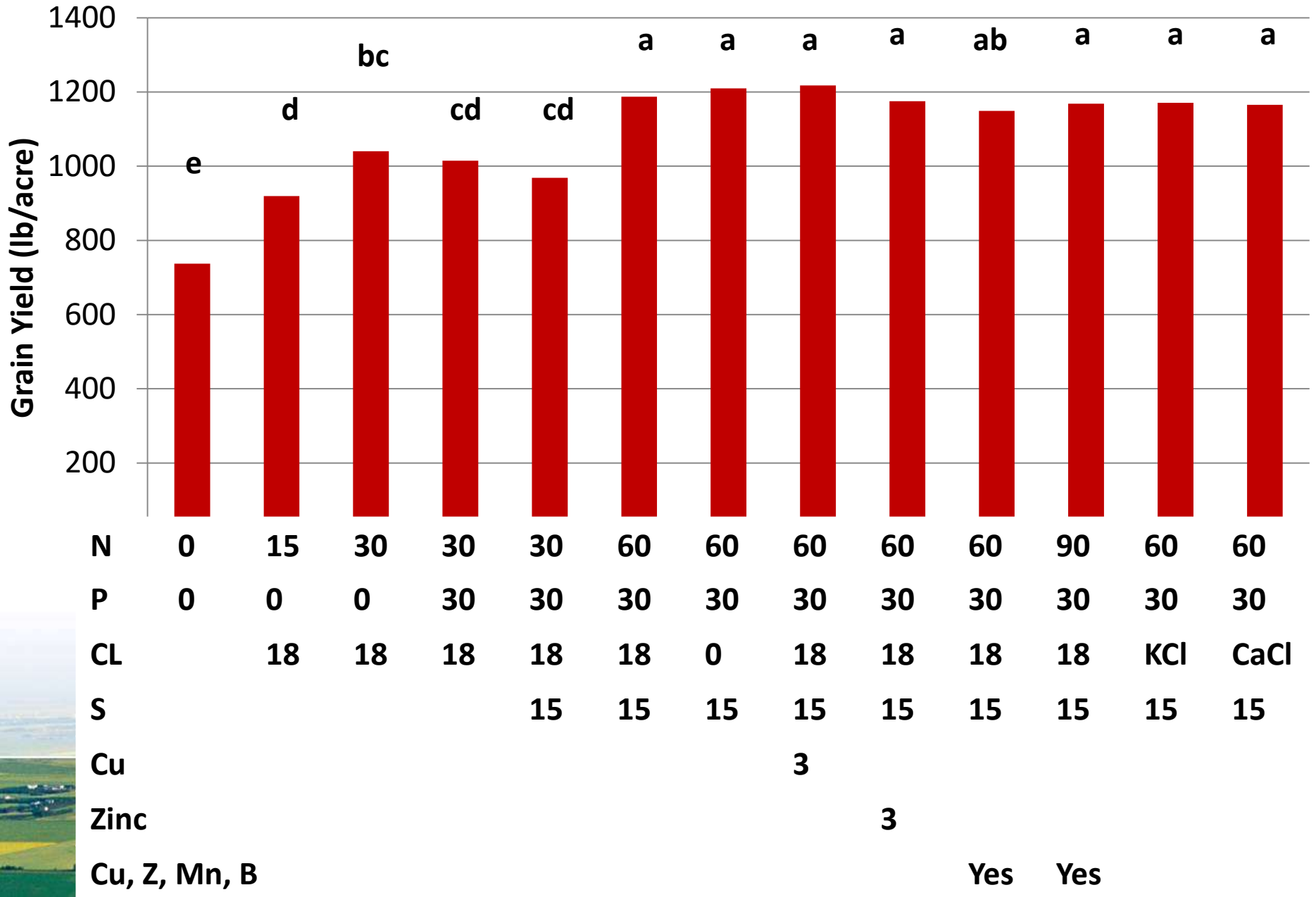
Nitrogen 30 kg/ha  
Phosphorus 30 kg/ha  
Chloride 18 kg/ha  
Micro 0 kg/ha

Nitrogen 90 kg/ha  
Phosphorus 30 kg/ha  
Chloride 18 kg/ha  
Micro Control

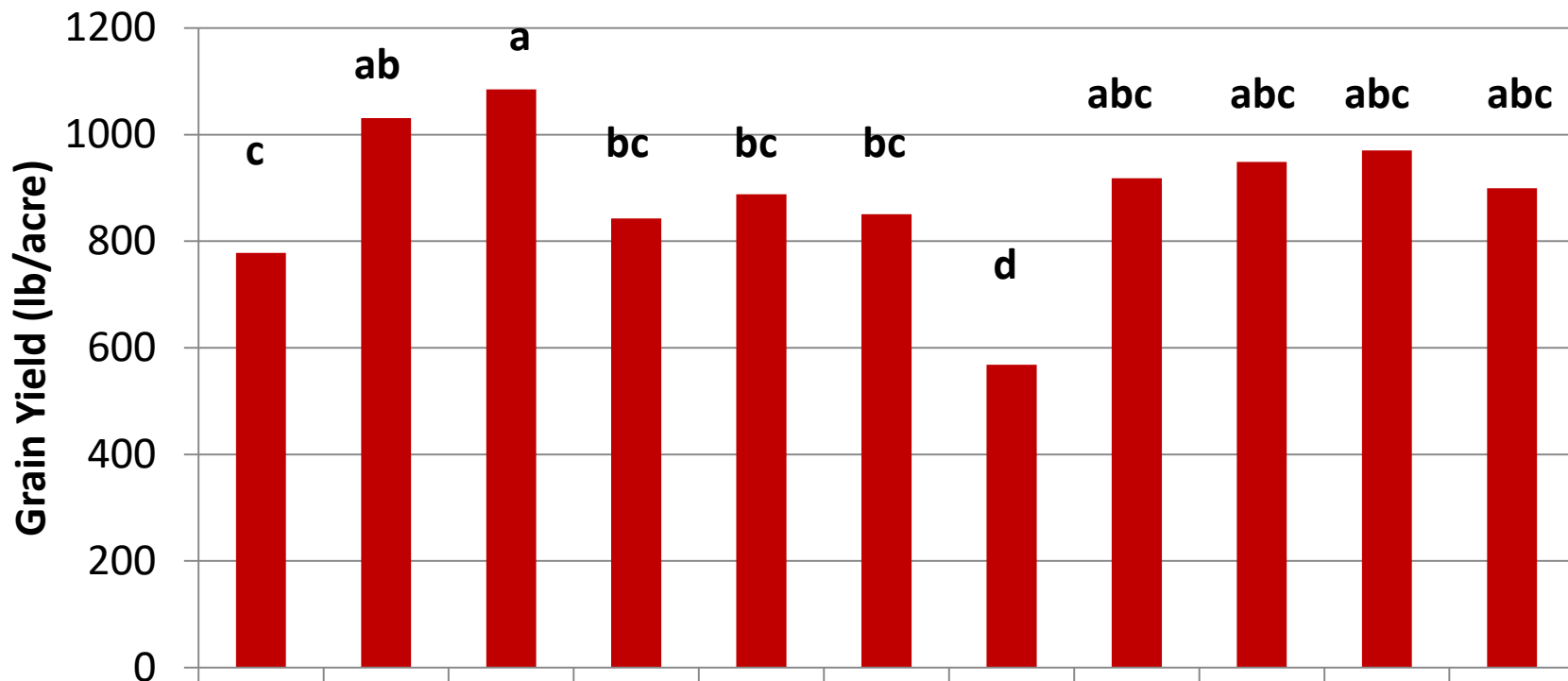
# Indian Head - 2015



# Indian Head - 2016

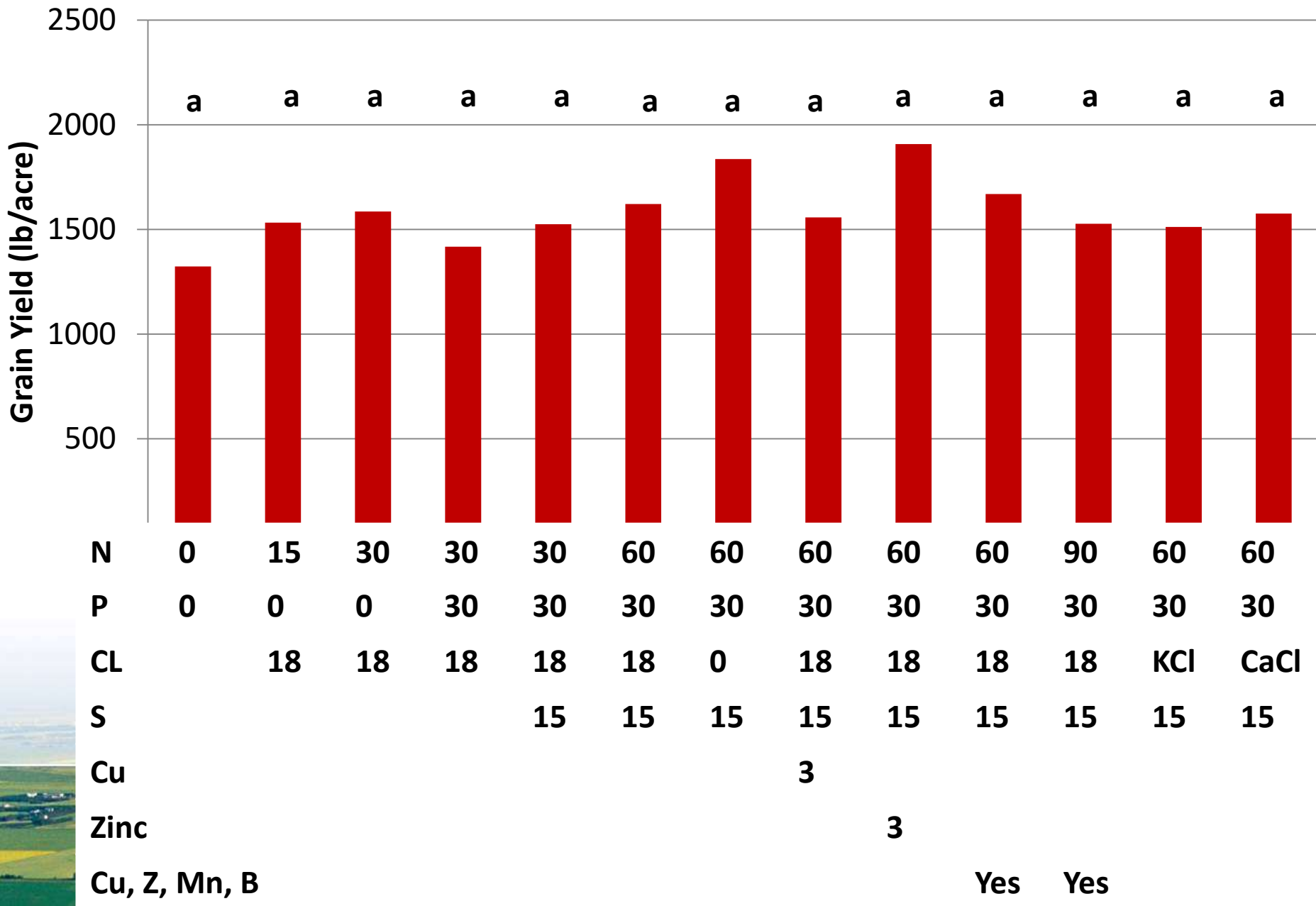


# Swift Current - 2014

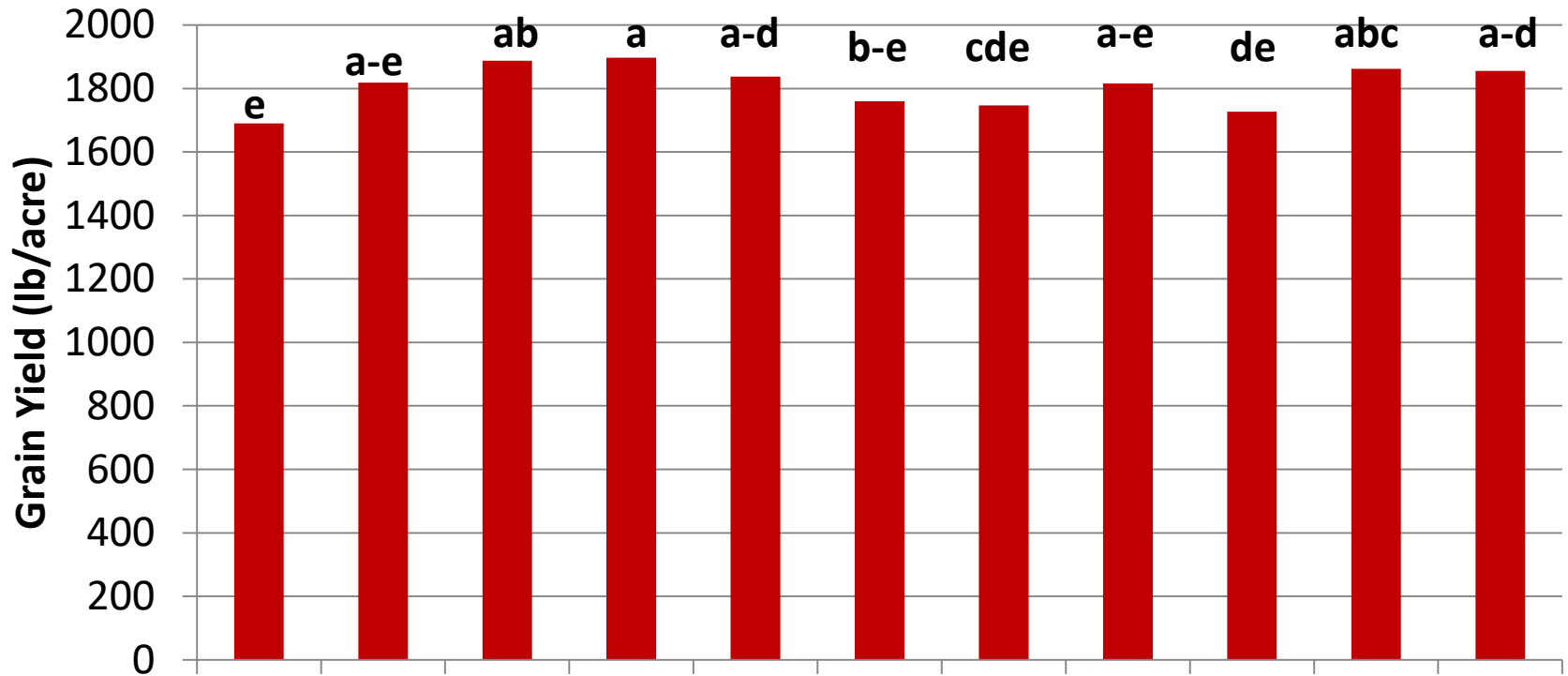


N	0	15	30	30	30	60	60	60	60	60	90
P	0	0	0	30	30	30	30	30	30	30	30
CL		18	18	18	18	18	0	18	18	18	18
S				15	15	15	15	15	15	15	15
Cu								3			
Zinc									3		
Cu, Z, Mn, B										Yes	Yes

# Swift Current - 2016

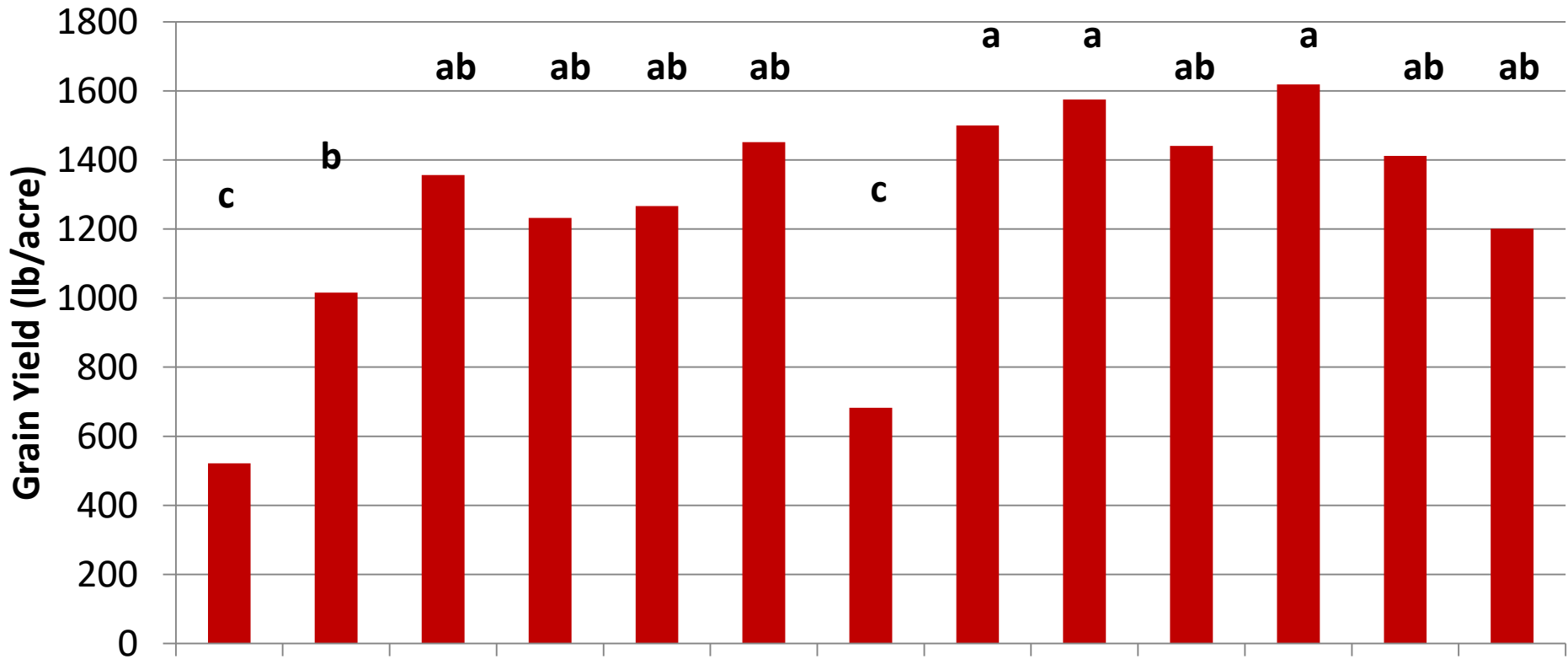


# Melfort - 2014



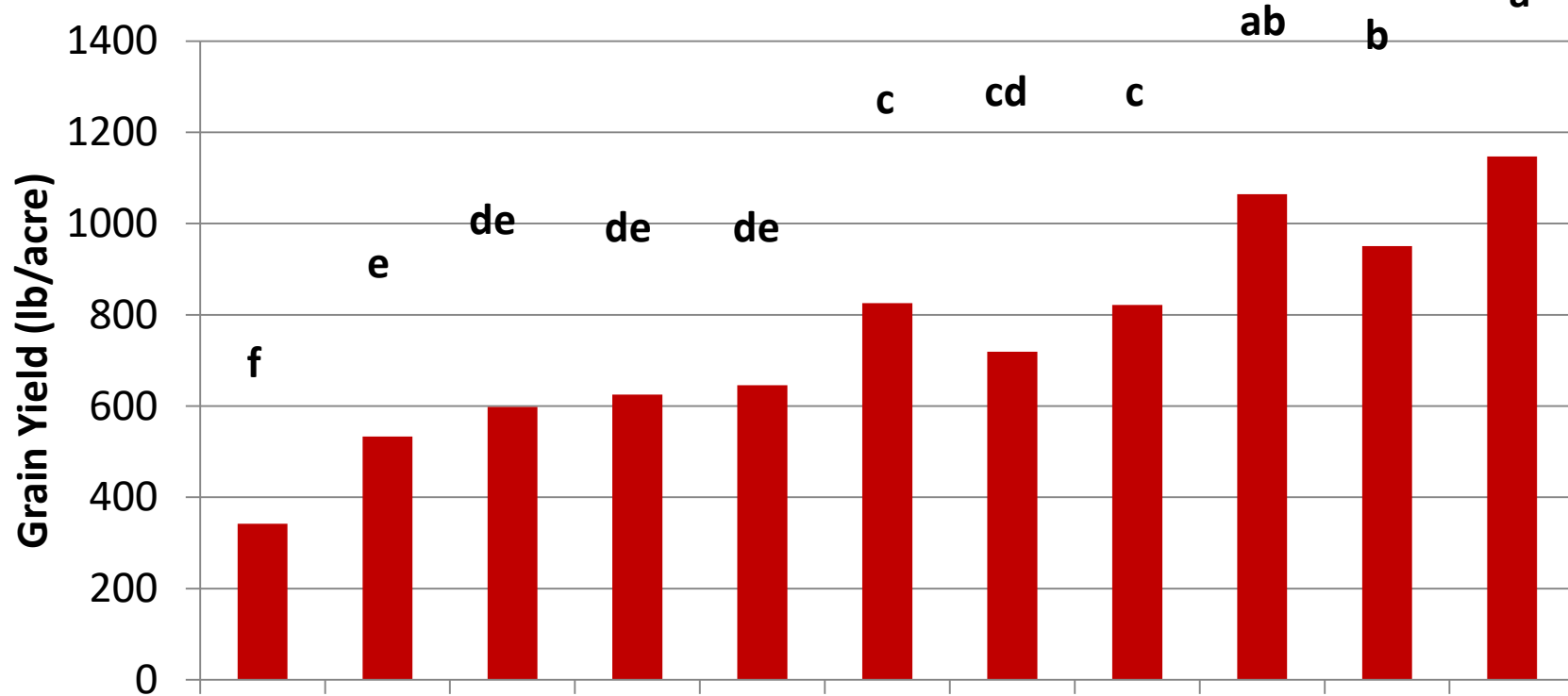
<b>N</b>	<b>0</b>	<b>15</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>90</b>
<b>P</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>	<b>30</b>
<b>CL</b>		<b>18</b>	<b>18</b>	<b>18</b>	<b>18</b>	<b>18</b>	<b>0</b>	<b>18</b>	<b>18</b>	<b>18</b>	<b>18</b>
<b>S</b>				<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>	<b>15</b>
<b>Cu</b>								<b>3</b>			
<b>Zinc</b>									<b>3</b>		
<b>Cu, Z, Mn, B</b>										<b>Yes</b>	<b>Yes</b>

# Melfort - 2015



N	0	15	30	30	30	60	60	60	60	60	90	60	60
P	0	0	0	30	30	30	30	30	30	30	30	30	30
CL		18	18	18	18	18	0	18	18	18	18	KCl	CaCl
S					15	15	15	15	15	15	15	15	15
Cu								3					
Zinc									3				
Cu, Z, Mn, B										Yes	Yes		

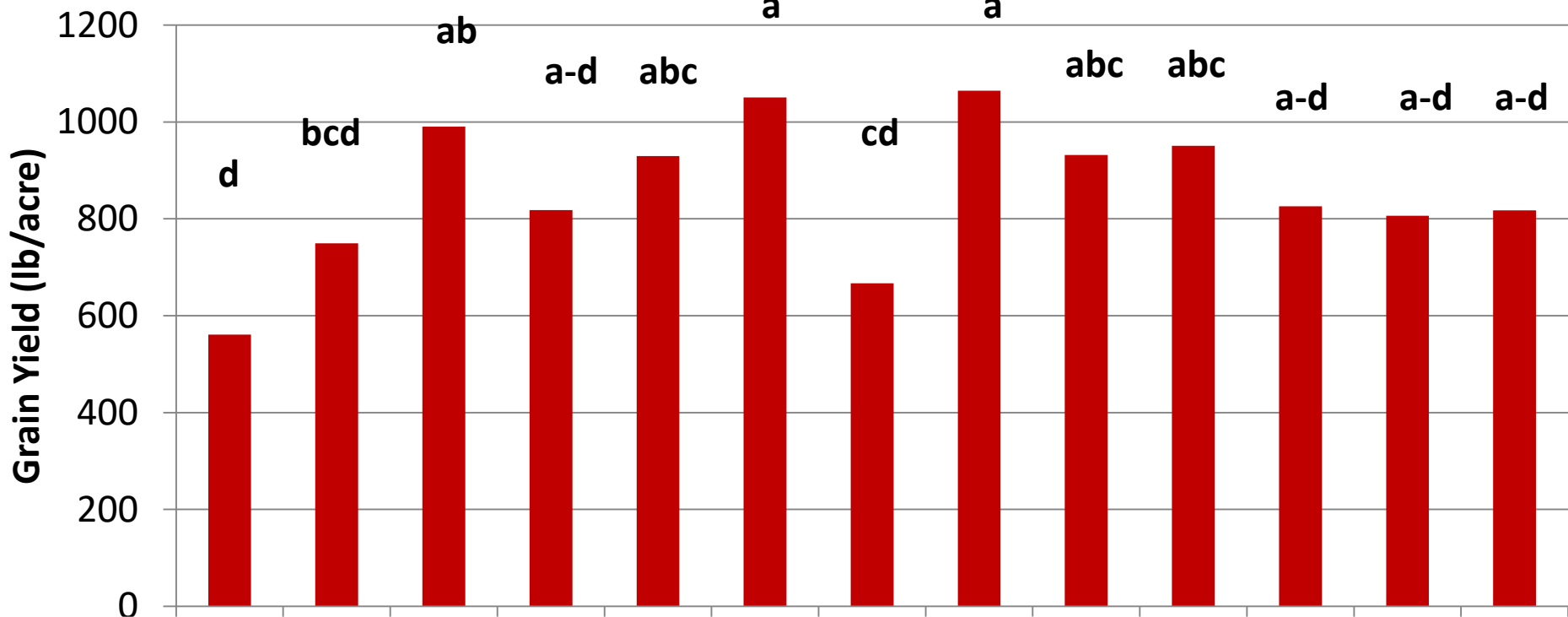
# Scott - 2014



N	0	15	30	30	30	60	60	60	60	60	90
P	0	0	0	30	30	30	30	30	30	30	30
CL		18	18	18	18	18	0	18	18	18	18
S				15	15	15	15	15	15	15	15
Cu								3			
Zinc									3		
Cu, Z, Mn, B										Yes	Yes

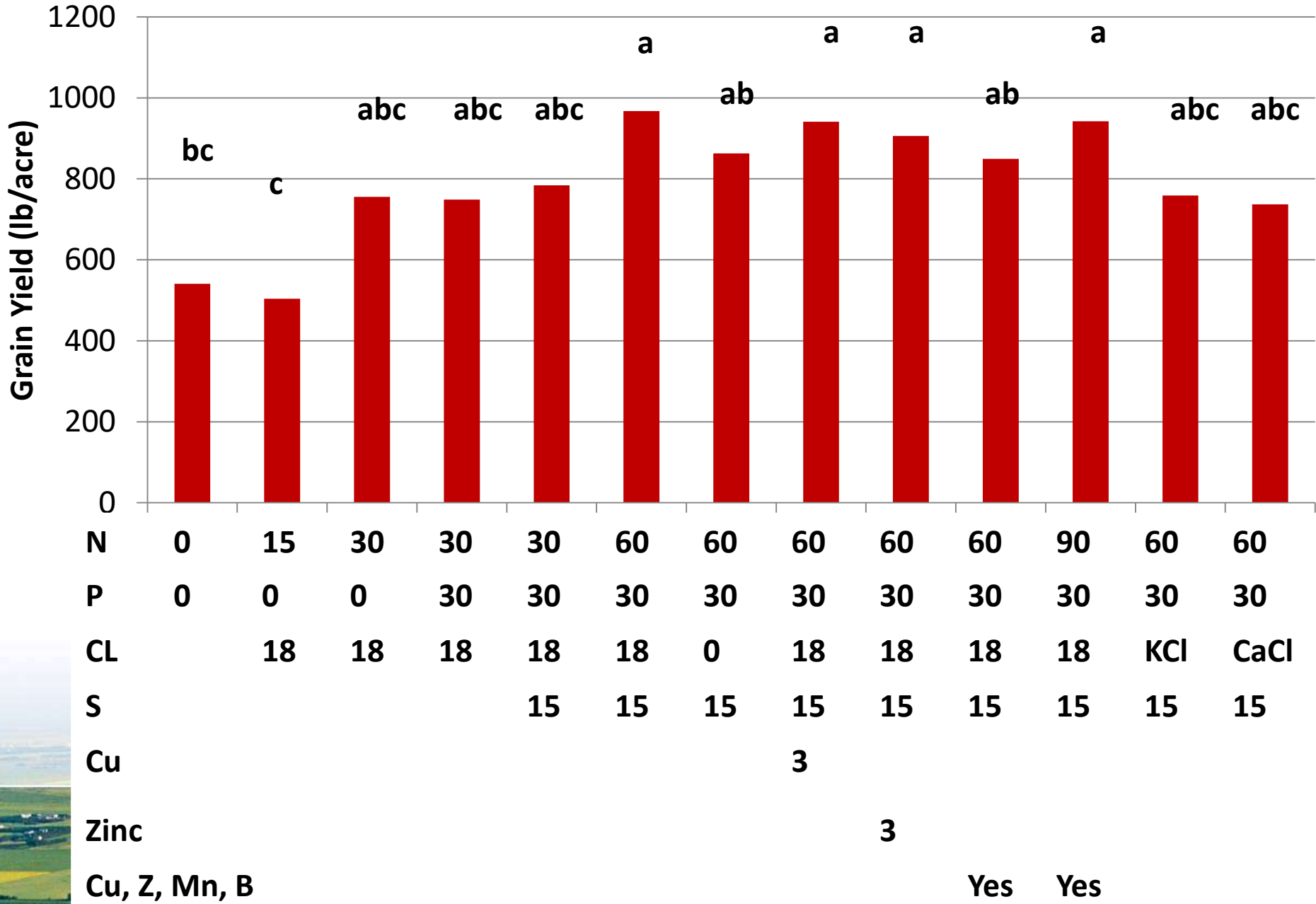


# Scott - 2015

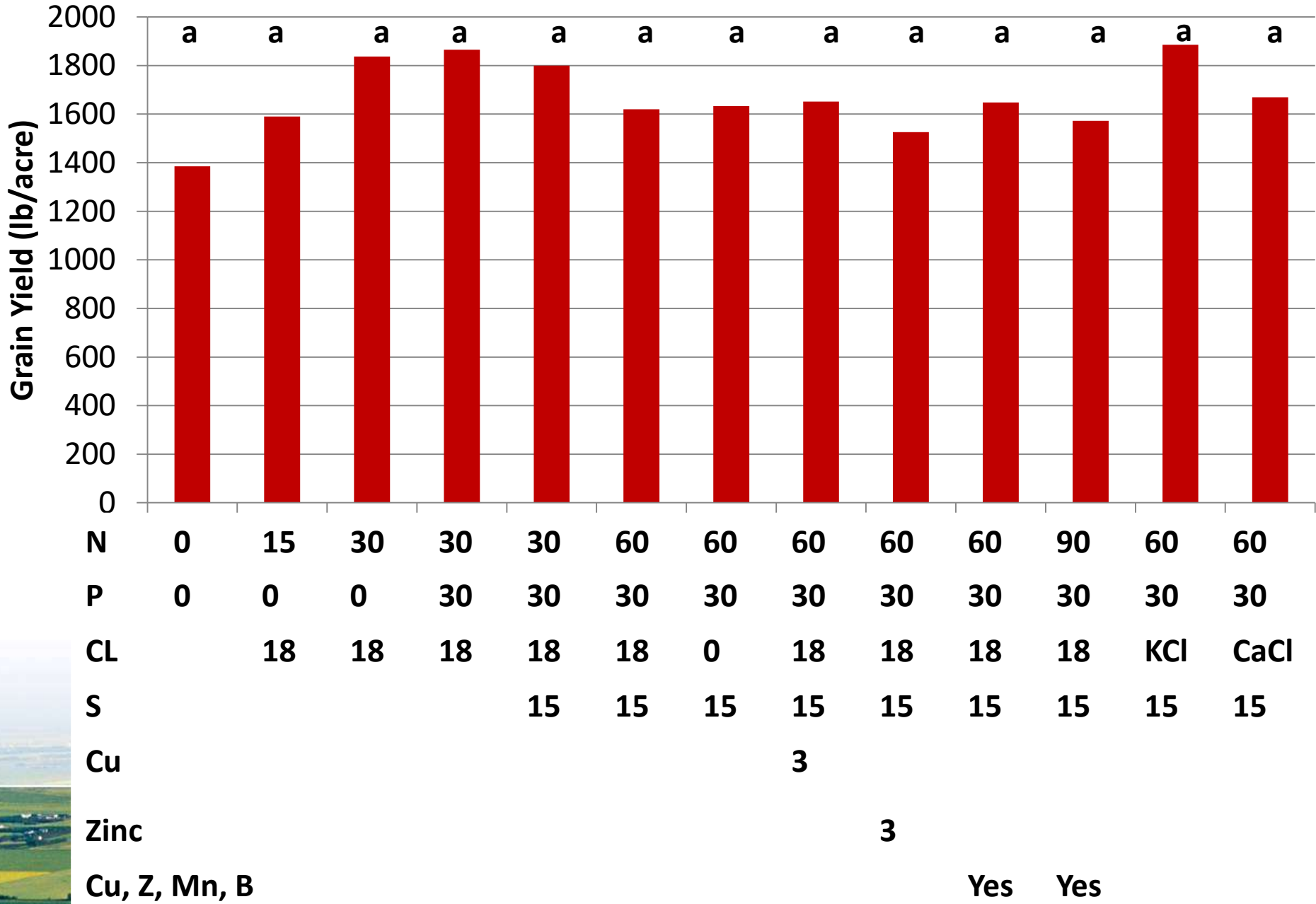


N	0	15	30	30	30	60	60	60	60	60	90	60	60
P	0	0	0	30	30	30	30	30	30	30	30	30	30
CL		18	18	18	18	18	0	18	18	18	18	KCl	CaCl
S					15	15	15	15	15	15	15	15	15
Cu								3					
Zinc									3				
Cu, Z, Mn, B										Yes	Yes		

# Redvers - 2015



# Redvers - 2016



# Overall Results

- N Fertilizer: response at 14 out of 15 site-years  
Optimum amount (eyeing the trend)
  - 15 kg/ha – 1 out of 15
  - 30 kg/ha – 7 out of 15
  - 60 kg/ha – 3 out of 15
  - 90 kg/ha – 3 out of 15



# Overall Results

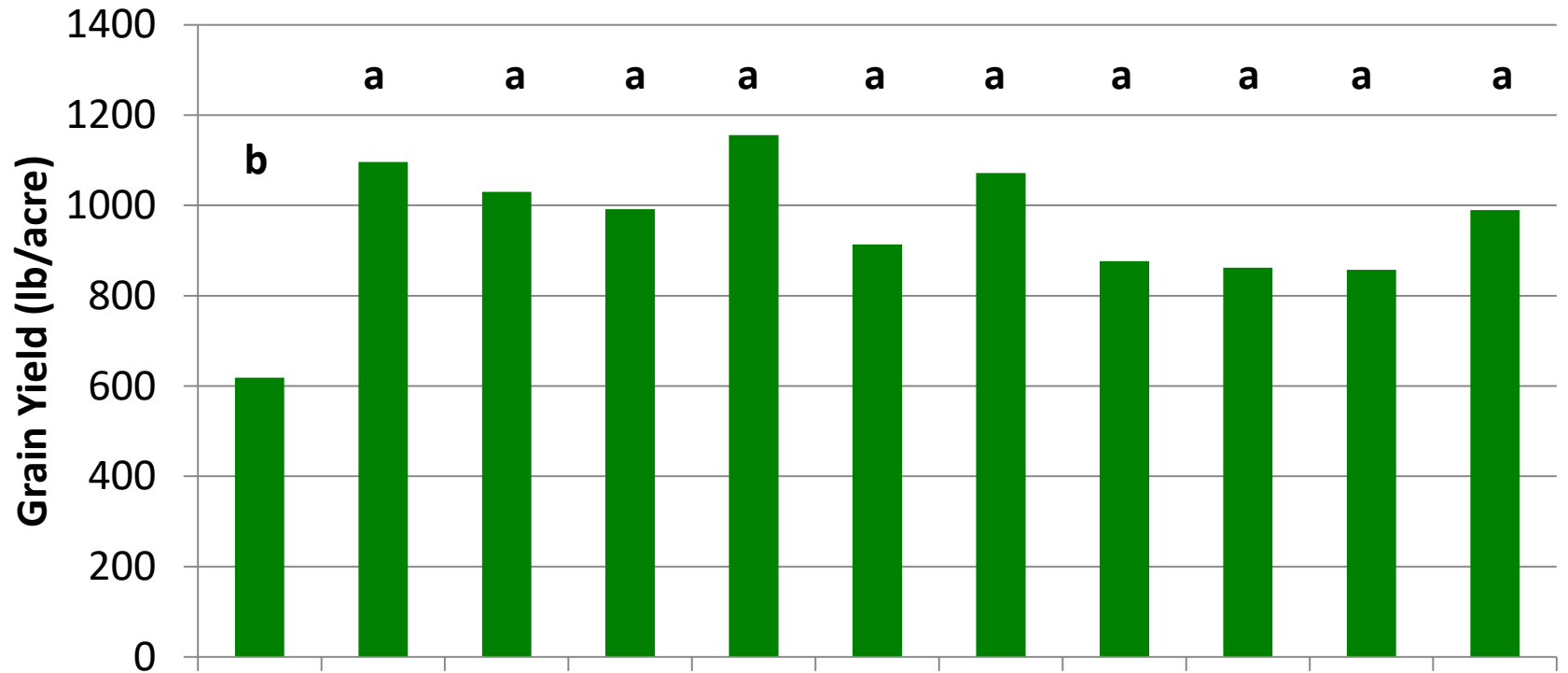
- Chloride: response at 5 out of 15
- Phosphate: response at 1 or 2 out of 15
- Zinc: response at 1 out of 15 locations



# Foliar Micronutrients

Treatment	Copper	Zinc	Mn	Boron
	Kg/ha of nutrient			
1	No fertilizer			
2	60, 30, 24, 18.1, 15 of N, P, K, Cl, and S			
3	3	3	3	3
	<b>Foliar at 3-6 leaf</b>			
4	0.25			
5		0.35		
6			0.55	
7				0.5
	<b>Foliar at Flag leaf</b>			
8	0.25			
9		0.35		
10			0.55	
11				0.5

# Foliar Indian Head 2015



N, P, Cl, S

0    60    60    60    60    60    60    60    60    60    60

3 leaf

Flag leaf

Cu

0.25

0.25

Zinc

0.35

0.35

Mn

0.55

0.55

Boron

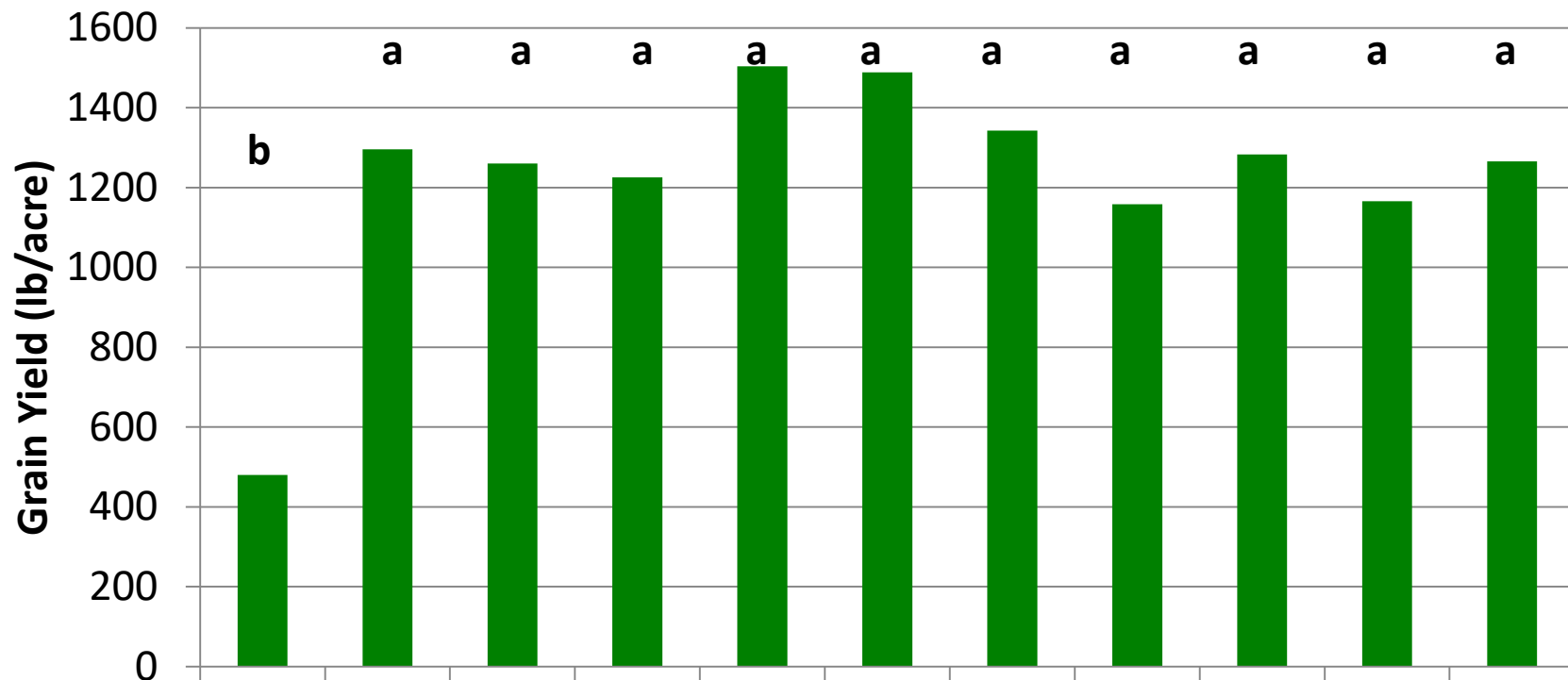
0.5

0.5

Cu, Z, Mn, B

Yes

# Foliar Melfort 2015



N, P, Cl, S

0

60

60

60

60

60

60

60

60

60

60

3 leaf

Flag leaf

Cu

0.25

0.25

Zinc

0.35

0.35

Mn

0.55

0.55

Boron

0.5

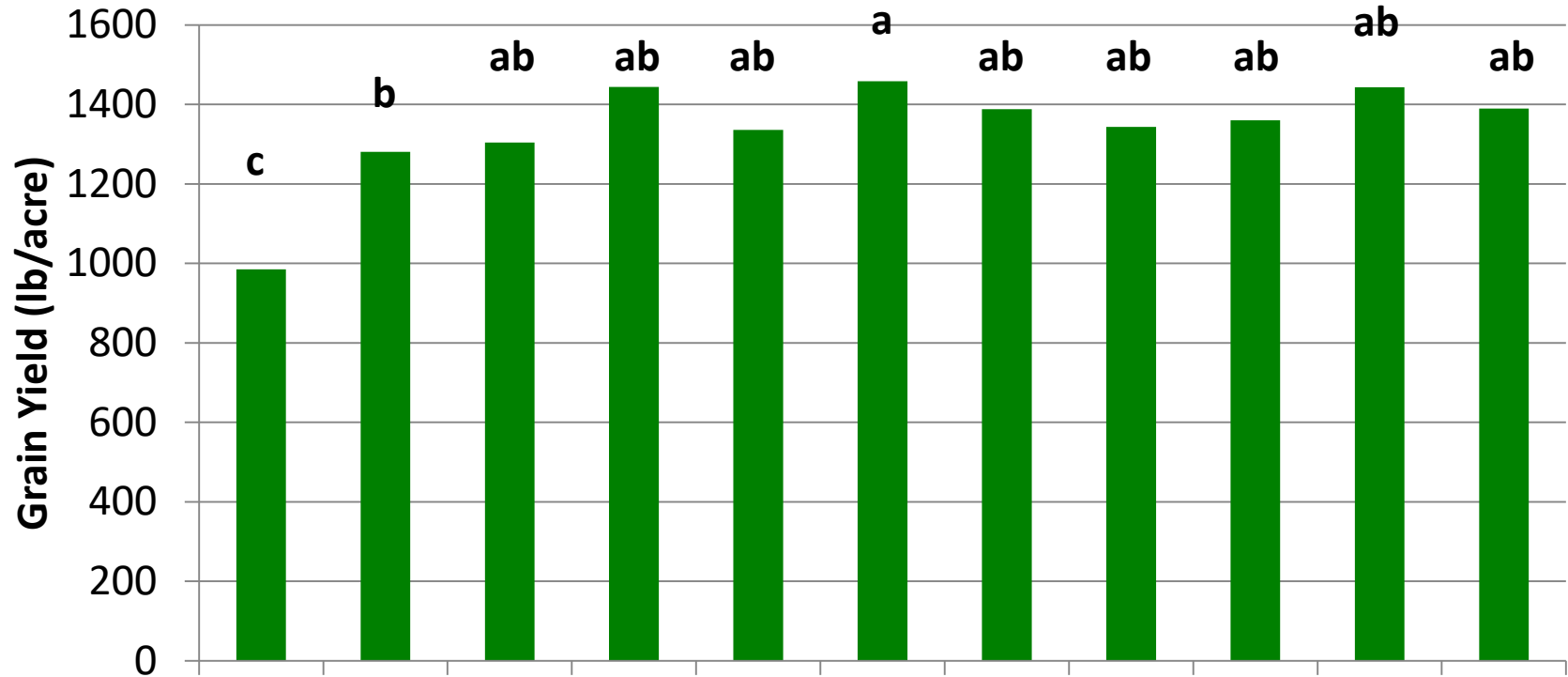
0.5

Cu, Z, Mn, B

Yes



# Foliar Indian Head 2016



N, P, Cl, S

0

60

60

60

60

60

60

60

60

60

60

3 leaf

Flag leaf

Cu

0.25

0.25

Zinc

0.35

0.35

Mn

0.55

0.55

Boron

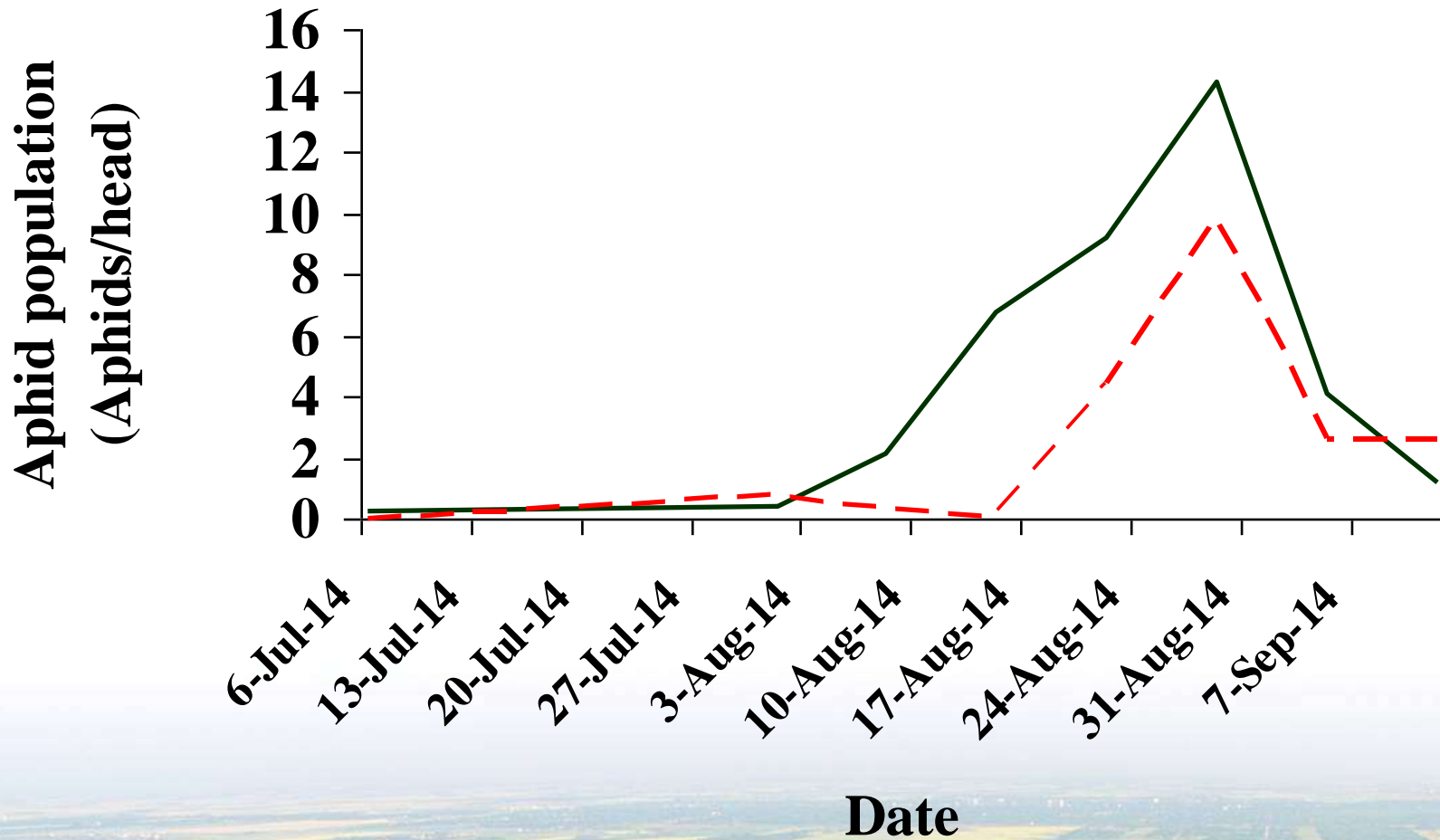
0.5

0.5

Cu, Z, Mn, B

Yes

# Aphid Populations in Canaryseed

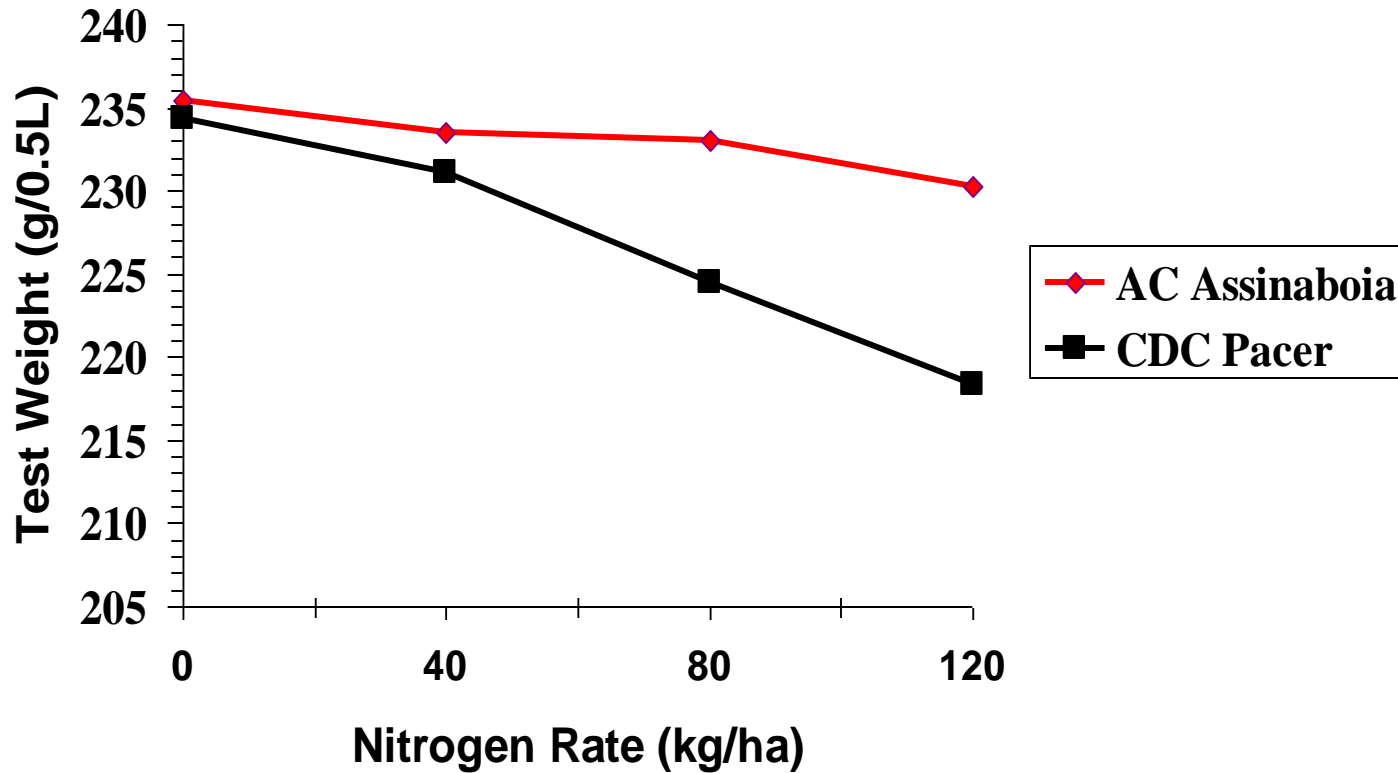


— Head - - Leaf Sheath

# Nitrogen, Yield and Test Weight in Oats



# Nitrogen Rate and Cultivar



# Test Weight Stability

Treatment Factors:

## 1) Cultivars

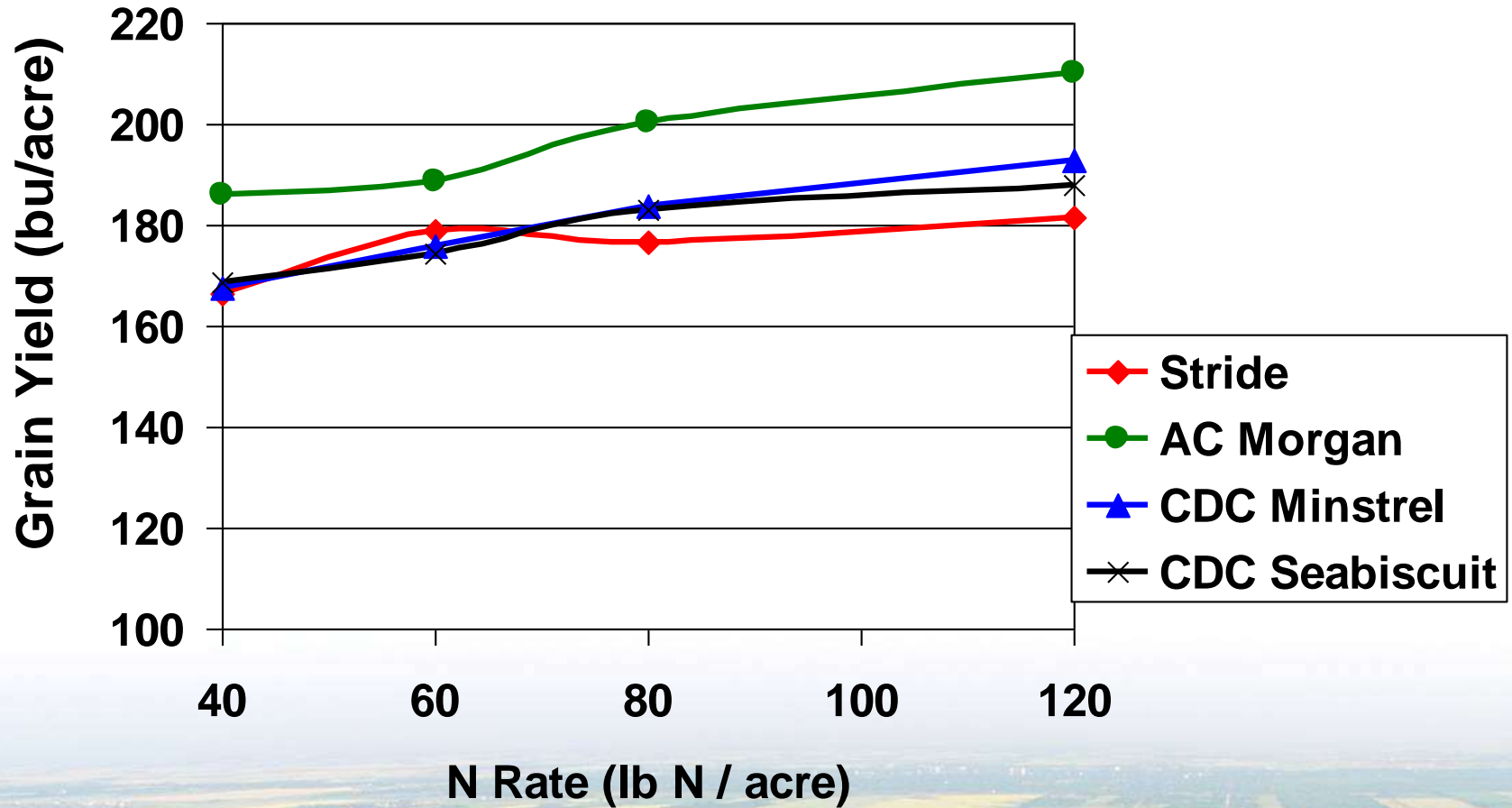
Location	Indian Head	Melfort	Redvers	Yorkton
Varieties	Stride CDC Ruffian CS Camden CDC Big Brown	Stride CDC Minstrel AC Morgan CDC Seabiscuit	Stride Justice Souris CDC Morrison	Stride CDC Dancer Summit Triactor

## 2) Nitrogen Rate (kg N ha<sup>-1</sup>)

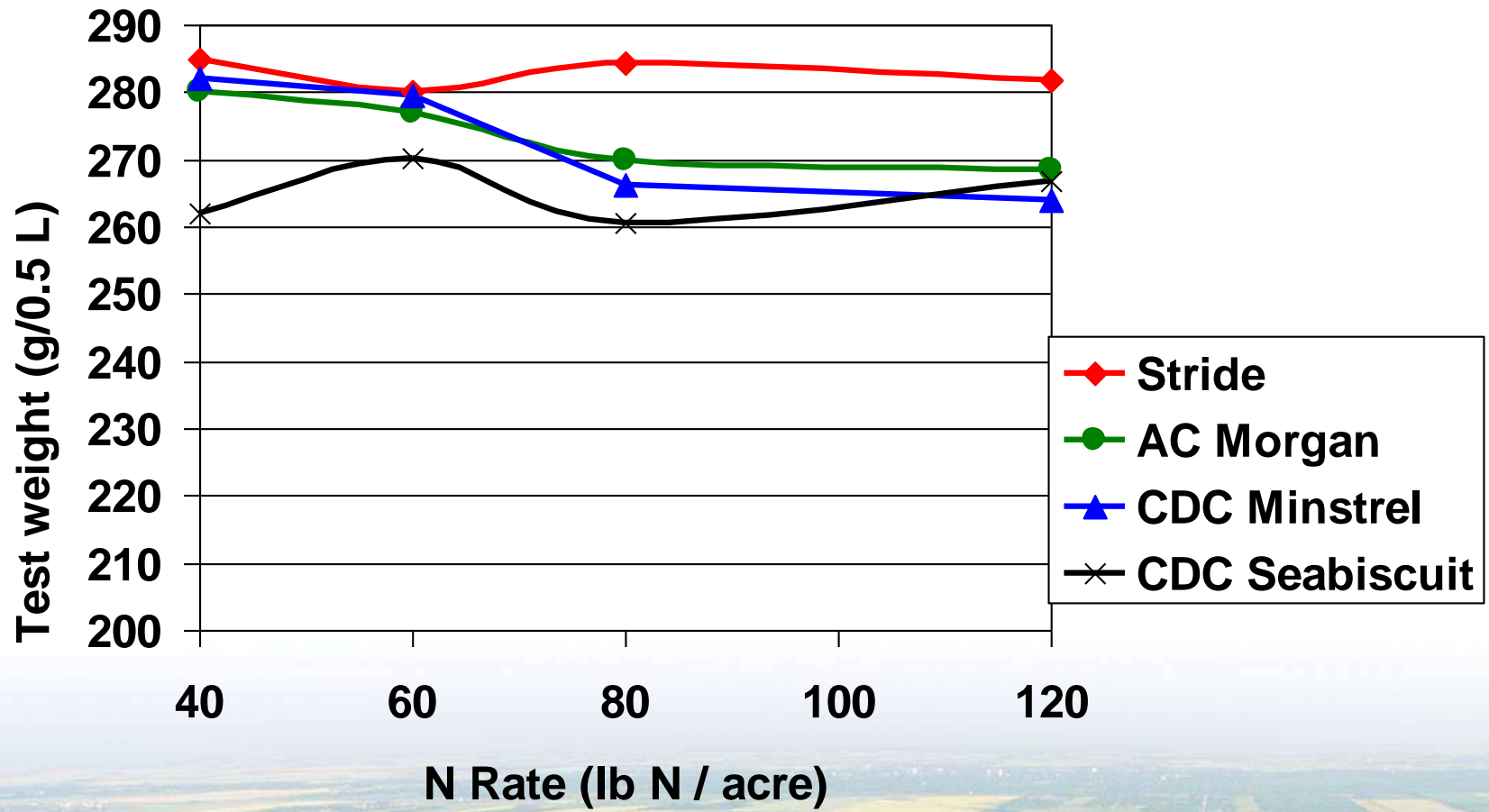
- I) 40
- II) 60
- III) 80
- IV) 120



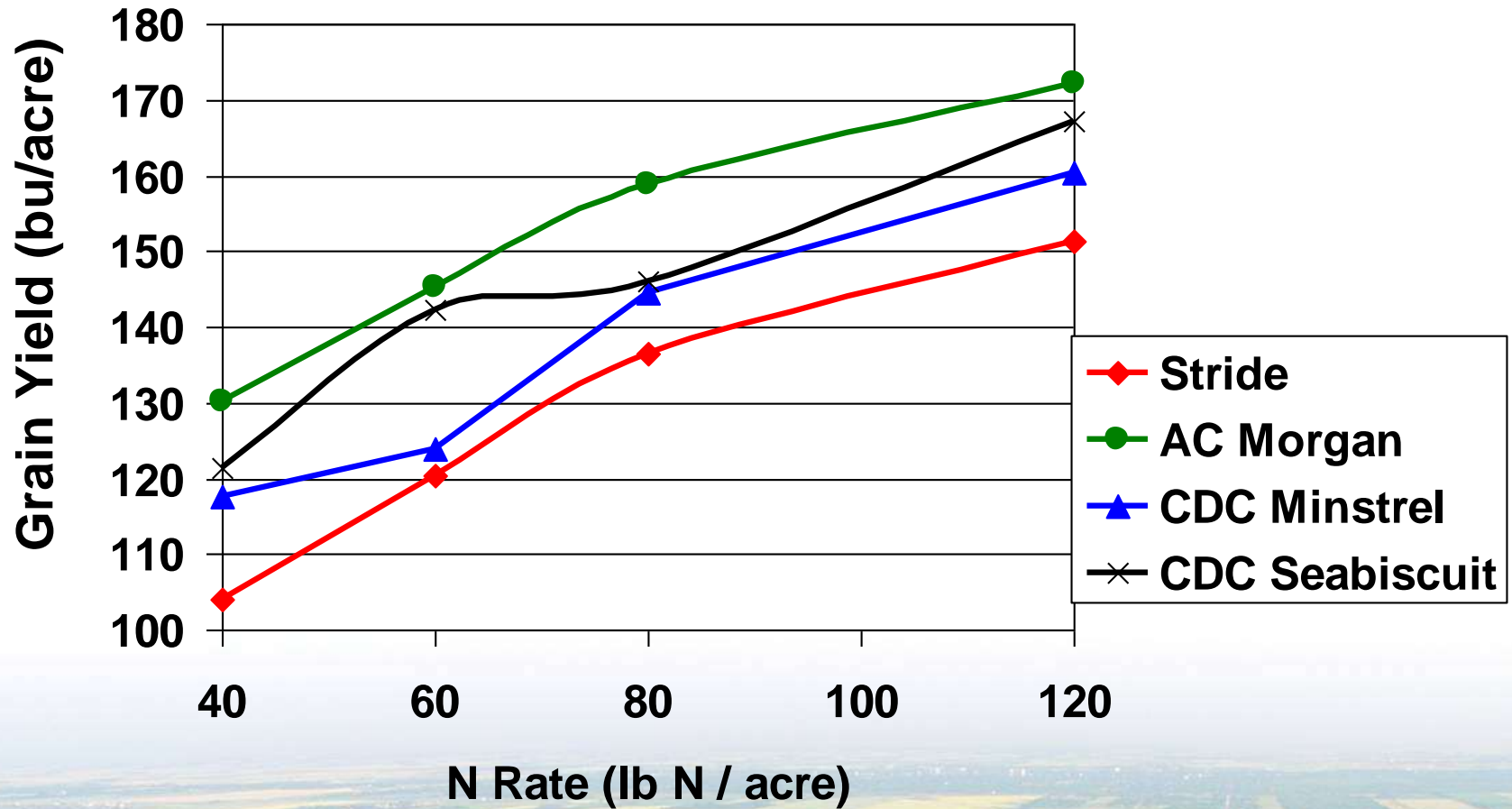
# Nitrogen x Cultivar at Melfort in 2014



# Nitrogen x Cultivar at Melfort in 2014

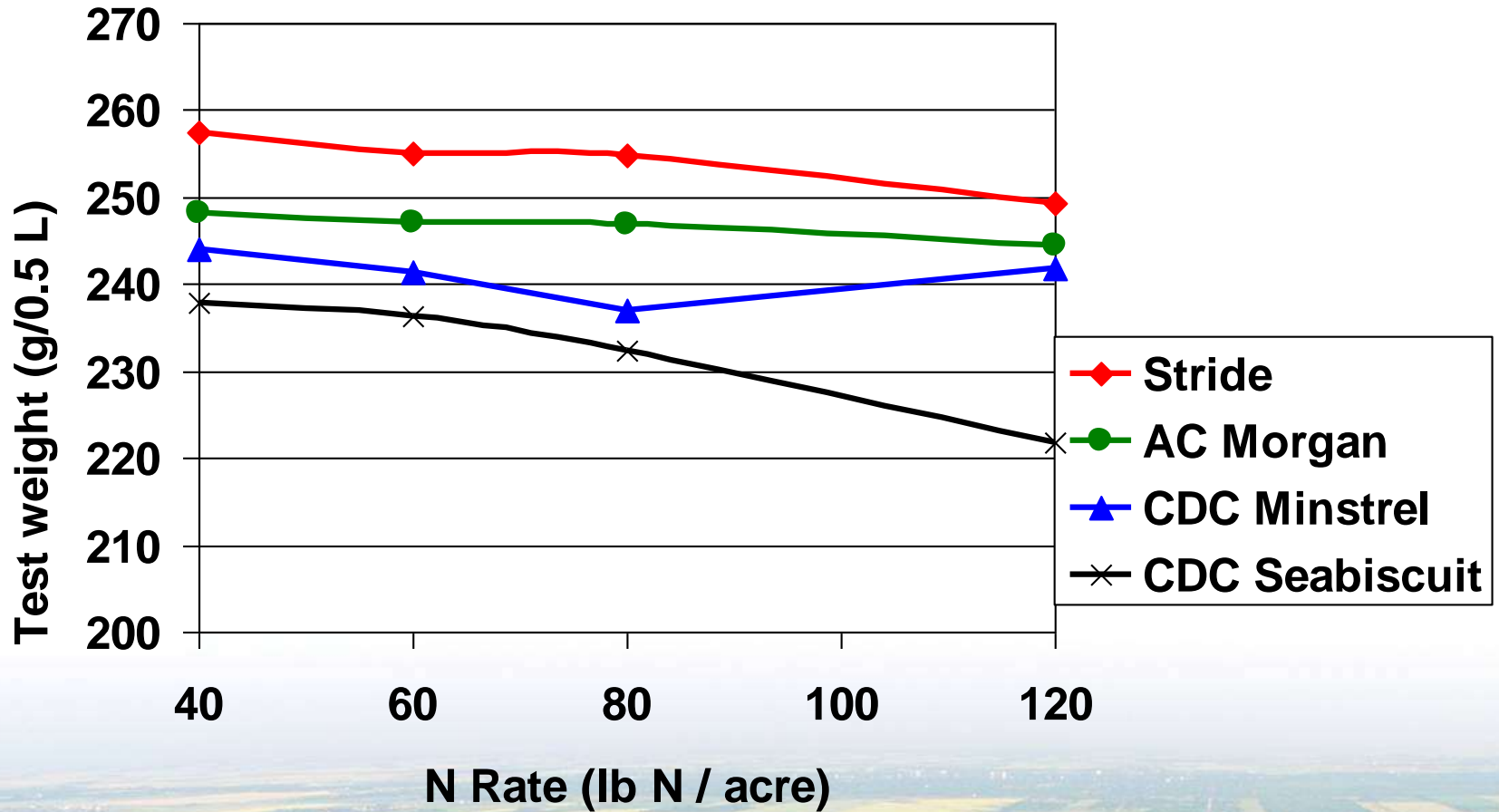


# Nitrogen x Cultivar at Melfort in 2015

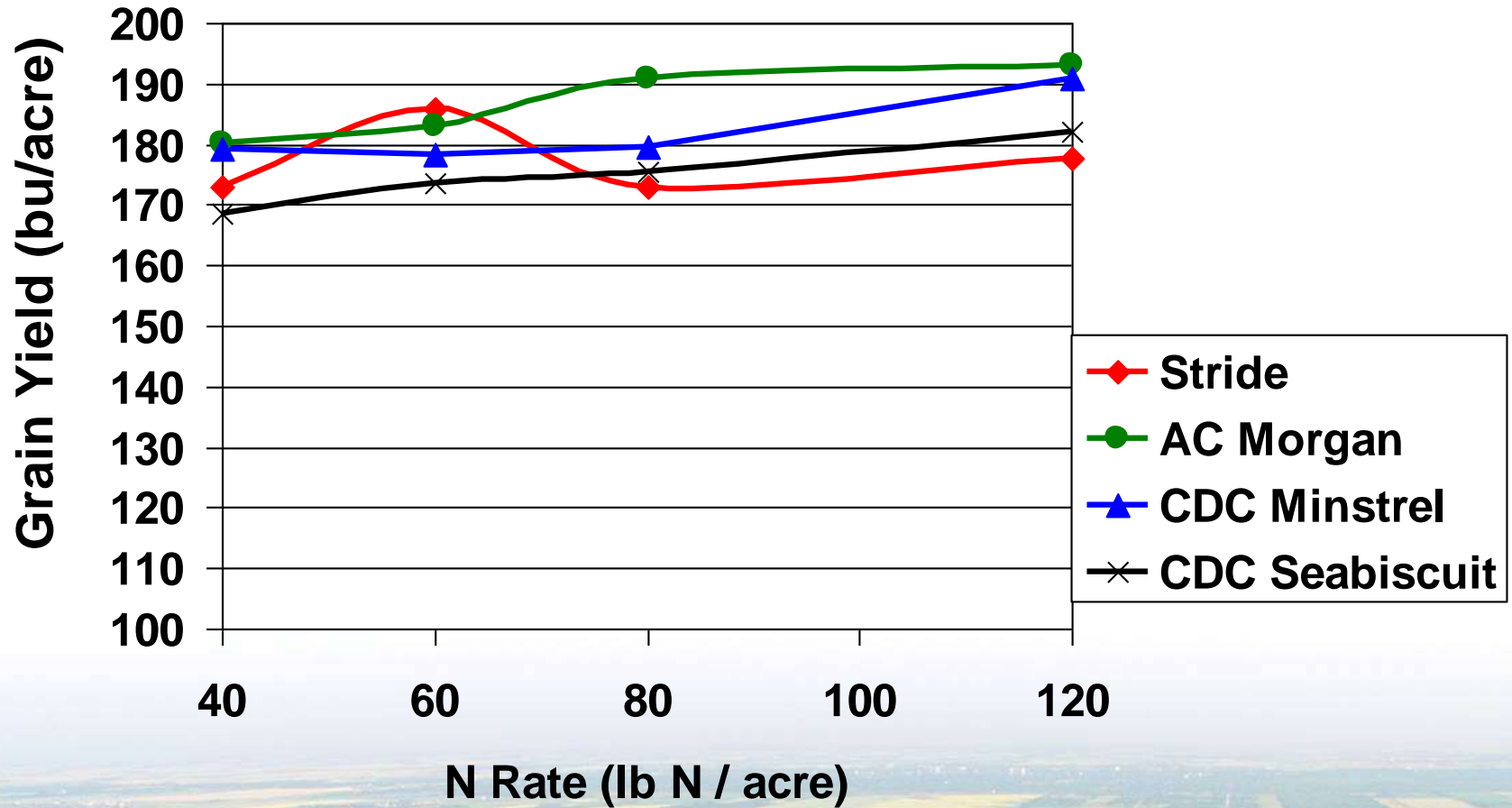




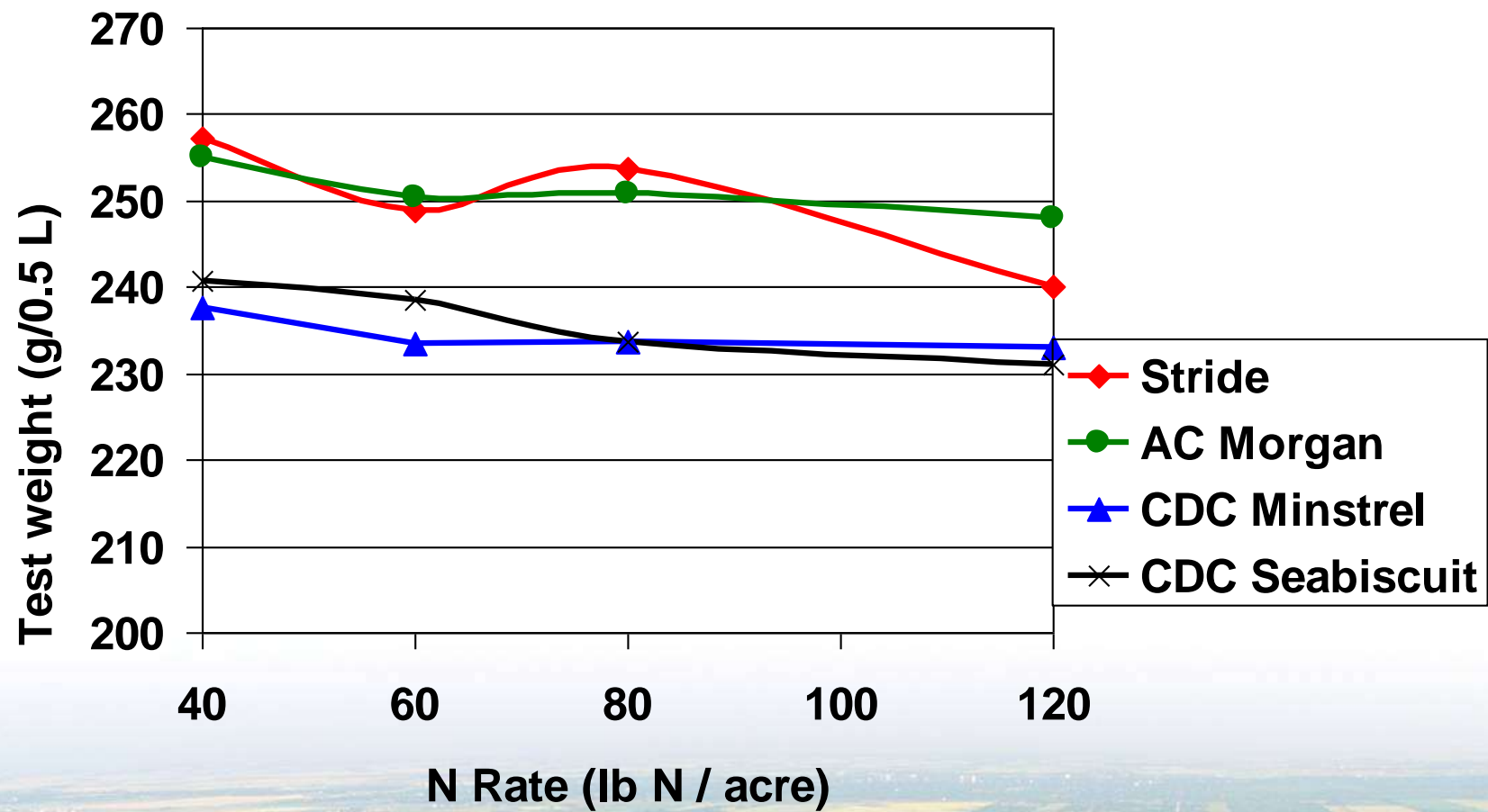
# Nitrogen x Cultivar at Melfort in 2015



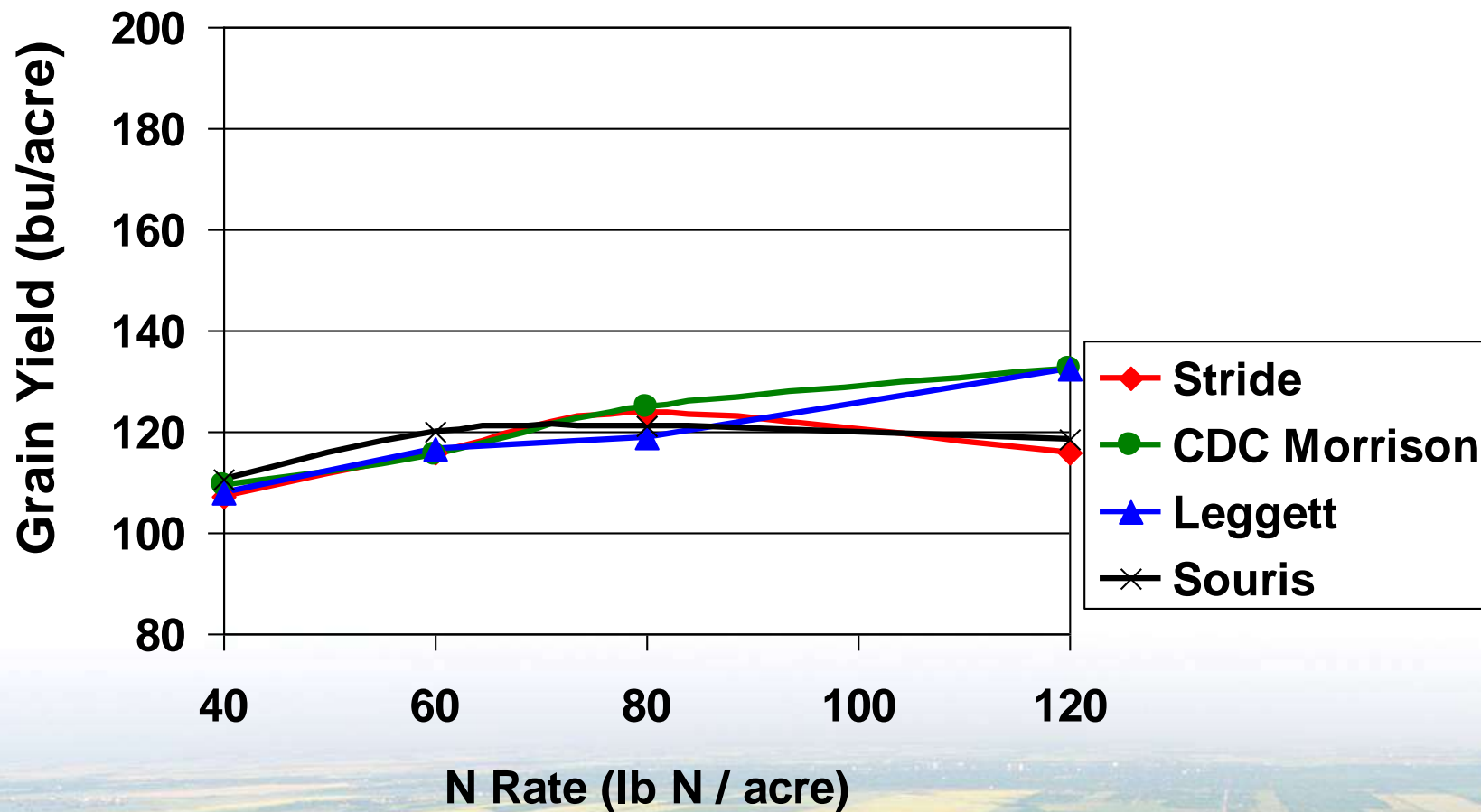
# Nitrogen x Cultivar at Melfort in 2016



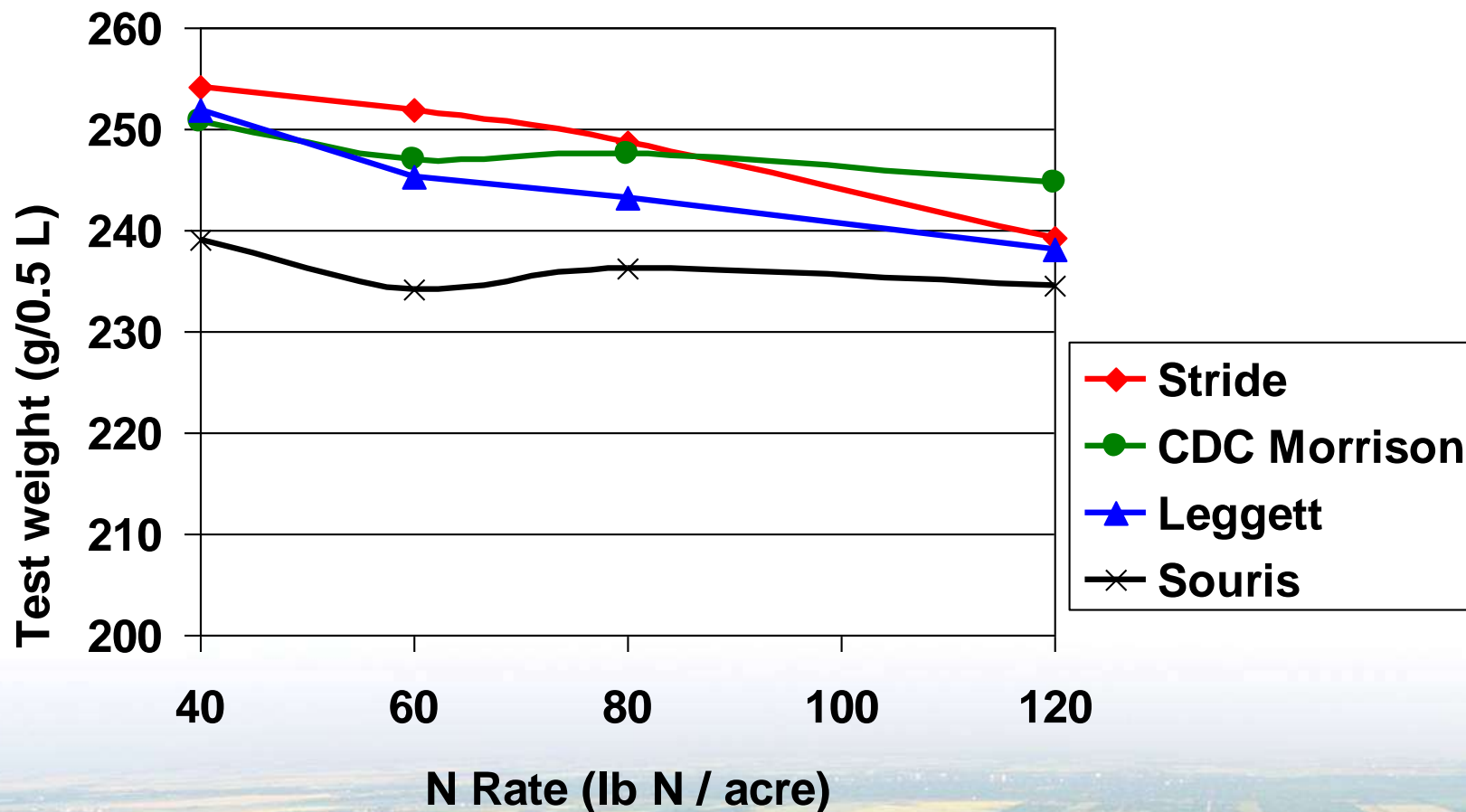
# Nitrogen x Cultivar at Melfort in 2016



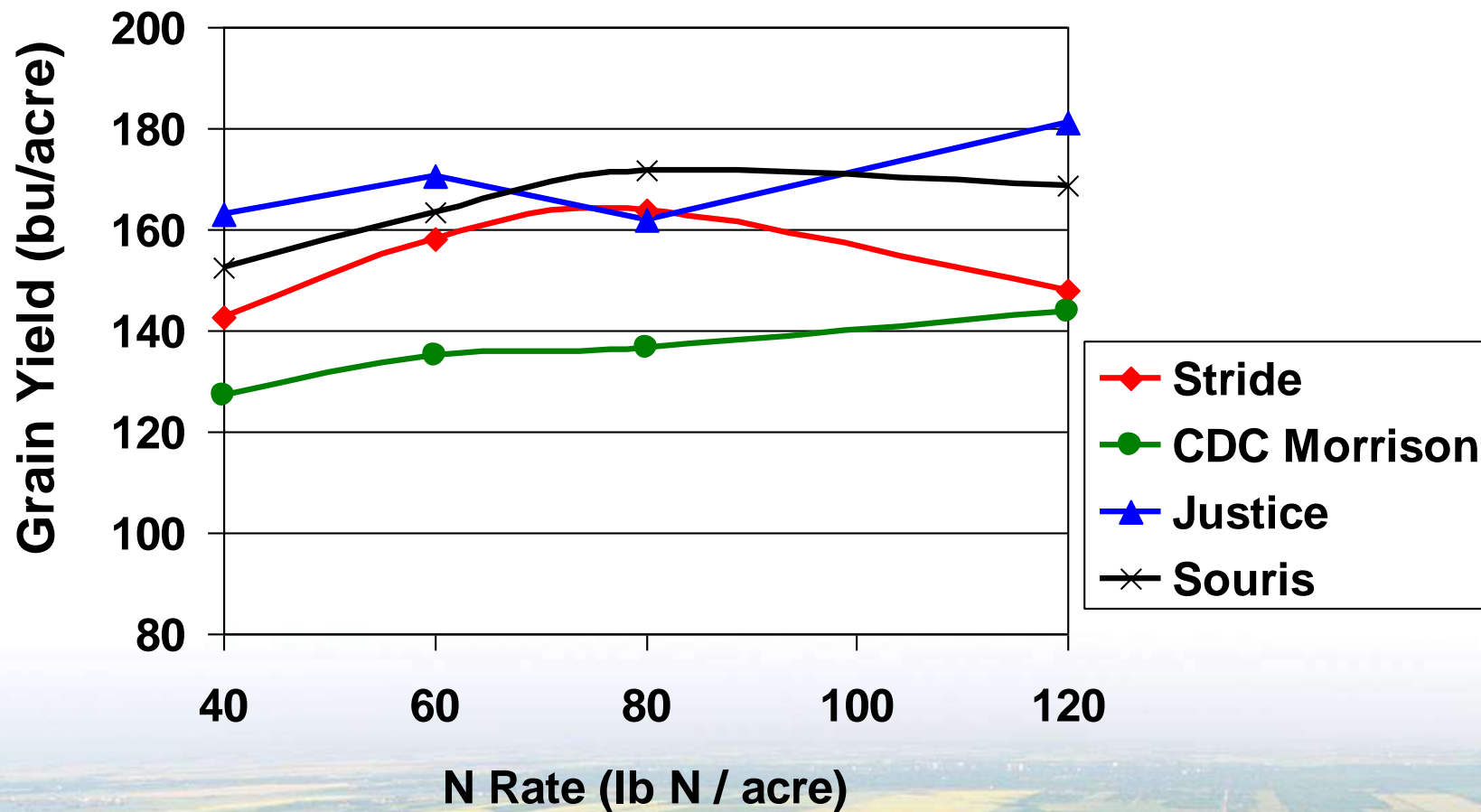
# Nitrogen x Cultivar at Redvers in 2015



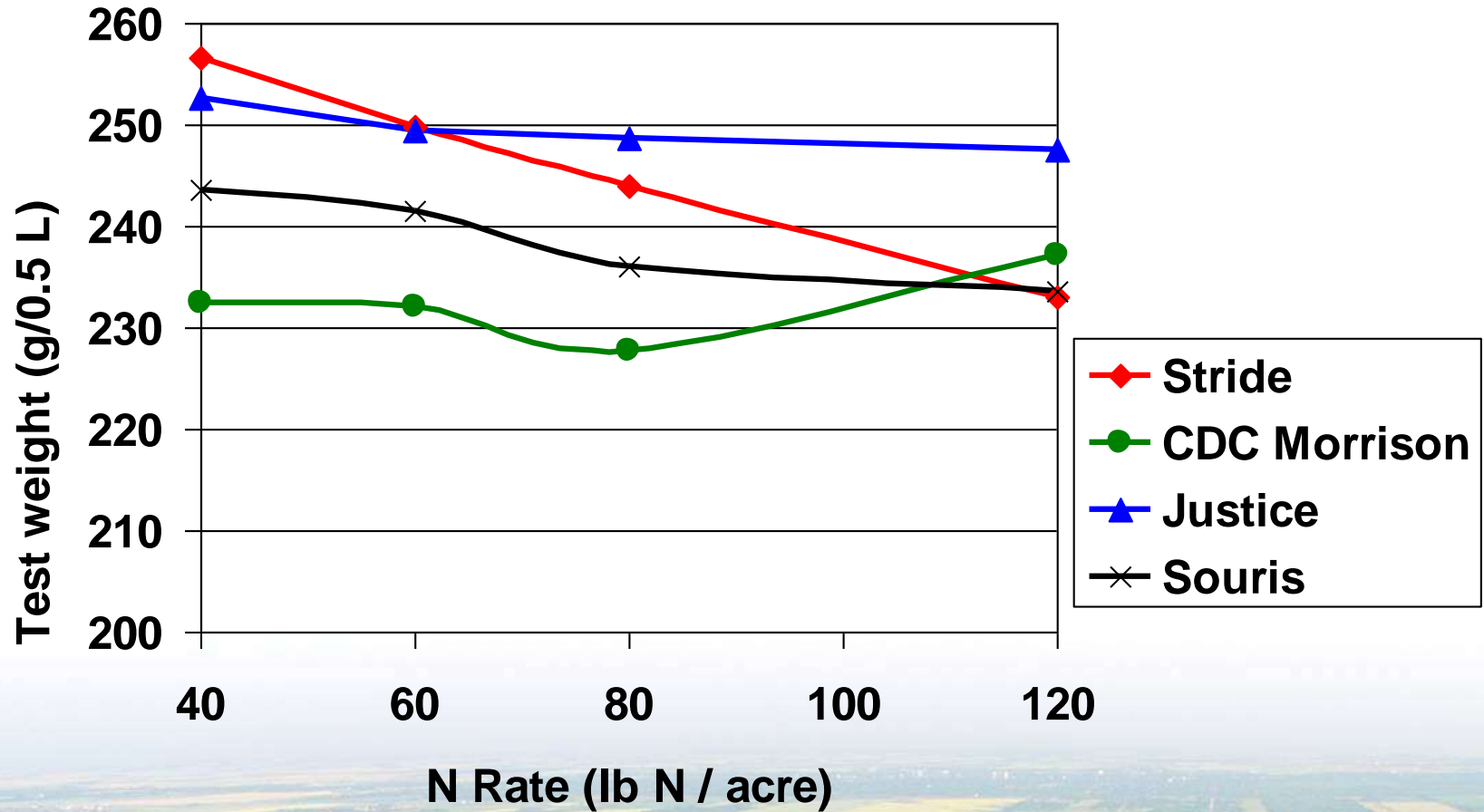
# Nitrogen x Cultivar at Redvers in 2015



# Nitrogen x Cultivar at Redvers in 2016



# Nitrogen x Cultivar at Redvers in 2016



# Early Conclusions

**Rain in august stops test weight problems from occurring**

**N response was often not large**

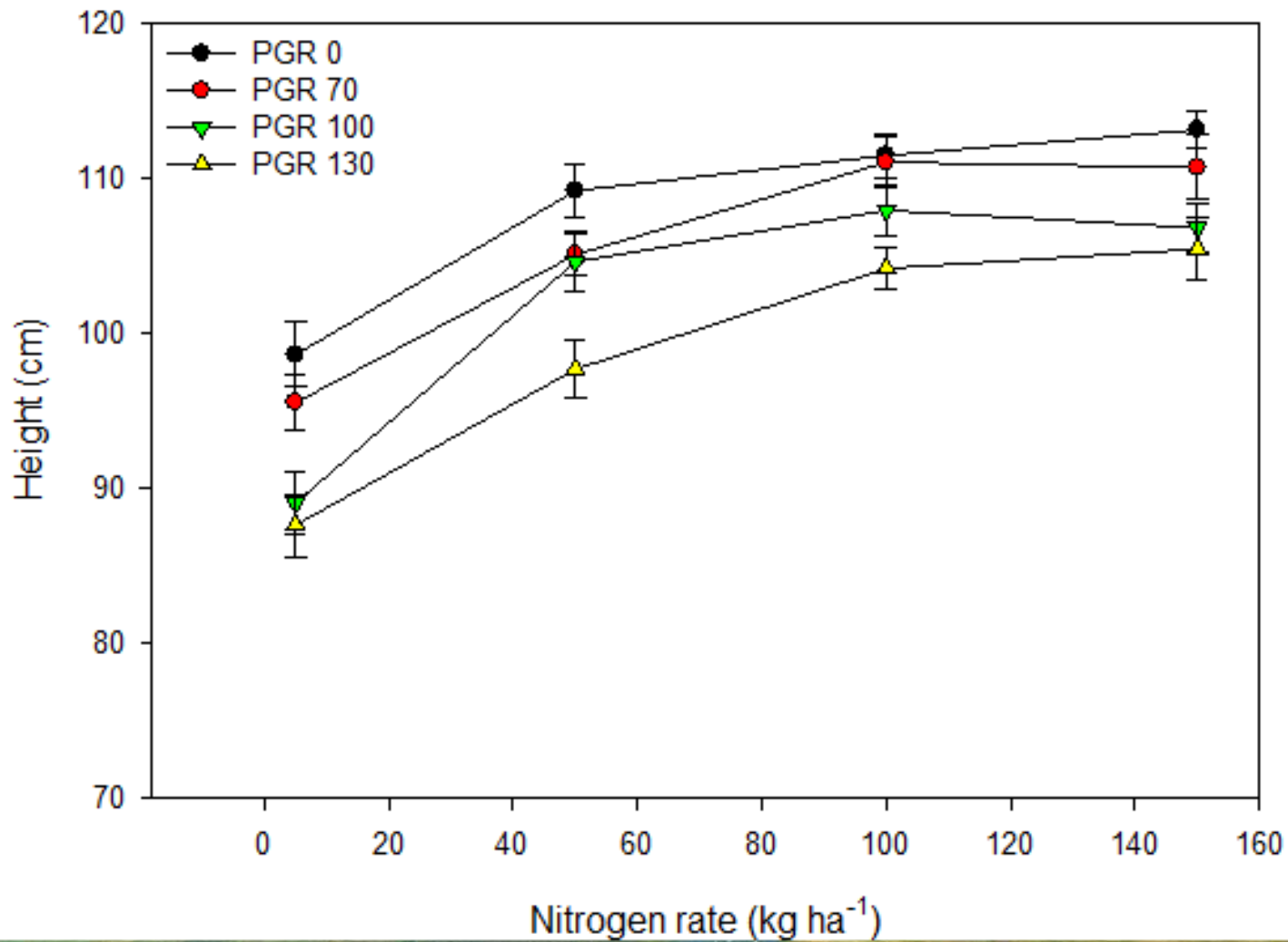
**Yield potential of Individual sites had a much larger impact**

**Need to complete study with analysis on probability of response to N**

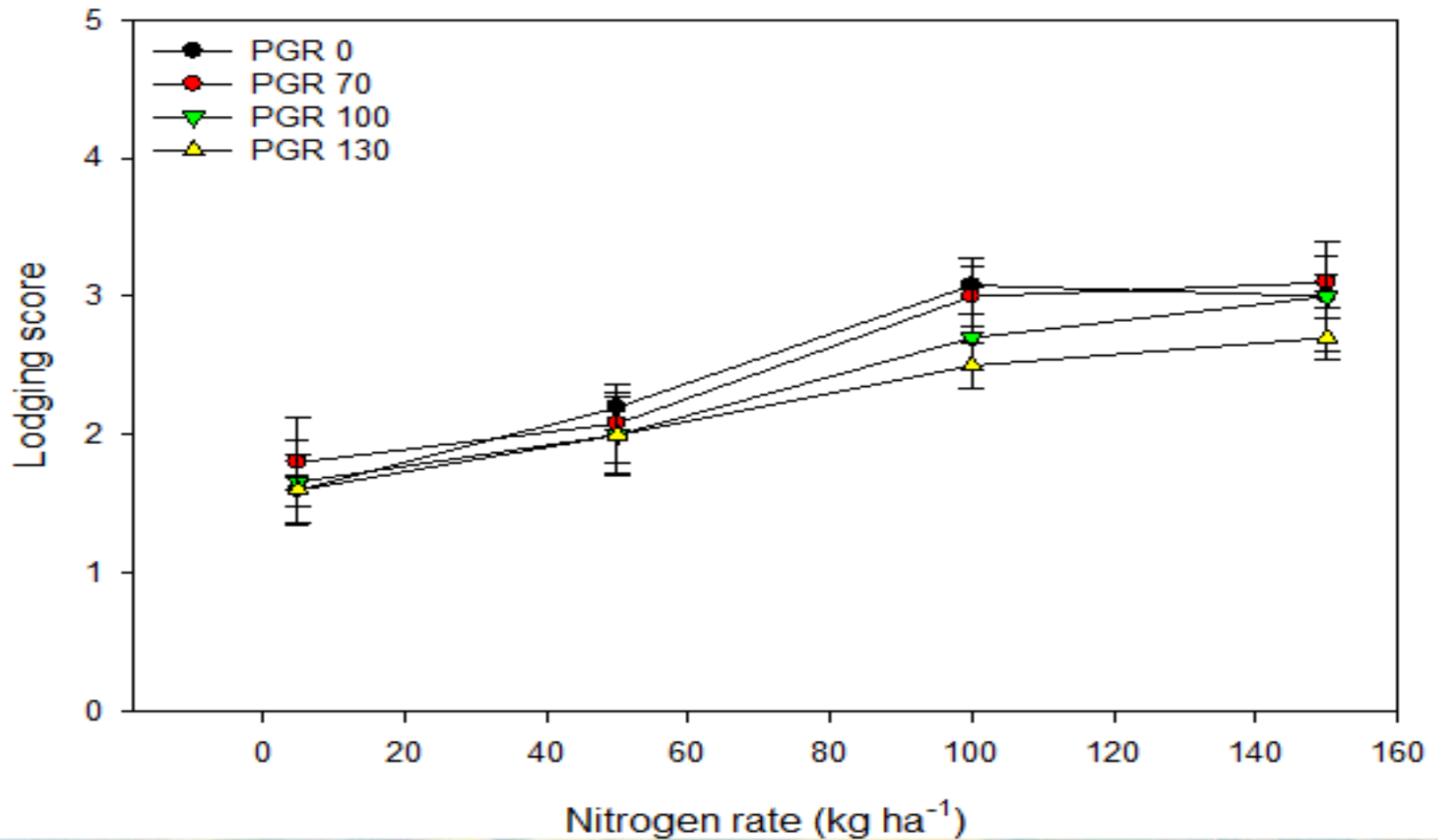




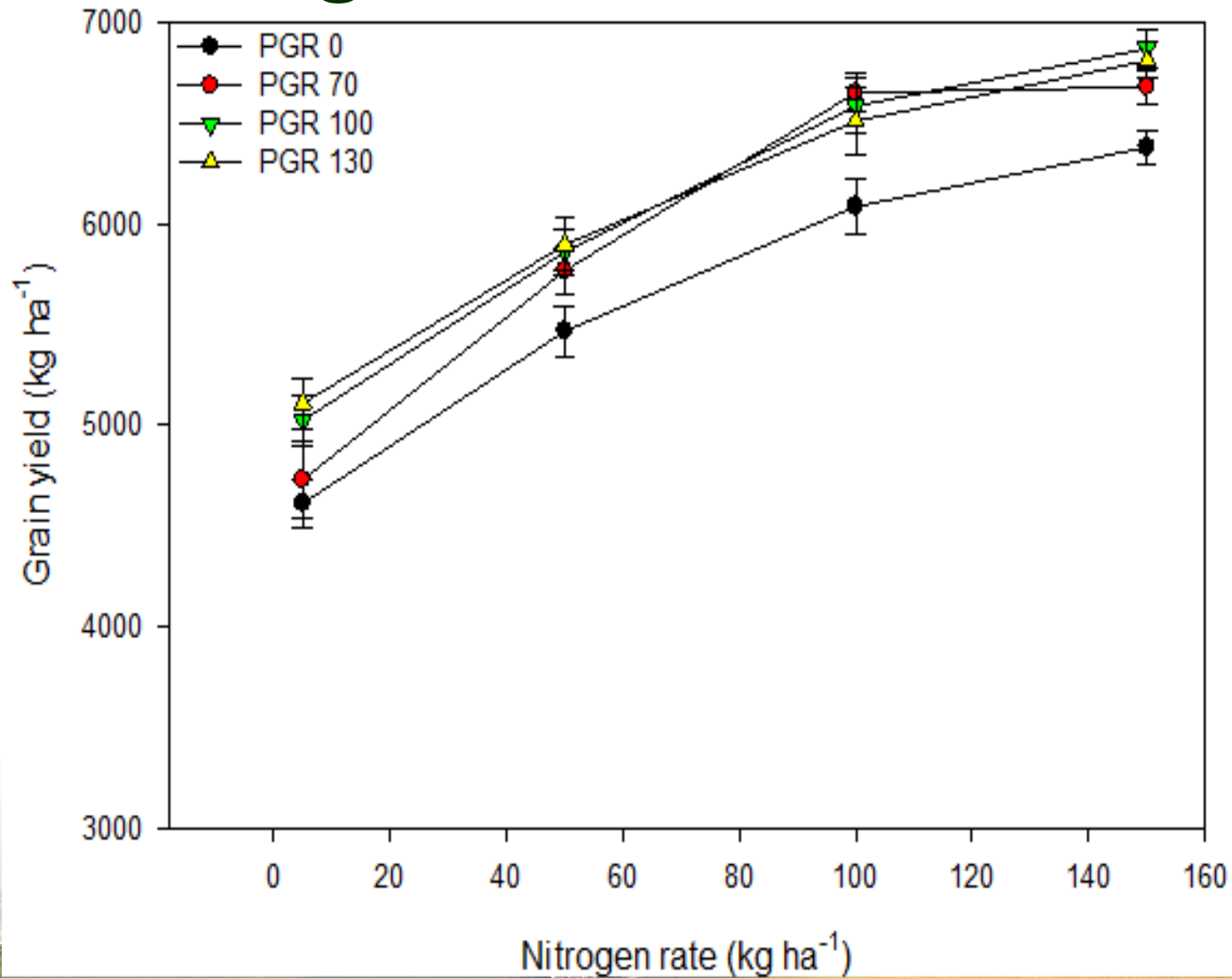
# Nitrogen x PGR Height in 2016



# Nitrogen x PGR Lodging in 2016



# Nitrogen x PGR Yield in 2016



# Barley PGR 2013

	<b>Plant Height</b>	<b>Lodging</b>	<b>Grain yield</b>	<b>Test Wt</b>
	<b>cm</b>	<b>Belgian</b>	<b>Bu/ac</b>	<b>g/0.5 L</b>
<b>none</b>	<b>87.88 a</b>	<b>0.81 a</b>	<b>89.02 a</b>	<b>335.8 a</b>
<b>Chlormequat</b>	<b>85.78 a</b>	<b>0.45 a</b>	<b>91.95 a</b>	<b>336.6 a</b>
<b>Ethephon</b>	<b>82.00 b</b>	<b>0.21 a</b>	<b>90.95 a</b>	<b>330.9 b</b>



# Barley PGR 2014

	Height	Lodging	Grain yield	Test weight
		Belgian		
	cm	Scale	bu/ac	g/0.5 L
none	87.71 a	1.19 a	61.27 a	303.53 a
Ethephon	73.96 c	0.20 b	58.40 b	301.52 a
Chlormequat	85.67 a	0.57 ab	61.75 a	302.21 a
Trinexapec	82.83 b	0.31 b	61.95 a	302.01 a



# Barley PGR 2015

	Height	Lodging	Grain yield	Test weight
		Belgian		
	cm	Scale	bu/ac	g/0.5 L
none	78 a	0.3 a	99 a	316 a
Ethephon	73 bc	0.2 a	98 a	309 b
Chlormequat	76 ab	0.3 a	100 a	316 a
Trinexapec	71 c	0.2 a	100 a	308 b



# Barley PGR 2016

	Height	Lodging	Grain yield	Test weight
		Belgian		
	cm	Scale	bu/ac	g/0.5 L
none	87.9 a	0.2 a	79.2 b	318.7 a
Ethephon	84.38 a	0.2 a	85.5 a	315.2 b
Chlormequat	90.48 a	0.2 a	82.8 a	317.3 ab
Trinexapec	86.81 a	0.2 a	83.9 a	317.0 ab

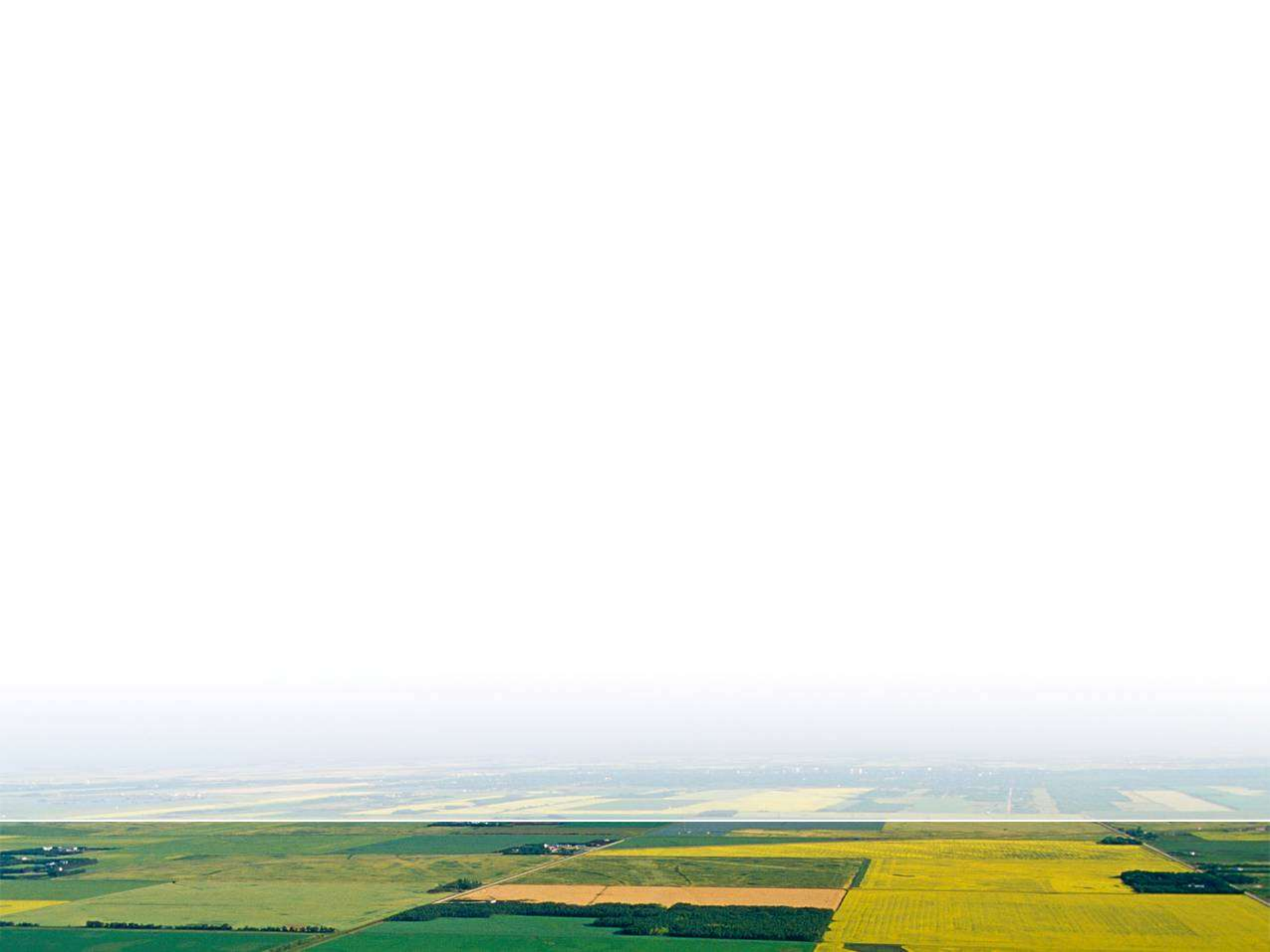


# Preliminary Conclusions

- Lack of lodging a real problem
- In the absence of lodging no benefit to PGR
- It will be interesting to see how much lodging occurred at other sites over the four years







# Crop Sequencing of Large acreage crops and special crops

- **First year** – all eight crops are seeded in strips
- **Second year** – all eight crops are seeded across the strips set up in the first year
- **Crops:**
  - 1) Wheat
  - 2) Oat
  - 3) Canola
  - 4) Pea
  - 5) Canaryseed
  - 6) Hemp
  - 7) Quinoa
  - 8) Coriander



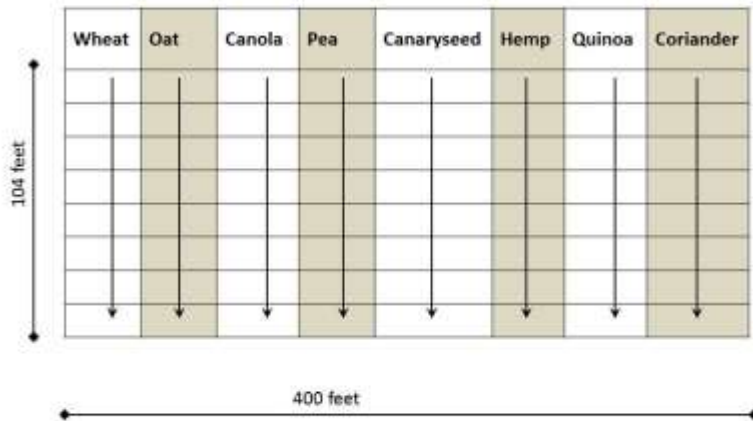
# Crop Sequencing of Large acreage crops and special crops

- **First year** – 2015, 2016, 2017
- **Second year** – 2016, 2017, 2018
- **Locations:**
  - 1) Swift Current
  - 2) Saskatoon
  - 3) Indian Head
  - 4) Melfort

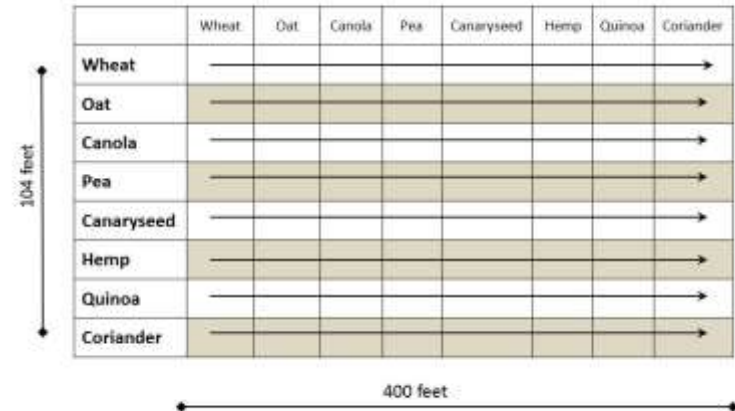


# Crop Sequencing of Large acreage crops and special crops

Year A Replicate 1



Year B Replicate 1



# Crop Sequencing of Large acreage crops and special crops

## Funding

- 1) Government of Saskatchewan
- 2) Saskatchewan Wheat Development Commission
- 3) Western Grains Research Foundation
- 4) Canaryseed Development Commission of Saskatchewan
- 5) Prairie Oat Growers Association



