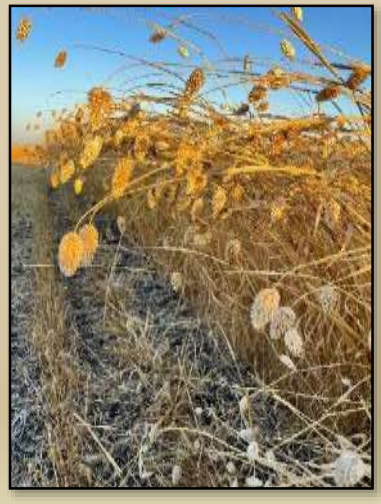
2022 IHARF Agronomy Update

Chris Holzapfel, MSc PAg



IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

Presentation Overview

1. **Lentil Response to Fertilizer Applications & Granular Inoculant** (multi-location, 2021-22)
2. **Lentil Response to Seeding Rate & Foliar Fungicide Applications** (multi-location, 2021-22)
3. **Canola Seed Safety & Yield Response to Various Phosphorus Forms** (multi-location, 2020-22)
4. **4R Nitrogen Management in Spring Wheat** (2017-22)
5. **Split-Nitrogen Applications to Manage Drought Risk in Spring Wheat** (multi-location, 2021-22)

Lentil Response to Fertilizer Applications & Rhizobial Inoculation (2021-22)

Lentil Response to Fertilizer Applications & Rhizobial Inoculation (2020-21)

Objectives: To demonstrate lentil response to a range of fertility treatments that focus on phosphorus fertilizer rate, rhizobial inoculation, & N fertilization strategies.

Locations: Indian Head, Scott, and Swift Current (2021 and 2022)

Treatments:

#	P rate	Inoculant	Extra N Fertilizer
1	0 lb P_2O_5/ac	No	None
2	0 lb P_2O_5/ac	Yes	None
3	20 lb P_2O_5/ac	No	None
4	20 lb P_2O_5/ac	Yes	None
5	40 lb P_2O_5/ac	No	None
6	40 lb P_2O_5/ac	Yes	None
7	40 lb P_2O_5/ac	No	50 lb N/ac sideband
8	40 lb P_2O_5/ac	No	50 lb N/ac in-season broadcast
9	40 lb P_2O_5/ac	Yes	50 lb N/ac sideband
10	40 lb P_2O_5/ac	Yes	50 lb N/ac in-season broadcast
11	60 lb P_2O_5/ac	Yes	None
12	60 lb P_2O_5/ac	Yes	50 lb N/ac sideband

Data Collection:

1) Emergence
2) Seed Yield
3) Test Weight
4) Seed Weight
5) Seed Protein

Basic Soil & Weather Information

Depth	pH	SOM (%)	CEC (meq/100g)	NO_3-N (lb/ac)	Olsen-P (ppm)
---------- Indian Head 2021 ----------					
0-6”	8.1	4.9	46.7	7	2
6-24”	8.3	–	–	12	–
---------- Indian Head 2022 ----------					
0-6”	8.1	4.7	52.0	11	4
6-24”	8.3	–	–	34	–
---------- Scott 2022 ----------					
0-6”	5.8	4.2	13.3	17	8
6-24”	7.7	–	–	22	–
---------- Swift Current 2022 ----------					
0-6”	6.1	2.7	19.2	10	15
6-24”	8.1	–	–	20	–

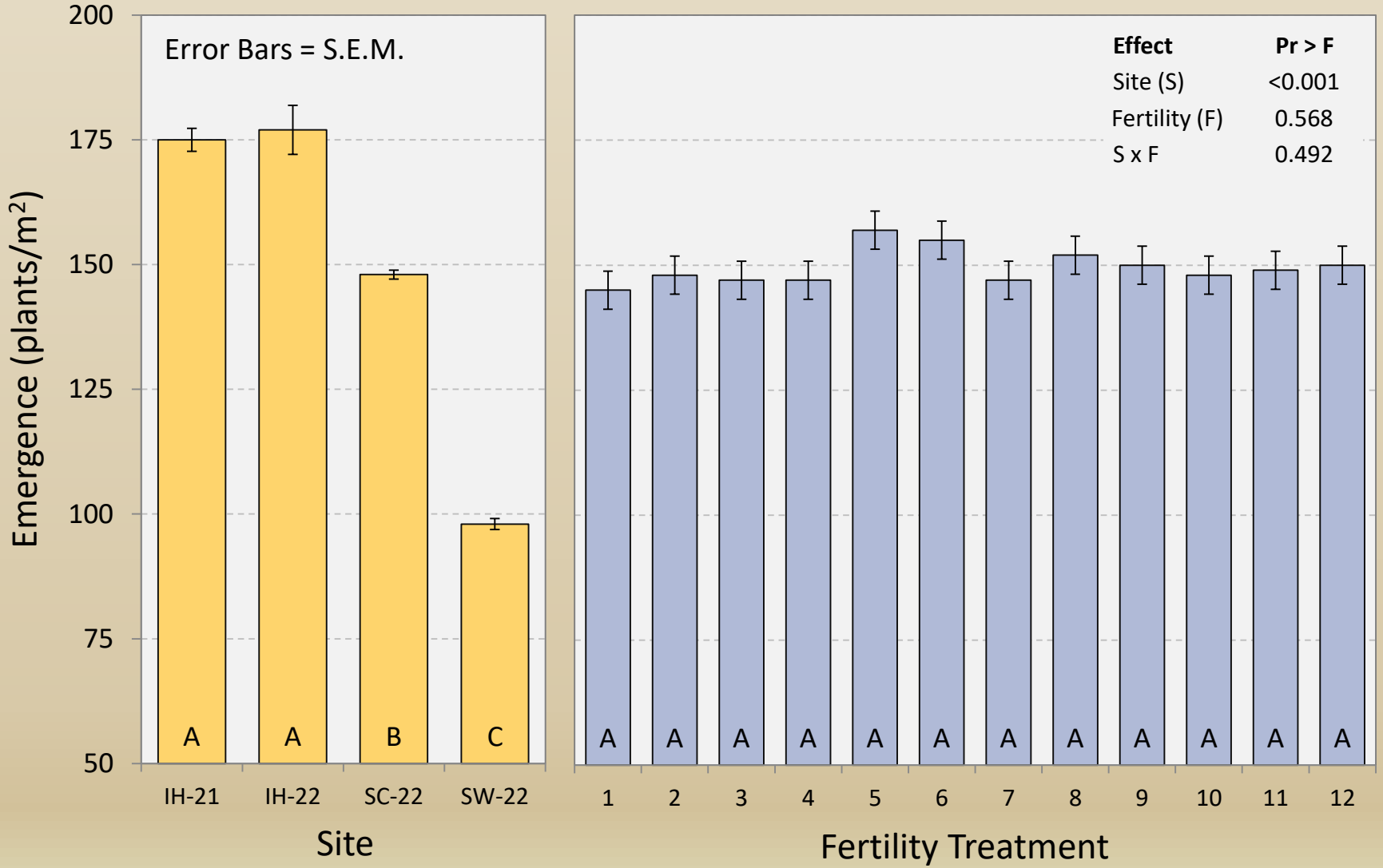
Indian Head – 2021:
- Dry, warm
- Low yields

Indian Head – 2022:
- Wet, normal temps
- High yields

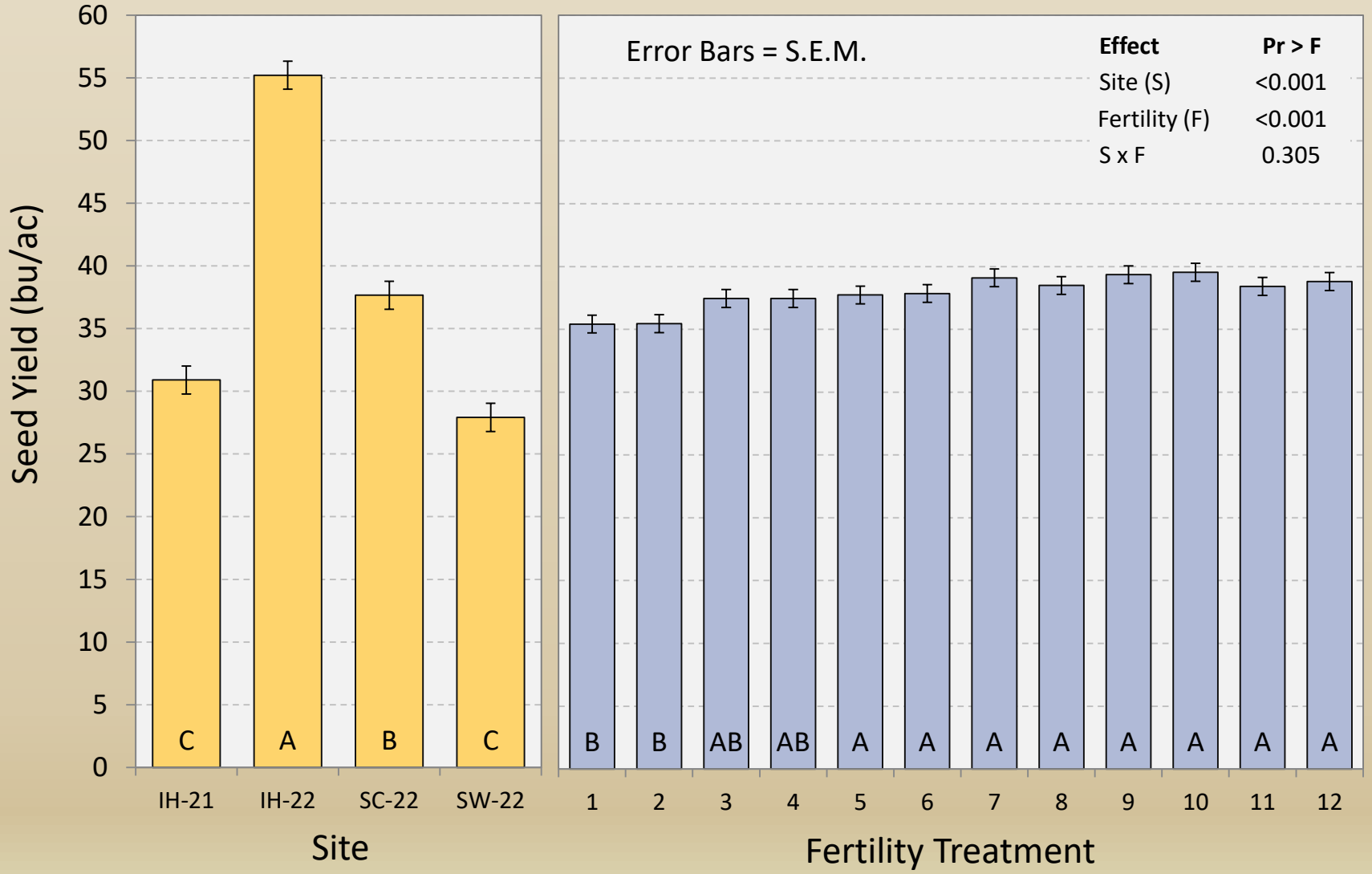
Scott – 2022:
- Dry, hot
- Average yields

Swift Current – 2022:
- Dry, hot
- Low yields

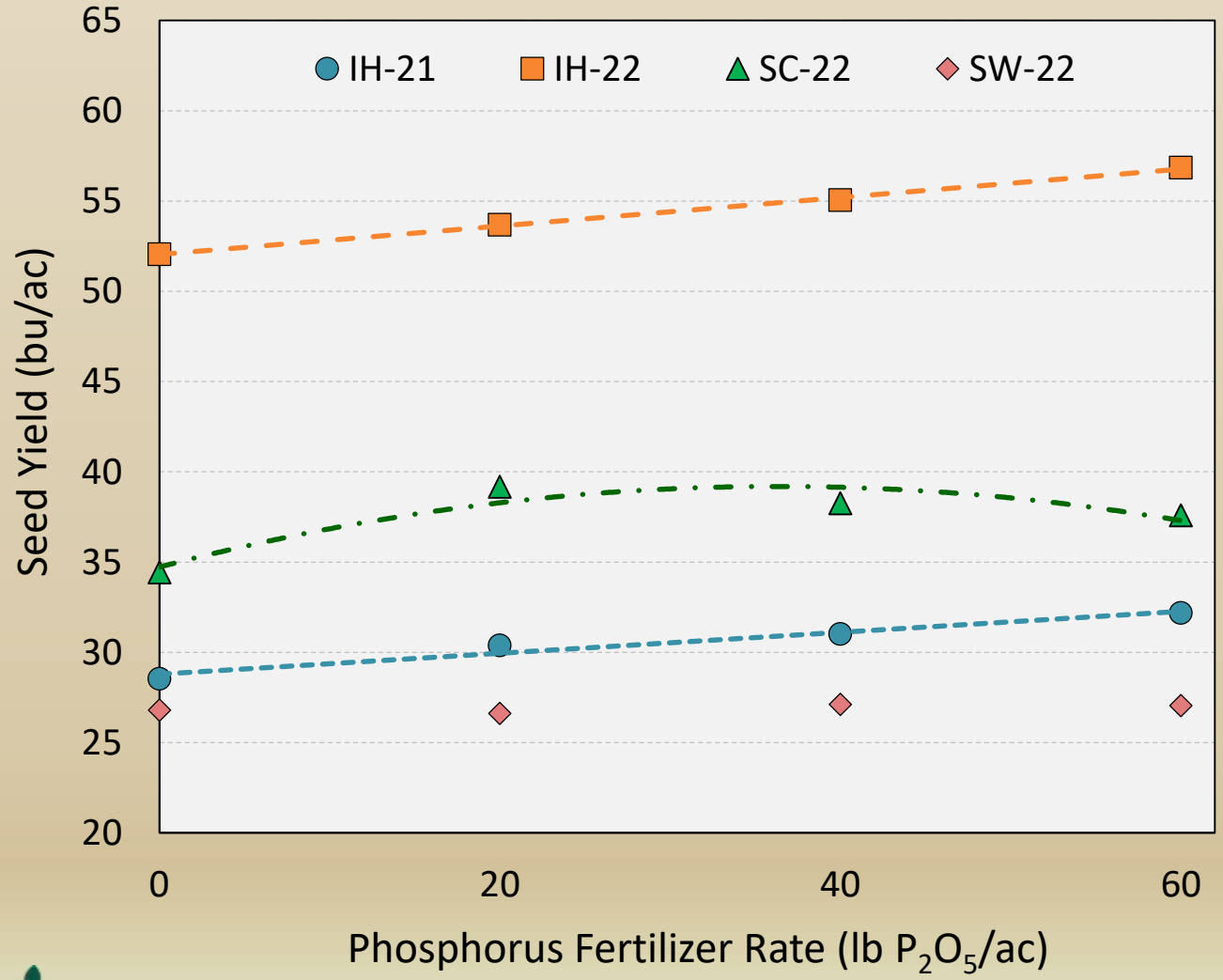
Site & Fertility Effects on Lentil Emergence



Site & Fertility Effects on Lentil Seed Yield

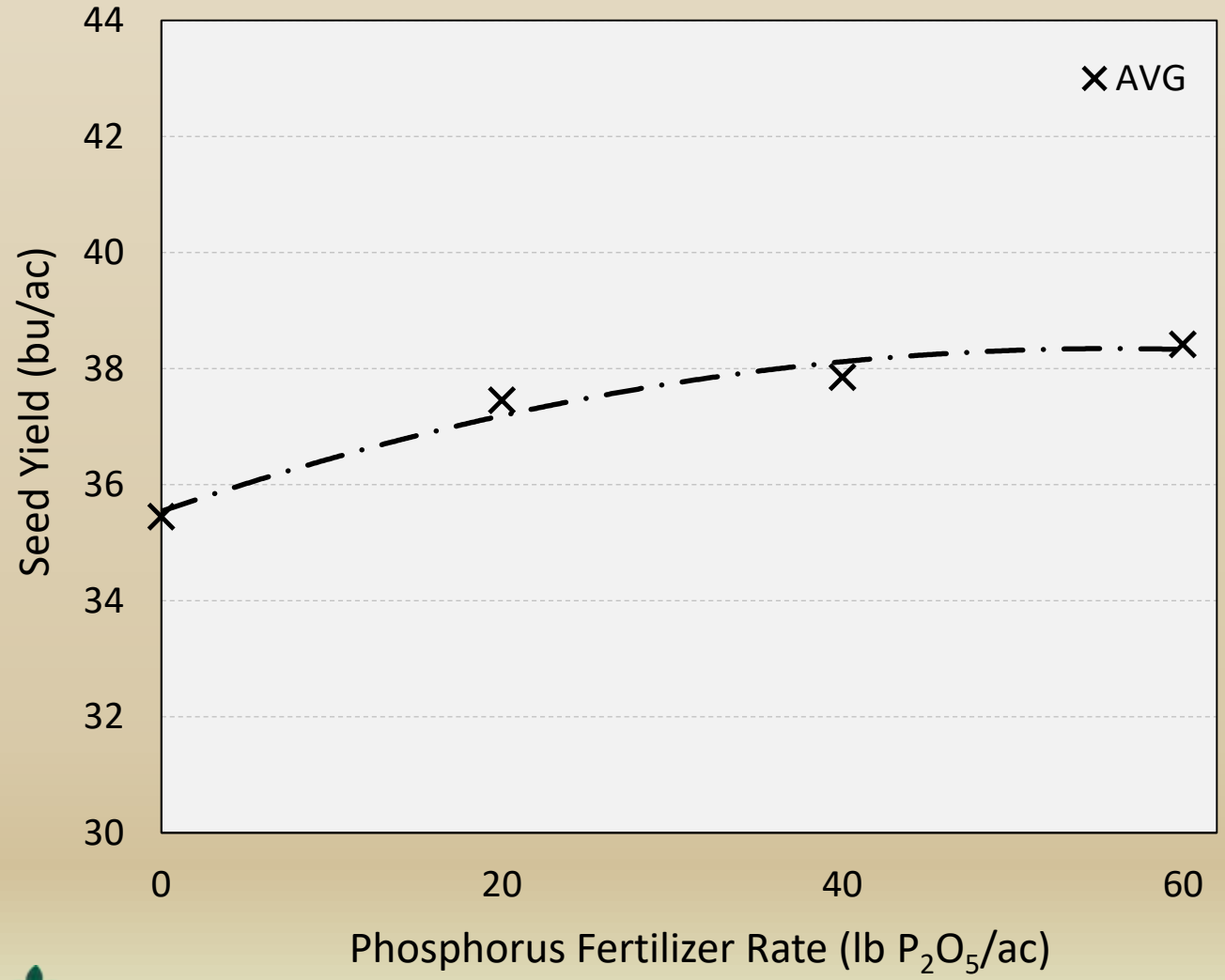


Lentil Seed Yield Response to Phosphorus Rate at Individual Sites



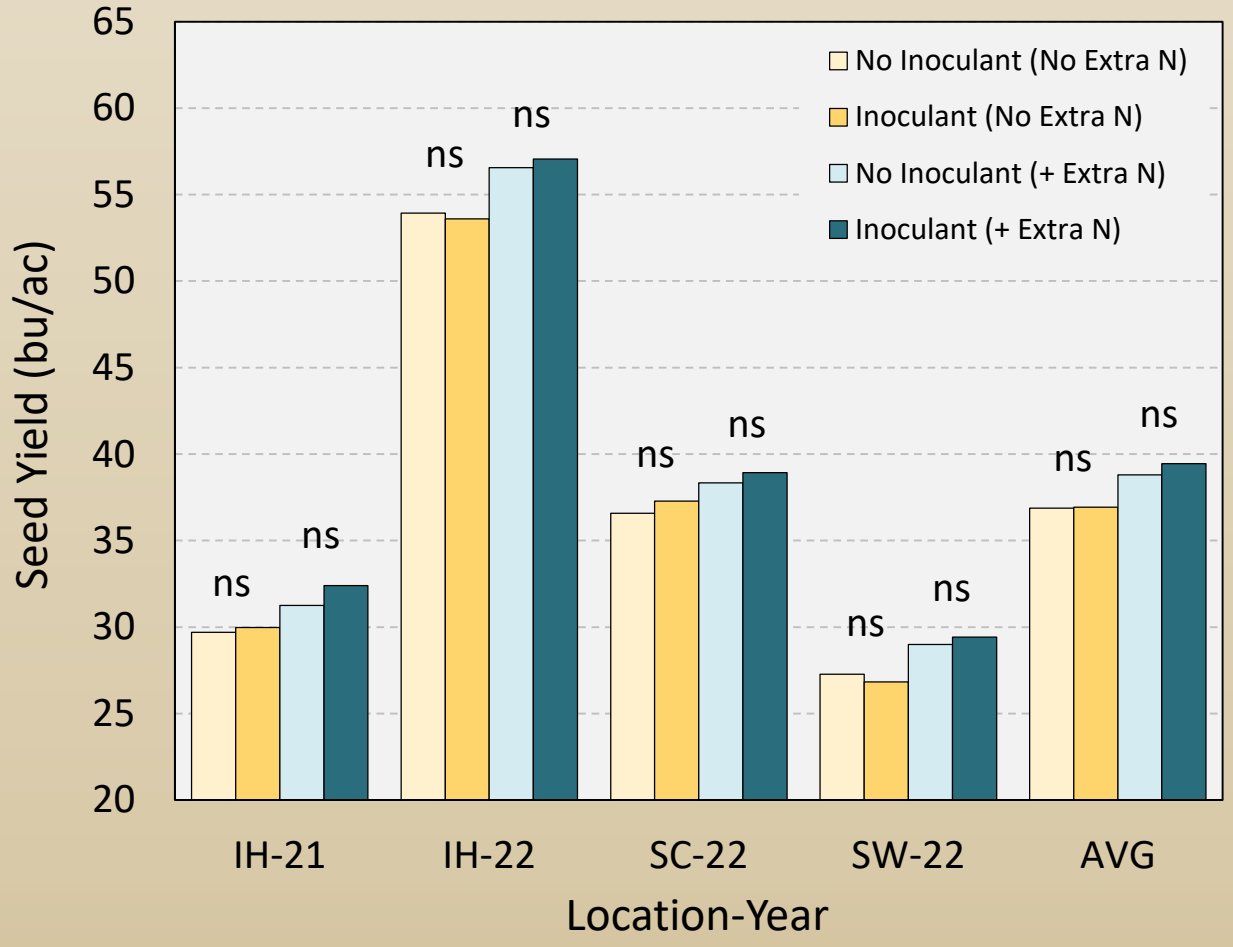
Contrast	Pr > F
IH-21 linear	0.005
IH-21 quadratic	0.705
IH-22 linear	<0.001
IH-22 quadratic	0.925
SC-22 linear	0.038
SC-22 quadratic	0.004
SW-22 linear	0.764
SW-22 quadratic	0.956

Lentil Seed Yield Response to Phosphorus Rate (Four Site Average)



Contrast	Pr > F
IH-21 linear	**<0.001**
IH-21 quadratic	0.114

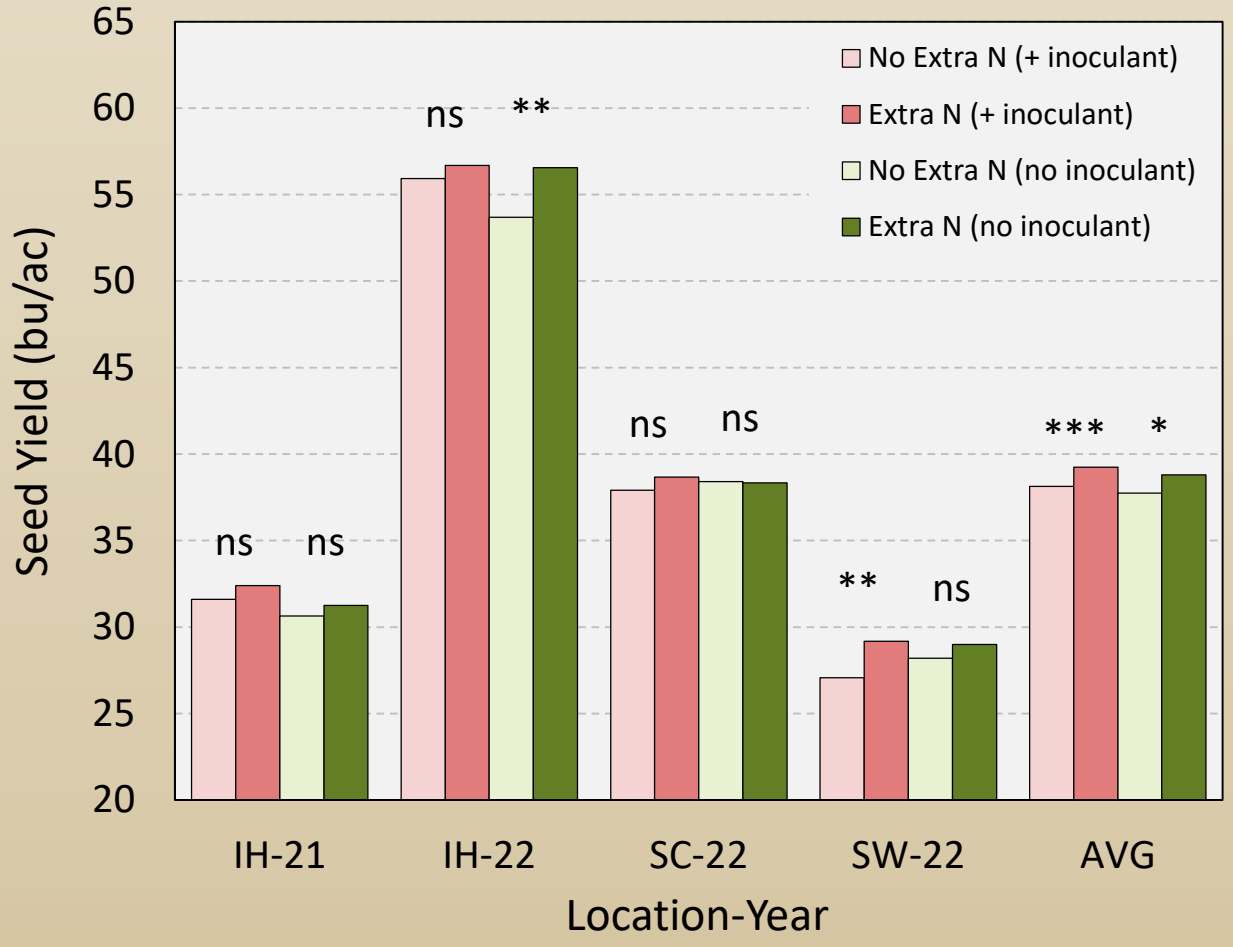
Inoculant Effects on Lentil Seed Yield



Inoculant Contrast	Pr > F
IH-21 (no extra N)	0.701
IH-21 (+ extra N)	0.217
IH-22 (no extra N)	0.645
IH-22 (+ extra N)	0.589
SC-22 (no extra N)	0.348
SC-22 (+ extra N)	0.534
SW-22 (no extra N)	0.556
SW-22 (+ extra N)	0.649
AVG (no extra N)	0.891
AVG (+ extra N)	0.155

IMPORTANT: The means presented in this figure cannot be used to compare lentil yields with & without extra N fertilizer

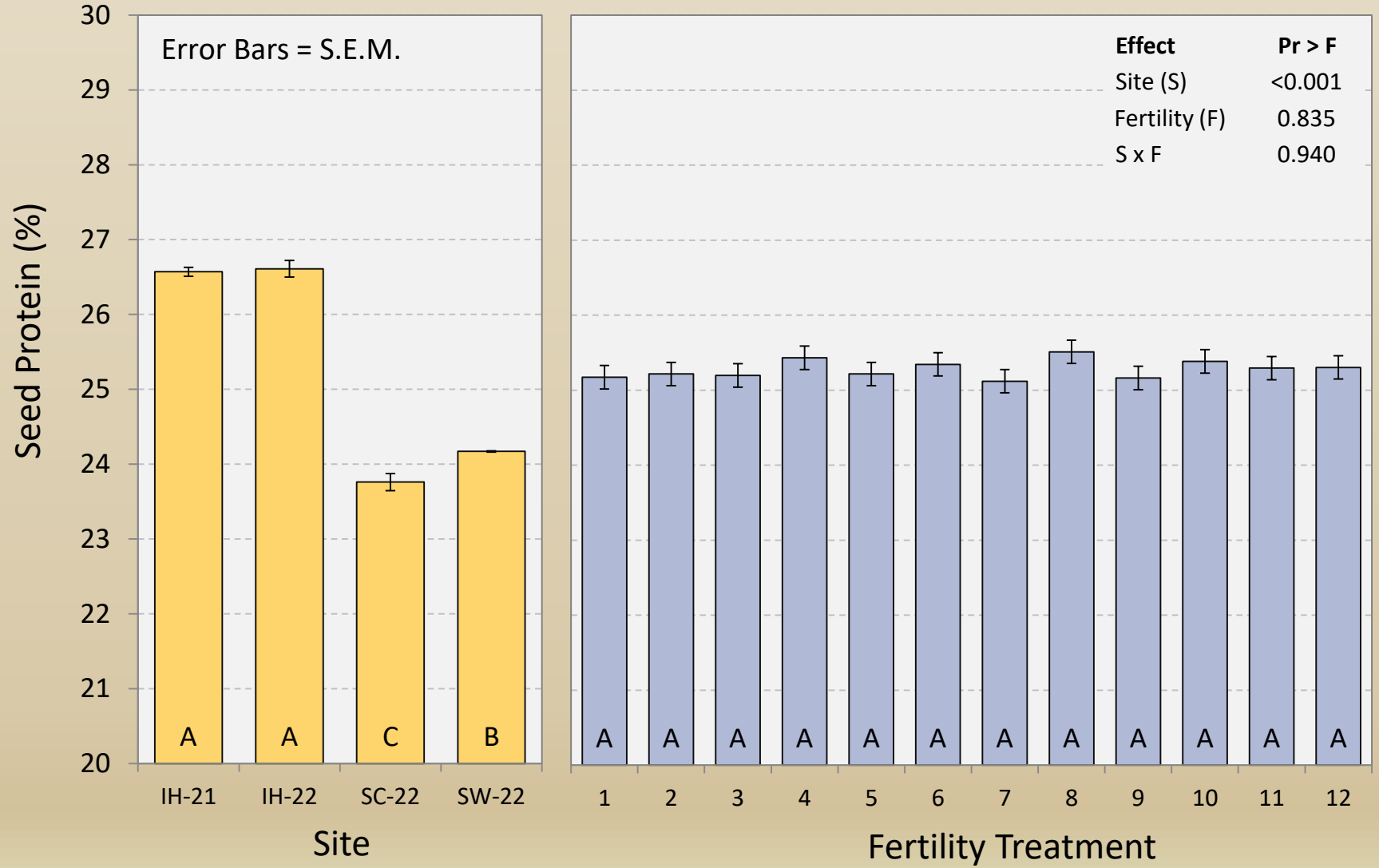
Nitrogen Effects on Lentil Seed Yield



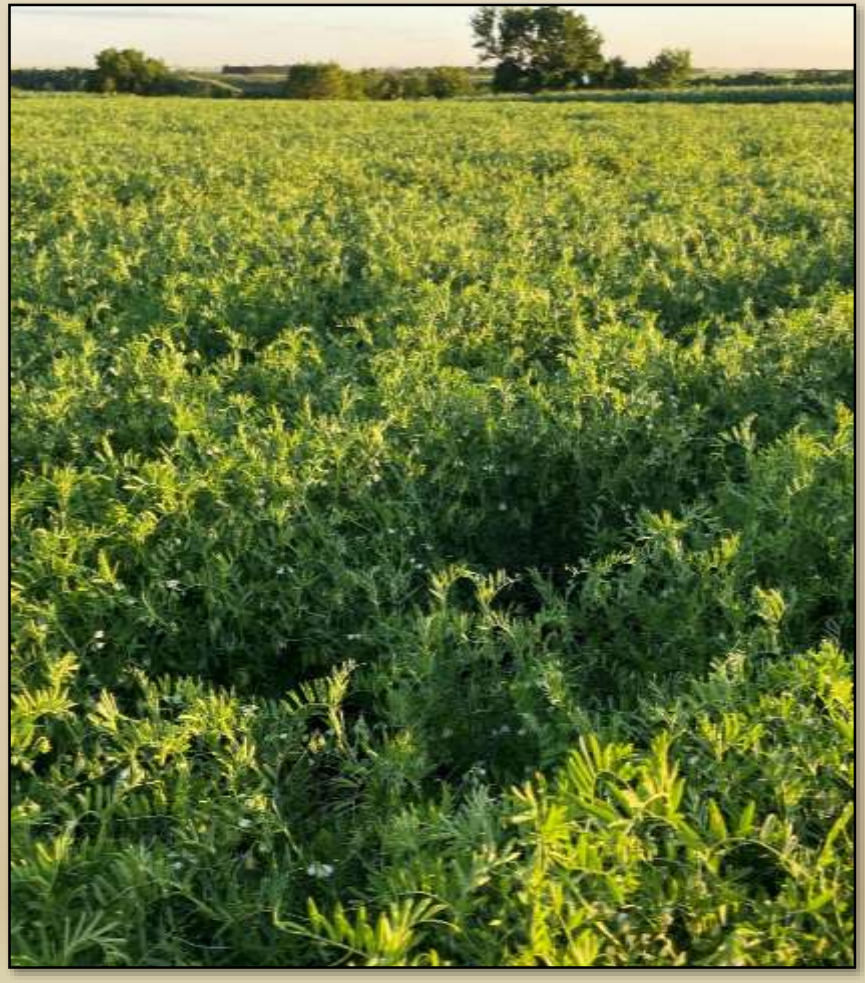
Extra N Contrast	Pr > F
IH-21 (+ Inoculant)	0.253
IH-21 (no inoculant)	0.576
IH-22 (+ inoculant)	0.229
IH-22 (no inoculant)	0.012
SC-22 (+ inoculant)	0.459
SC-22 (no inoculant)	0.962
SW-22 (+ inoculant)	0.017
SW-22 (no extra N)	0.472
AVG (+ inoculant)	0.007
AVG (no inoculant)	0.060

IMPORTANT: The means presented in this figure cannot be used to compare lentil yields with & without granular inoculant

Site & Fertility Effects on Lentil Seed Protein



Lentil Response to Varying Seeding Rates & Fungicide Applications (2021-22)



Lentil Response to Varying Seeding Rates & Fungicide Applications (2021-22)

Objectives: To demonstrate the effects of lentil seeding rates on competition with weeds, disease, yield, grain quality, & response to foliar fungicide applications.

Locations: Indian Head, Scott, & Swift Current (2021 & 2022)

Treatments:

Seeding Rates

1) 130 seeds/m^2
2) 190 seeds/m^2
3) 250 seeds/m^2

Foliar Fungicides

1) Control (no foliar fungicide)
2) 1x (160 ml/ac Dyax applied at early bloom)
3) 2x (160 ml/ac Dyax at early bloom followed by 170 g/ac Lance WDG applied ~14 days later

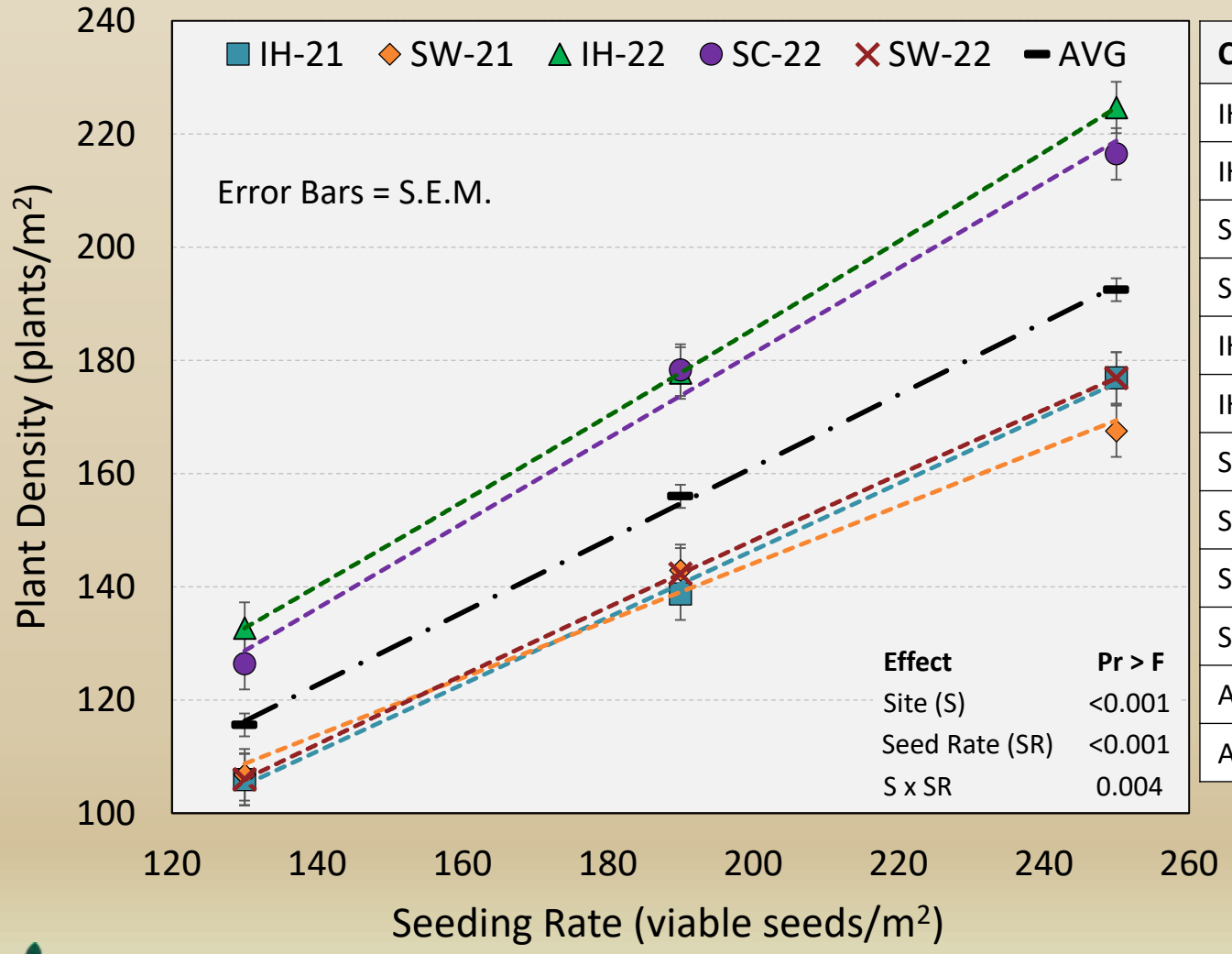
Data Collection:

1) Plant densities, disease ratings, weediness ratings, seed yield, test weight, & seed size

IHARF INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

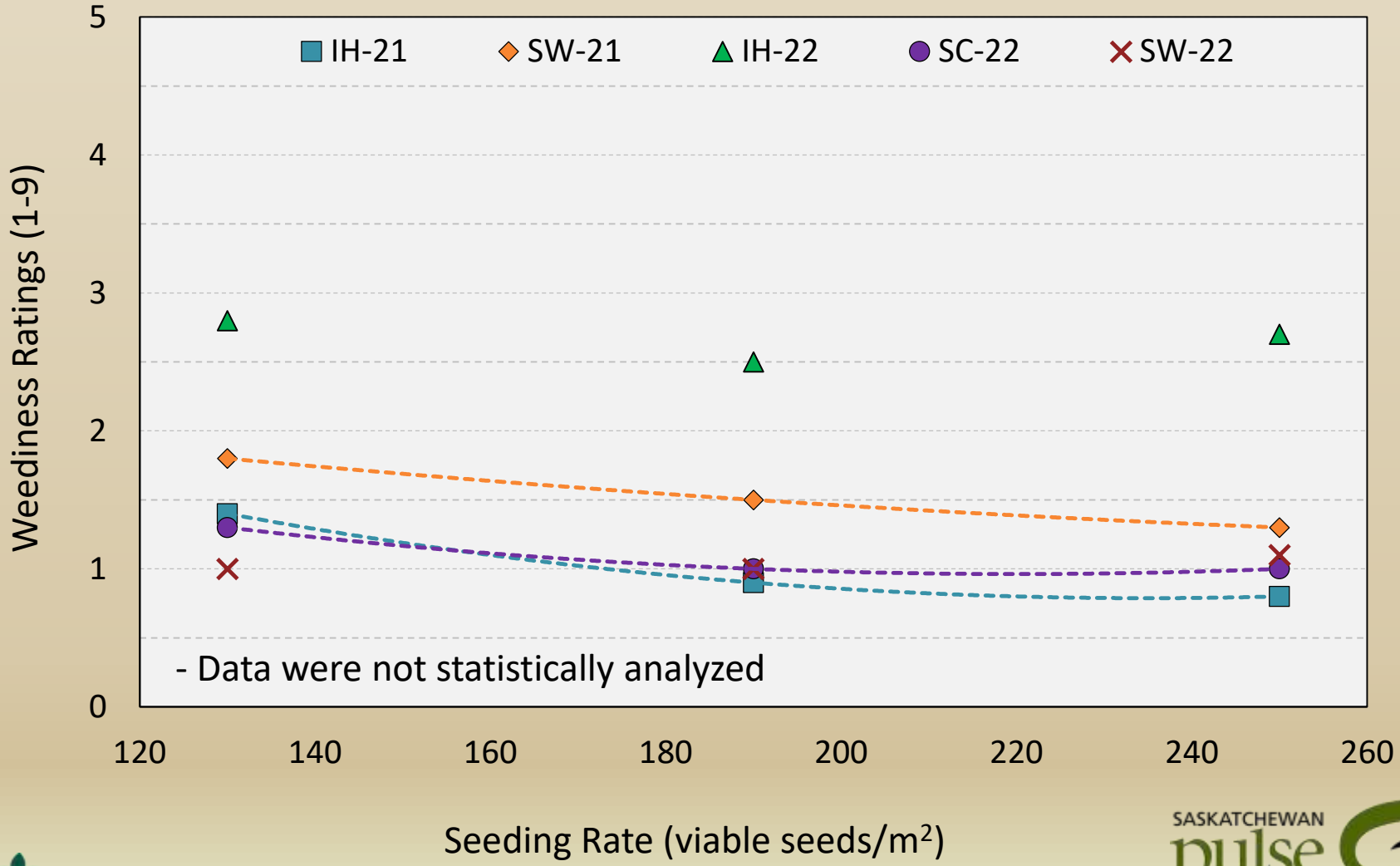
SASKATCHEWAN pulse Growers

Lentil Seeding Rate Effects on Plant Densities at Individual Sites & Across Sites

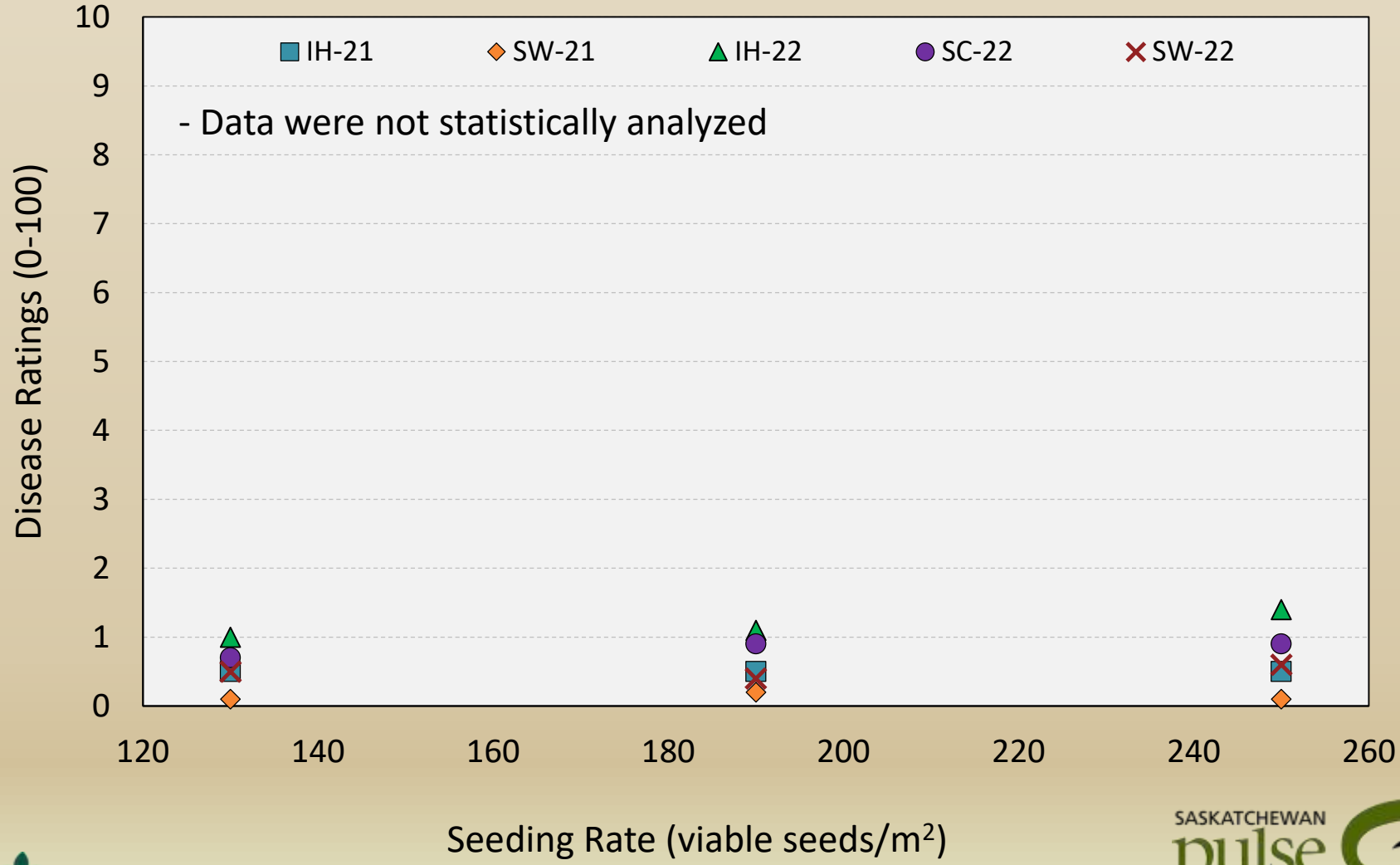


Contrast	Pr > F
IH-21 linear	<0.001
IH-21 quadratic	0.598
SC-22 linear	<0.001
SC-22 quadratic	0.264
IH-22 linear	<0.001
IH-22 quadratic	0.179
SC-22 linear	<0.001
SC-22 quadratic	0.179
SW-22 linear	<0.001
SW-22 quadratic	0.869
AVG linear	<0.001
AVG quadratic	0.391

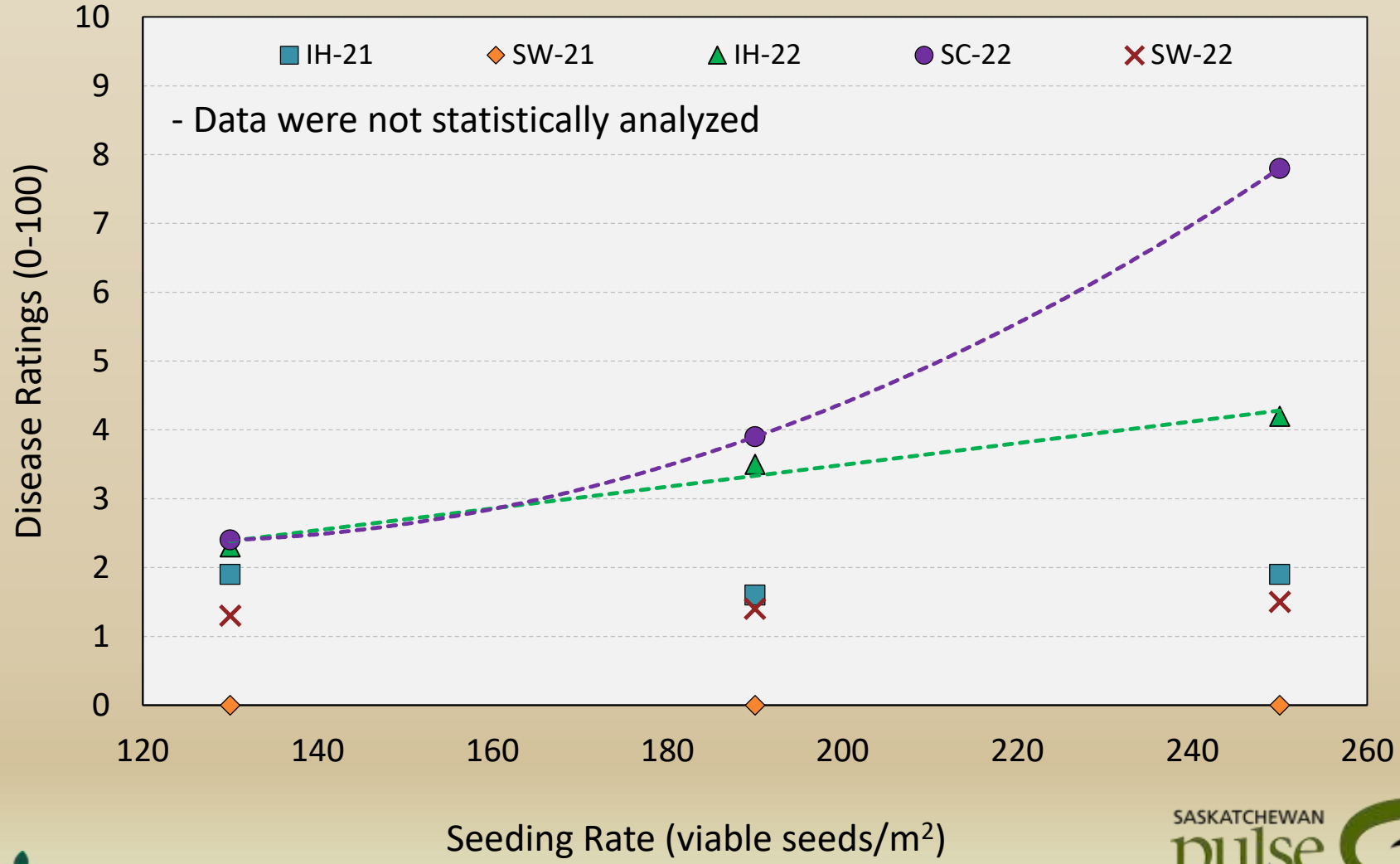
Lentil Seeding Rate Effects on Relative Weediness of Plots at Maturity



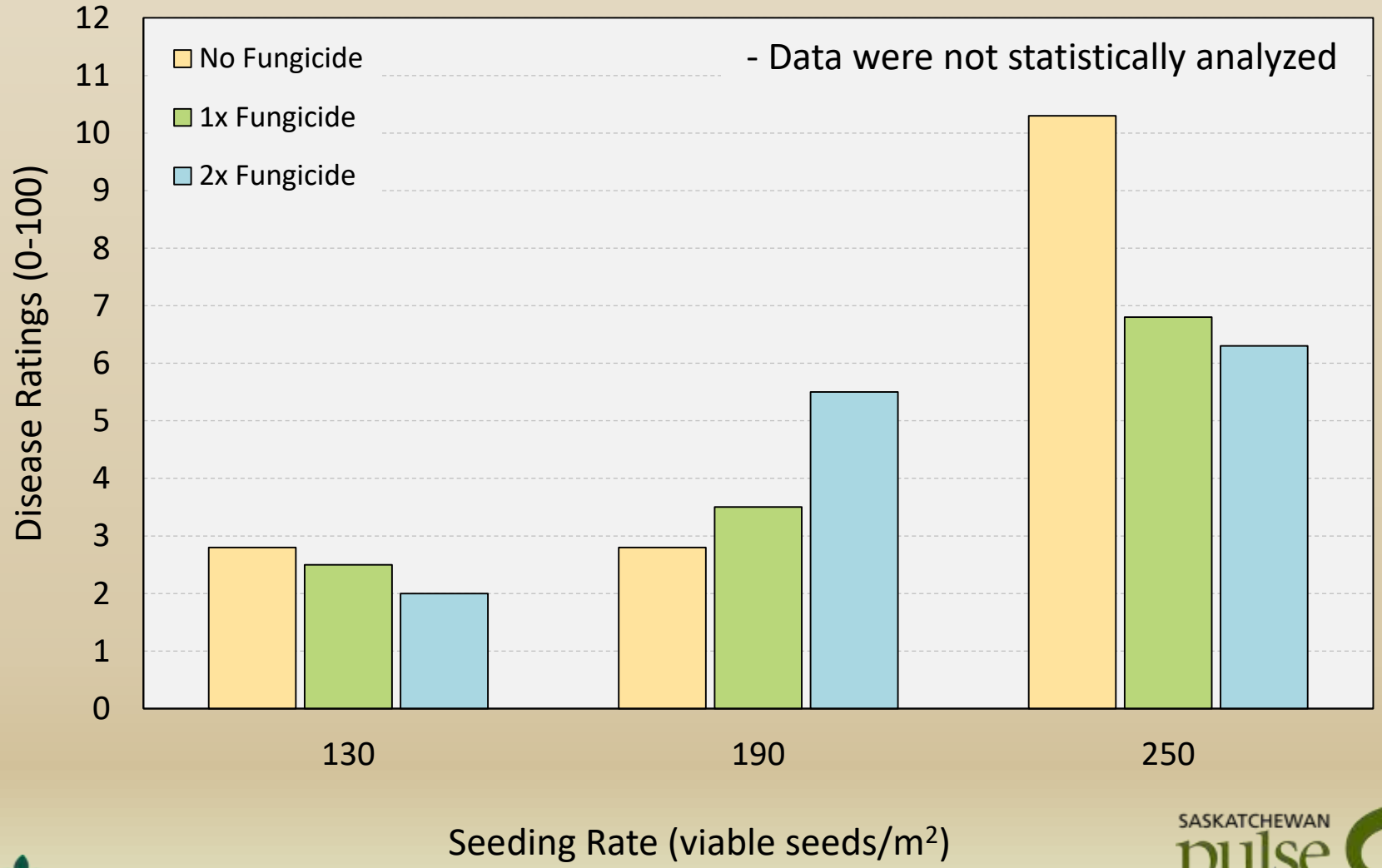
Lentil Seeding Rate Effects on Initial Disease Ratings (prior to 1st fungicide application)



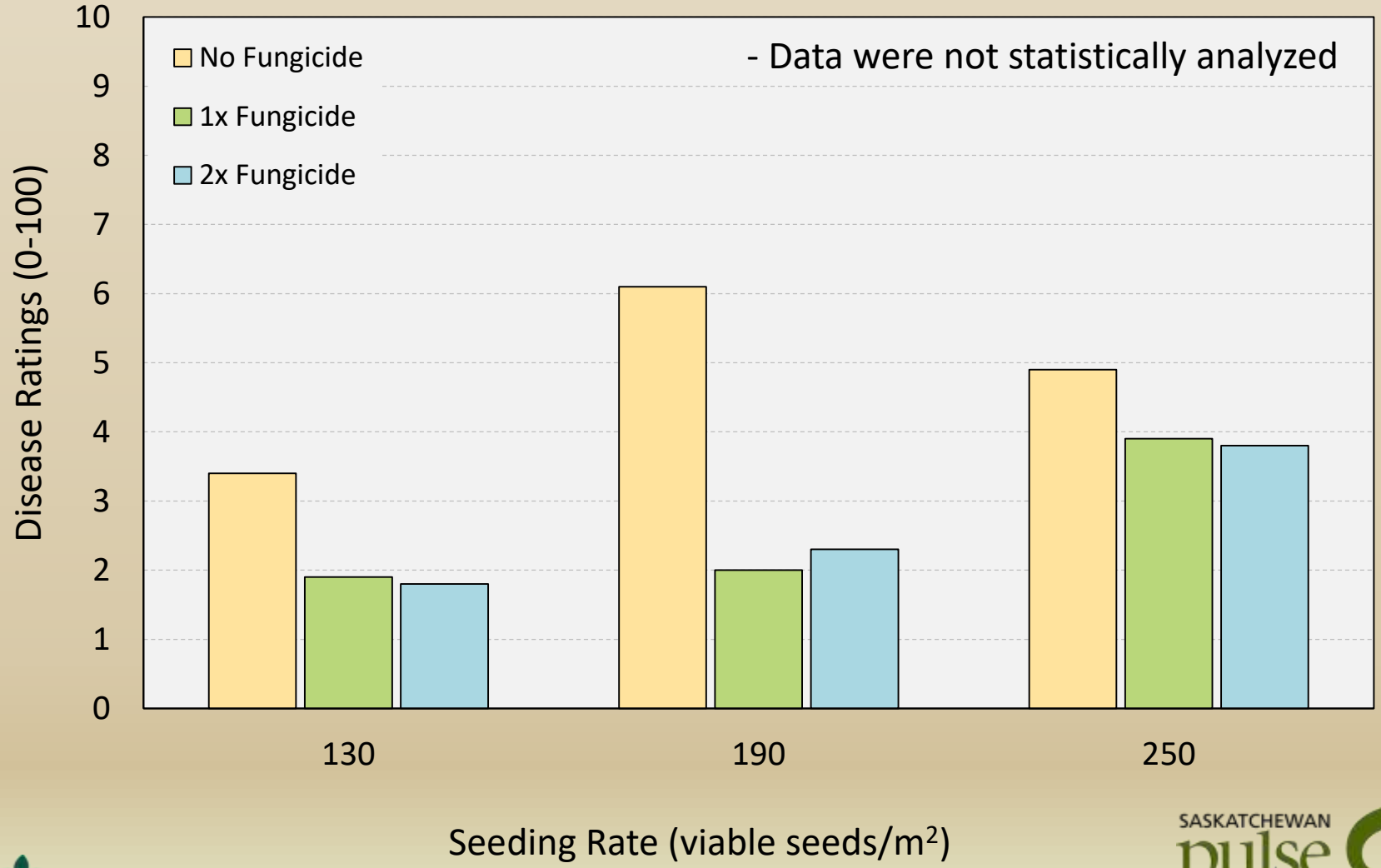
Lentil Seeding Rate Effects on Final Disease Ratings (~7 days after 2nd fungicide application)



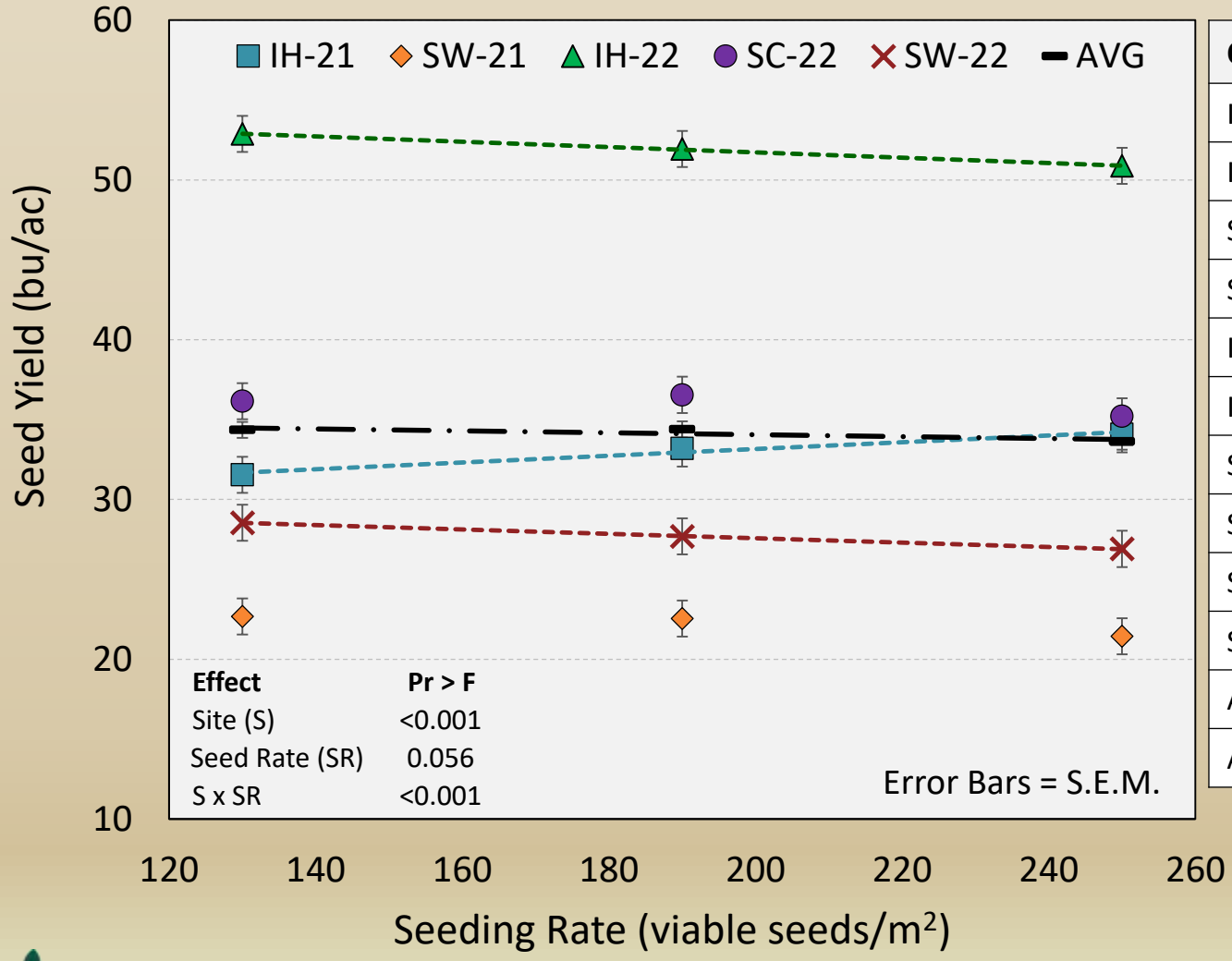
Lentil Seeding Rate x Fungicide Effects on Final Disease Ratings (SC-22)



Lentil Seeding Rate x Fungicide Effects on Final Disease Ratings (IH-22)

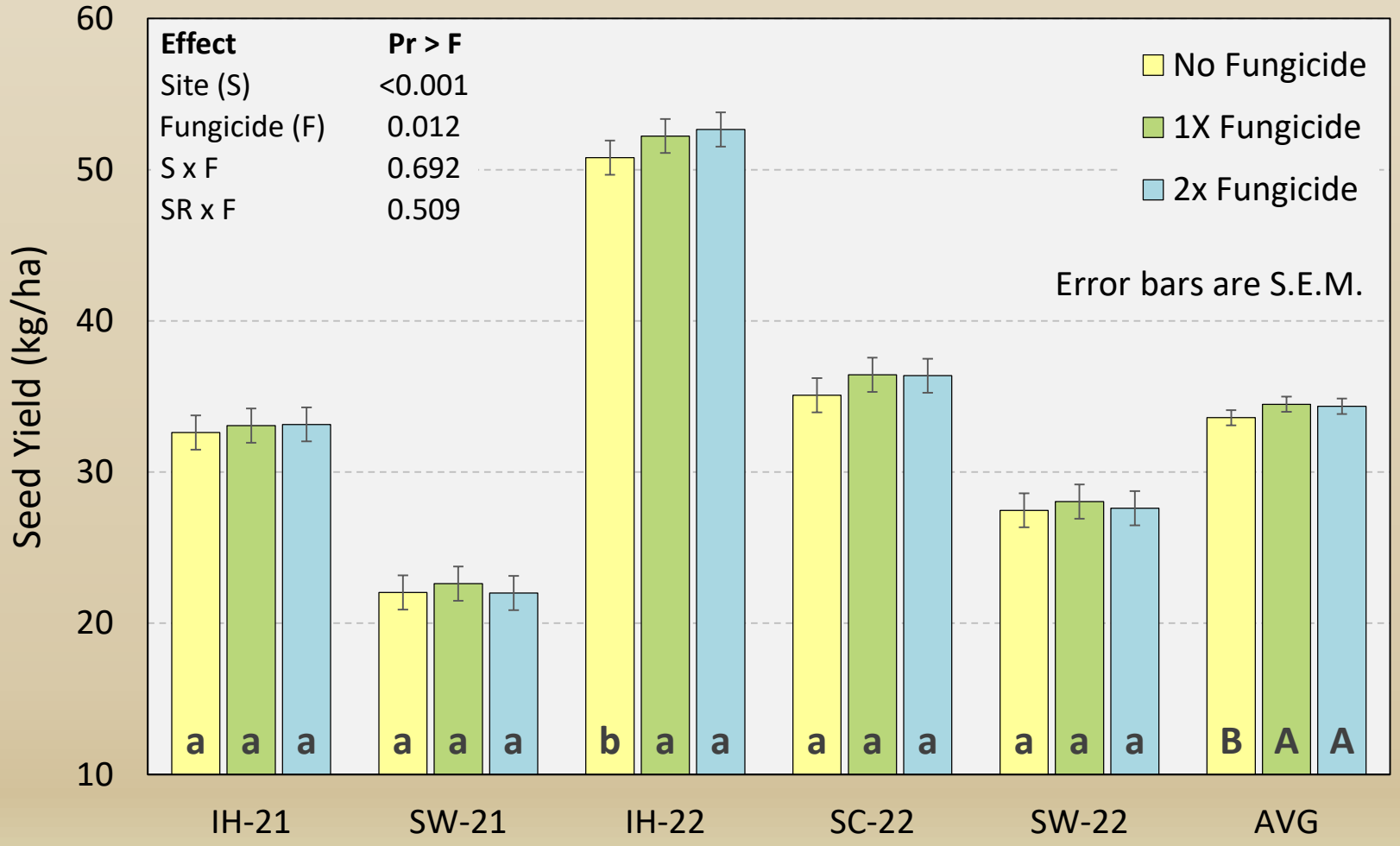


Lentil Seeding Rate Effects on Seed Yield at Individual Sites & Across Sites

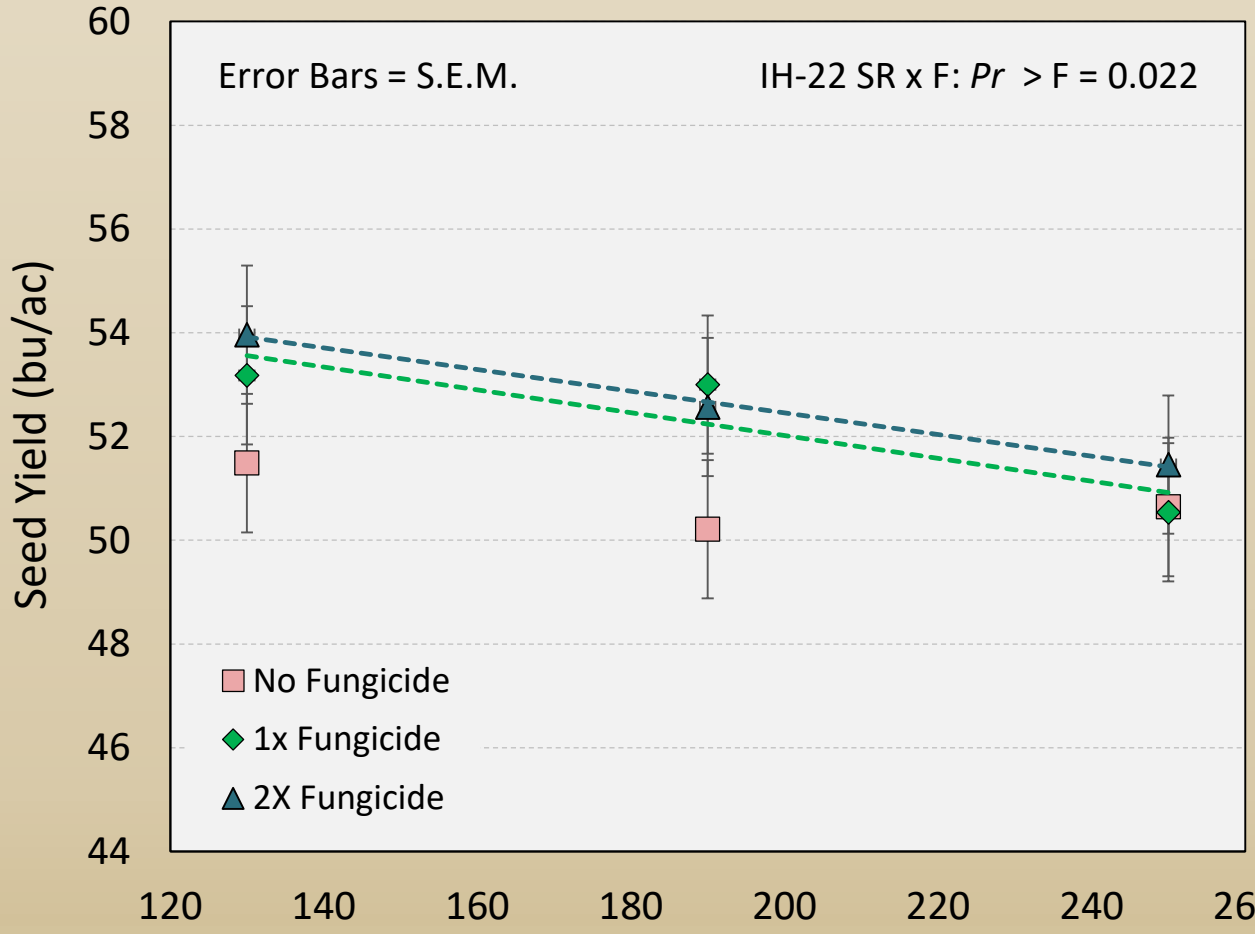


Contrast	Pr > F
IH-21 linear	<0.001
IH-21 quadratic	0.543
SC-22 linear	0.083
SC-22 quadratic	0.434
IH-22 linear	0.006
IH-22 quadratic	0.939
SC-22 linear	0.181
SC-22 quadratic	0.154
SW-22 linear	0.024
SW-22 quadratic	0.962
AVG linear	0.041
AVG quadratic	0.204

Fungicide Effects on Lentil Seed Yield at Individual Sites & Across Sites



Lentil Seeding Rate x Fungicide Effects on Seed Yield (Indian Head 2022)



Contrast (IH-22)	Pr > F
No fung – linear	0.495
No fung – quadratic	0.424
1x fung – linear	0.033
1x fung – quadratic	0.289
2x fung – linear	0.043
2x fung – quadratic	0.896

Lentil Fertility & Seeding Rate Implications for Disease Management: Conclusions

- Responses to P fertilizer were modest but frequently significant, with the greatest potential for response when soil test P is low & yield potential is high
  - While responses were commonly linear, 20-40 lb P_2O_5/ac is likely adequate in most cases
- Yield gains attributable to granular inoculant were not observed; however, biological N fixation is critical in lentil production & withholding inoculant altogether is not recommended
- Yield benefits associated with N fertilization occasionally occurred but were inconsistent & difficult to predict – perhaps most likely in low N, low OM, coarse textured soils or under very high yielding conditions? Be cautious.
- Higher seeding rates in lentils can improve ability to compete with weeds but may come with a risk of yield loss under some conditions (drought or very wet)
  - 130-190 seeds/m^2 will generally be sufficient, especially in relatively clean fields or when combined with residual herbicides
- Observed fungicide responses were small & not always economical; however, most sites were dry, disease risk in small plots may be less than commercial fields, & fungicide will generally be recommended with this crop. Dual applications are less likely to be profitable.

Canola Seed Safety & Yield Response to Various Phosphorus Forms (2020-21)

Canola Seed Safety & Yield Response to Various Phosphorus Forms (2020-22)

Objectives: To demonstrate canola establishment & yield response to increasing rates of seed-placed phosphorus fertilizer for various formulations

Locations: Indian Head (2020-22), Melfort (2021-22), Outlook (2021), Redvers (2021), Scott (2020-22), Swift Current (2020-22), & Yorkton (2021)

Treatments: 4 formulations x 3 rates plus a 0 P control treatment

Formulations

1) Monoammonium Phosphate (**MAP**; 11-52-0)
2) MicroEssentials® **S15** (13-33-0-15)
3) Crystal Green® (**Struvite**; 5-28-0 + 10% Mg)
4) 50:50 MAP:Struvite (**Blend**; 8-40-0 + 5% Mg)

*** Salt Index values are MAP=27, S15=21, Struvite=8**

Rates

1) 22 lb P_2O_5/ac
2) 40 lb P_2O_5/ac
3) 58 lb P_2O_5/ac

Note: All P fertilizer was seed-placed, urea & ammonium sulphate were side-banded

Data Collection: Emergence & final densities, maturity, & yield

Growing Season Weather

Location – Year	Avg. Temperature (°C)	Total Precipitation (mm)
Indian Head – 2020	15.7 **(101%)**	113 **(46%)**
Indian Head – 2021	16.0 **(103%)**	295 **(121%)**
Indian Head – LT [Z]	15.6	244
Melfort – 2021	16.2 **(106%)**	139 **(61%)**
Melfort – LT	15.2	226
Outlook [Y] – 2021	17.1 **(106%)**	96 **(47%)** + 208 irrigation
Outlook – LT	16.1	205
Redvers – 2021	16.8 **(105%)**	247 **(93%)**
Redvers – LT	16.0	267
Scott – 2020	14.6 **(98%)**	258 **(114%)**
Scott – 2021	15.8 **(107%)**	149 **(66%)**
Scott – LT	14.8	227
Swift Current – 2020	15.9 **(100%)**	157 **(83%)**
Swift Current – 2021	16.8 **(106%)**	147 **(78%)**
Swift Current – LT	15.8	188
Yorkton – 2021	16.5 **(109%)**	148 **(54%)**
Yorkton – LT	15.2	272

LT – Long-Term (1981-2010); Outlook site received supplemental irrigation

Soil Test Info (0-6”)

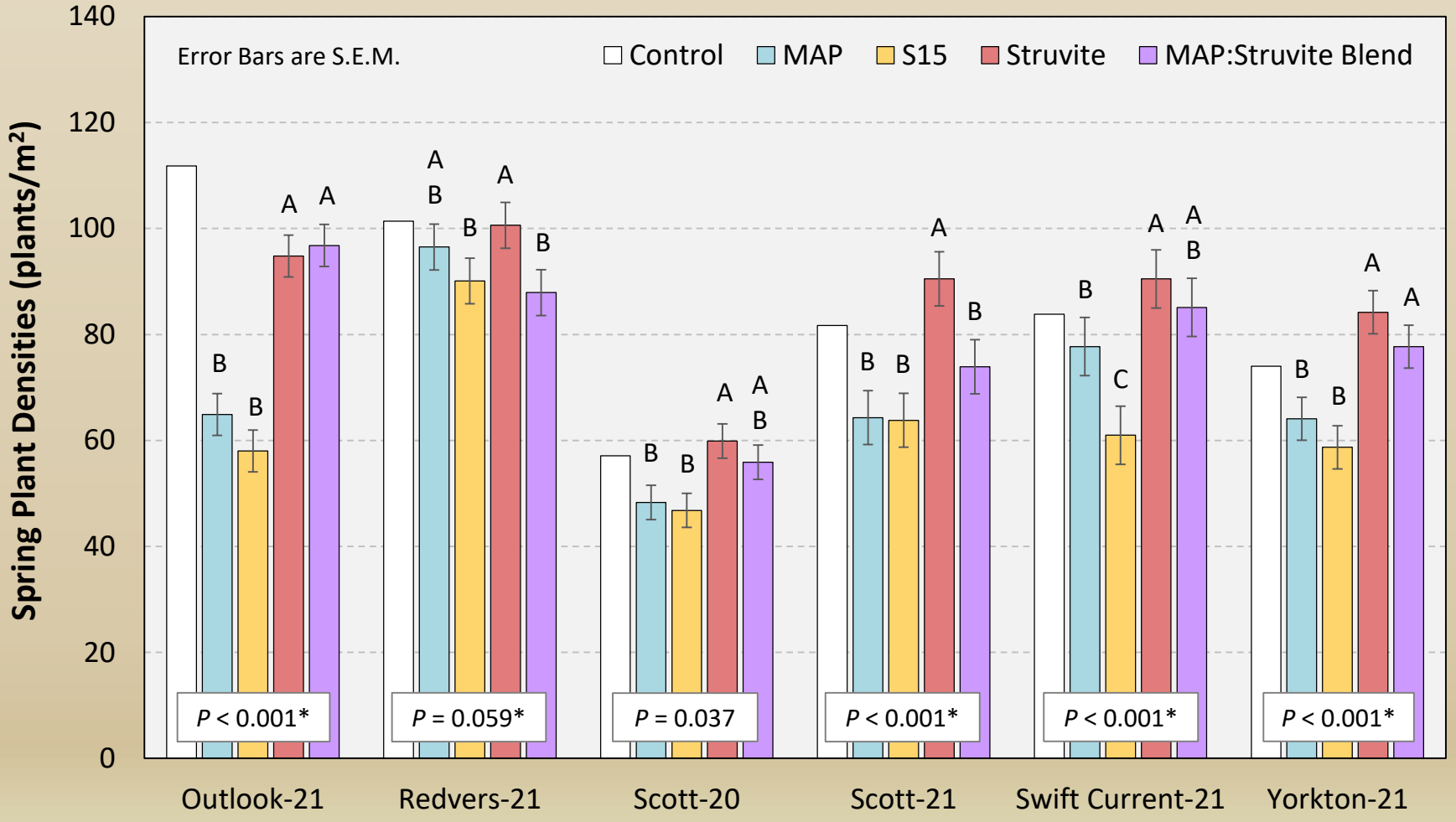
Location – Year	pH	SOM (%)	CEC (meq)	Olsen-P (ppm)
Indian Head – 2020	7.9	5.2	40.6	7
Indian Head – 2021	7.8	4.8	47.2	8
Melfort – 2021	5.9	12.1	n/a	8
Outlook – 2021	7.9	2.7	19.9	11
Redvers – 2021	8.0	3.6	34.6	6
Scott – 2020	6.4	4.0	13.3	12
Scott – 2021	5.5	4.4	15.7	6
Swift Current – 2020	6.6	2.8	n/a	10
Swift Current – 2021	6.5	2.4	n/a	16
Yorkton – 2021	7.1	4.7	22.1	13

F-test Results x Site: Spring Plant Density

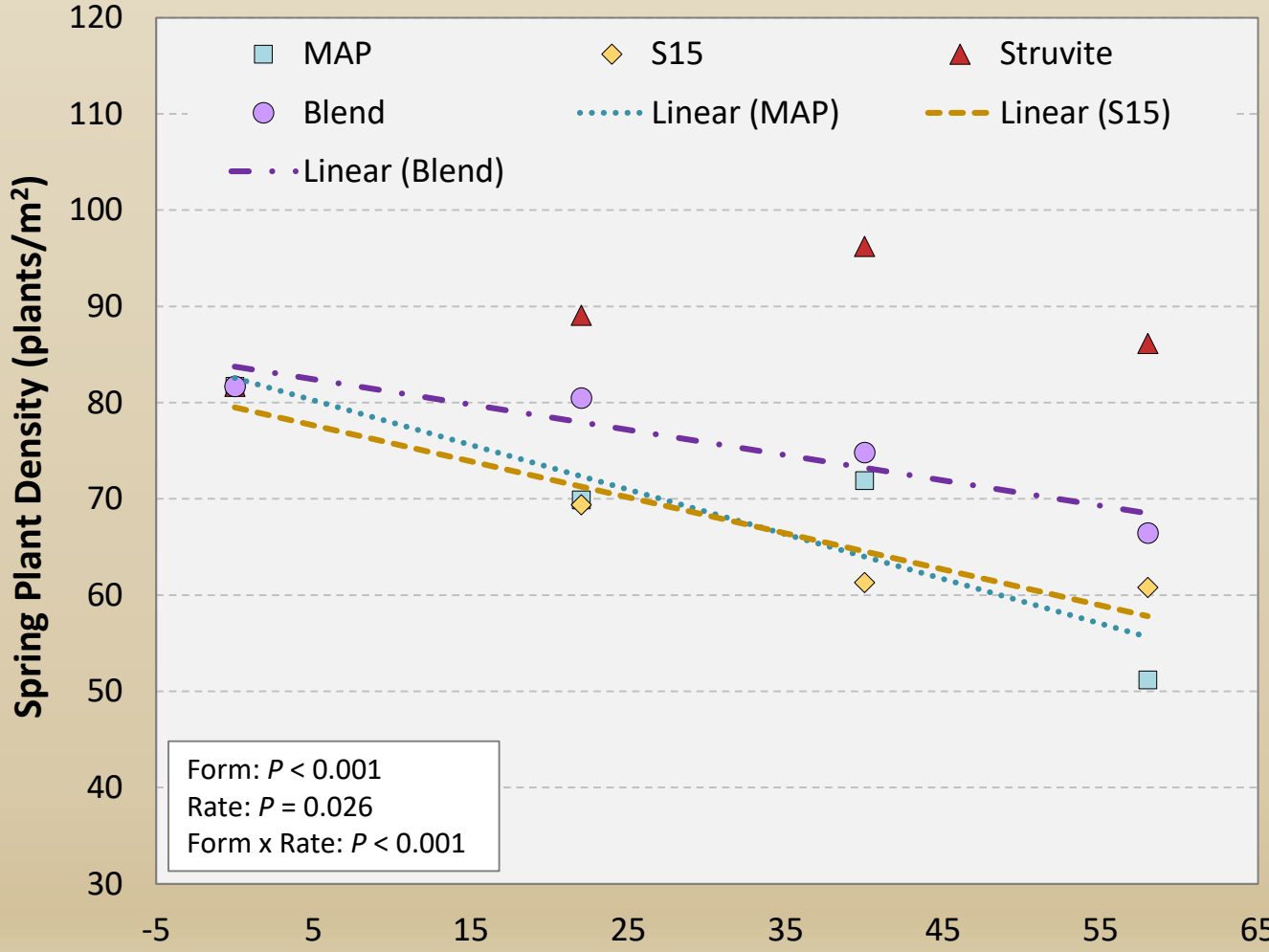
Location – Year	Form	Rate	Form × Rate	Entry
	---------- Pr > F (p-value) ----------			
Indian Head – 2020	ns	ns	ns	ns
Indian Head – 2021	ns	ns	ns	ns
Melfort – 2021	ns	ns	ns	ns
Outlook – 2021	**<0.001**	**<0.001**	**<0.001**	**<0.001**
Redvers – 2021	**0.059**	ns	**0.009**	**0.008**
Scott – 2020	**0.037**	ns	ns	ns
Scott – 2021	**<0.001**	**0.026**	**<0.001**	**<0.001**
Swift Current – 2020	ns	ns	ns	ns
Swift Current – 2021	**<0.001**	**<0.001**	**<0.001**	**<0.001**
Yorkton – 2021	**<0.001**	ns	**<0.001**	**<0.001**

Seed-Placed P Form Effects on Canola Emergence (Responsive 6/10 Sites)

Averaged Across Rates of 22, 40, & 58 lb P_2O_5/ac



Seed-Placed P Form x Rate Effects on Canola Emergence at Scott 2021



Contrast	Pr > F
MAP – lin	**0.002**
MAP – quad	0.431
S15 – lin	**0.011**
S15 – quad	0.427
Struv – lin	0.429
Struv – quad	0.191
Blend – lin	**0.073**
Blend – quad	0.501

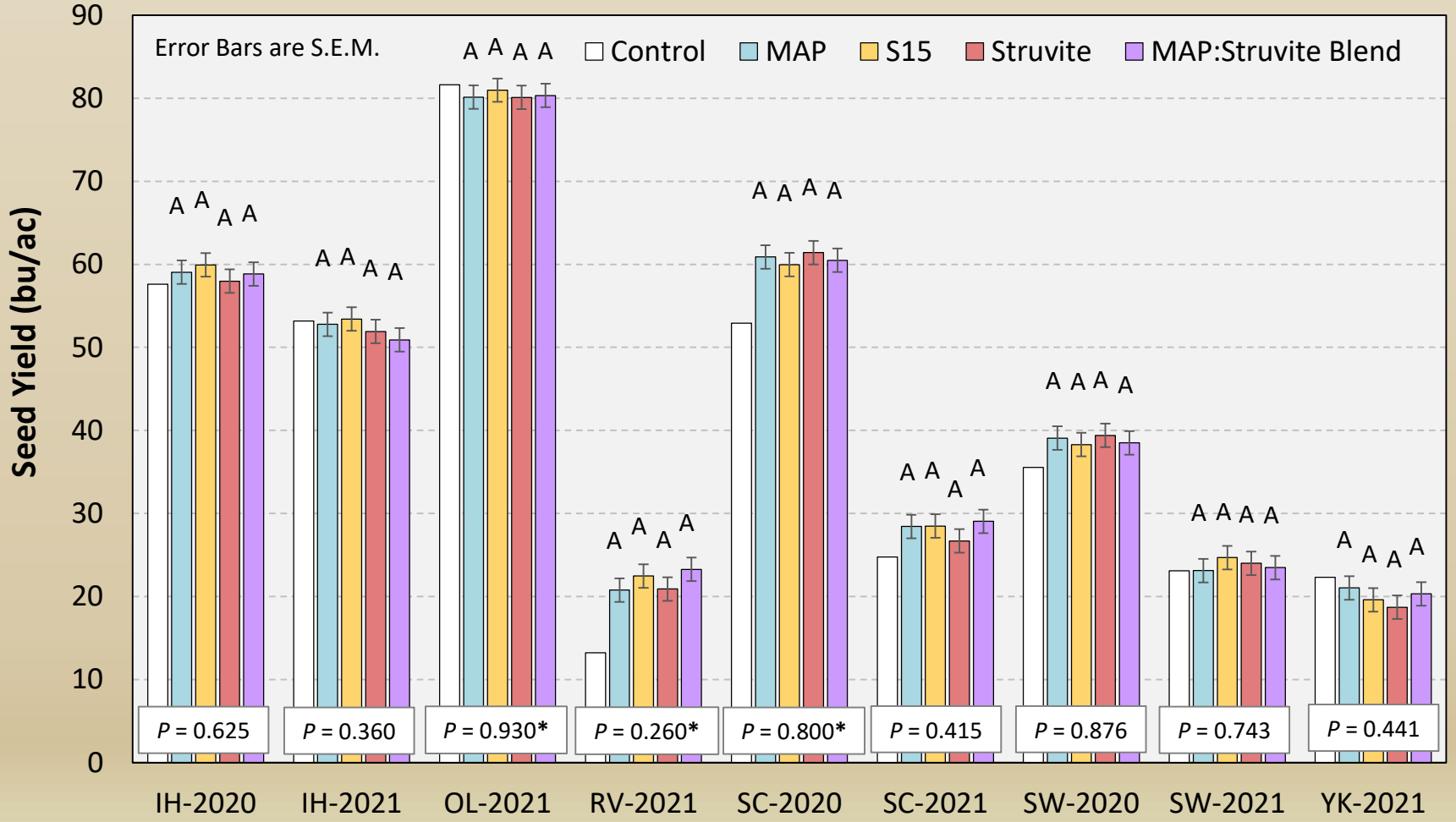
All P fertilizer was placed in the seed-row

F-Test Results x Site: Seed Yield

Location – Year	Form	Rate	Form × Rate	Entry
	---------- Pr > F (p-value) ----------			
Indian Head – 2020	ns	ns	ns	ns
Indian Head – 2021	ns	ns	ns	ns
Melfort – 2021	**<0.001**	**0.008**	**<0.001**	**<0.001**
Outlook – 2021	ns	ns	**<0.001**	**<0.001**
Redvers – 2021	ns	**0.004**	**0.009**	**<0.001**
Scott – 2020	ns	**0.001**	**0.045**	**<0.001**
Scott – 2021	ns	**0.022**	ns	ns
Swift Current – 2020	ns	ns	ns	ns
Swift Current – 2021	ns	ns	ns	ns
Yorkton – 2021	ns	ns	ns	ns

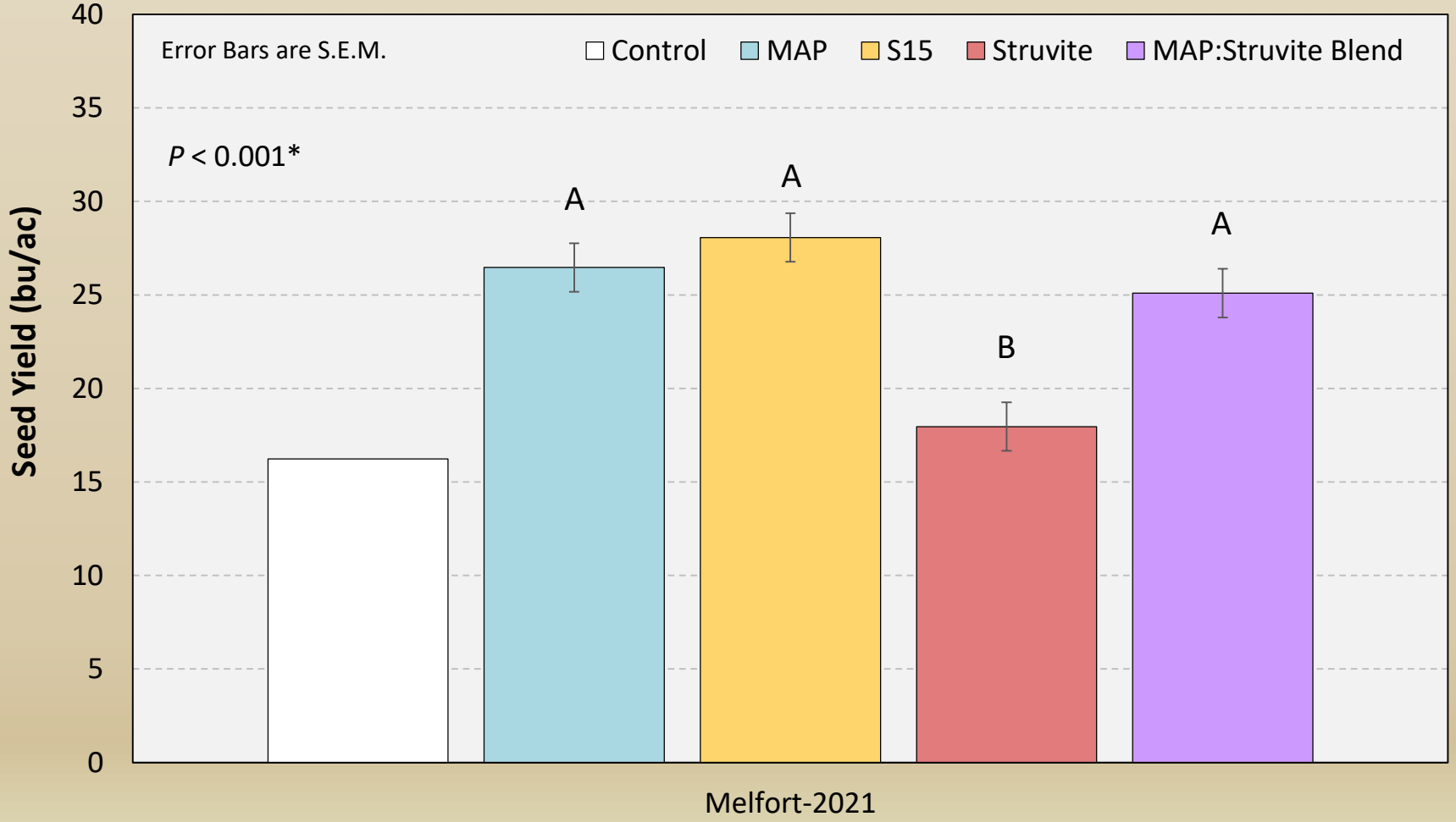
Seed-Placed P Form Effects on Canola Seed Yield (Non-Responsive 9/10 Sites)

Averaged Across Rates of 22, 40, & 58 lb P_2O_5/ac

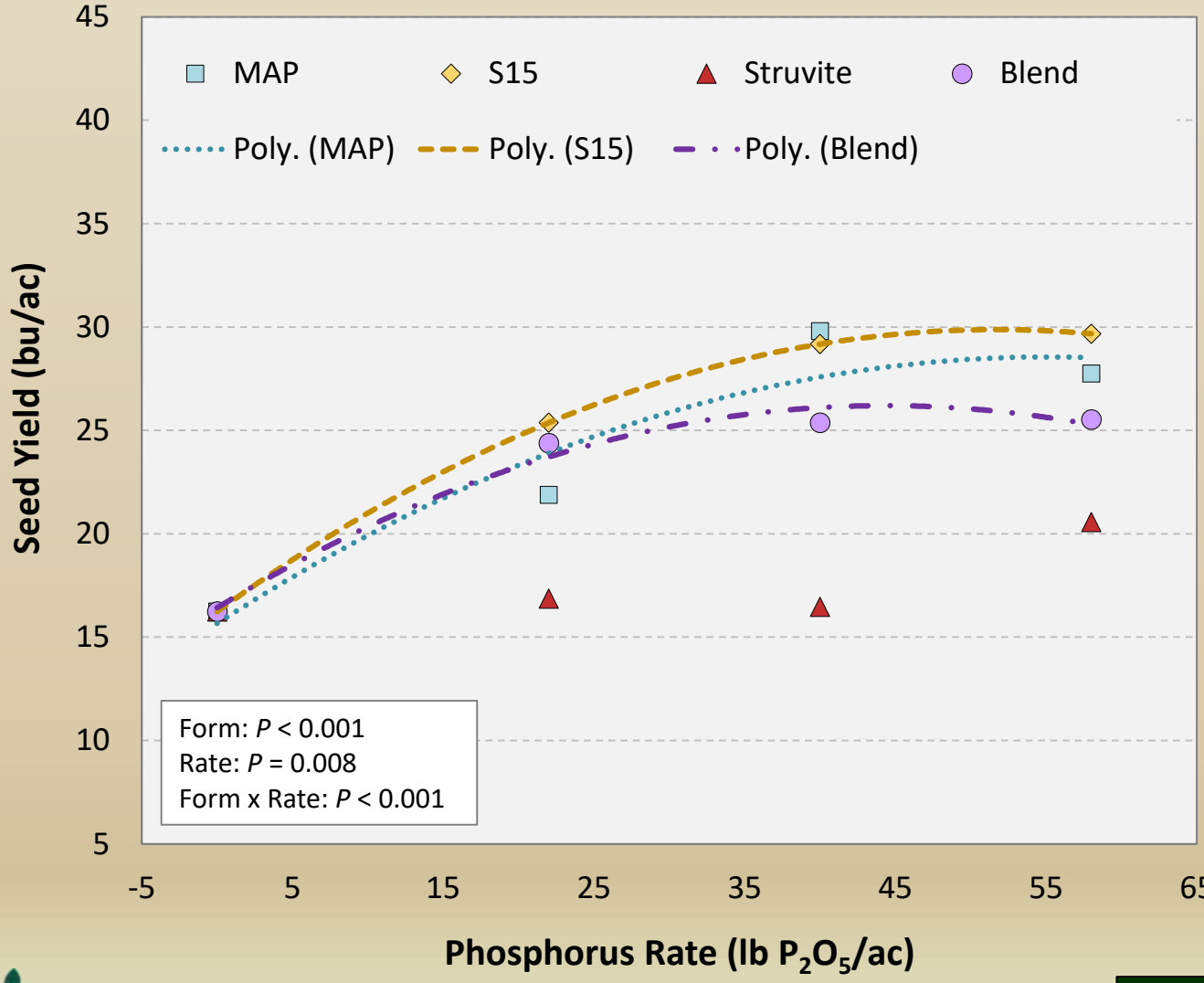


Seed-Placed P Form Effects on Canola Seed Yield (Responsive 1/10 Sites)

Averaged Across Rates of 22, 40, & 58 lb P_2O_5/ac

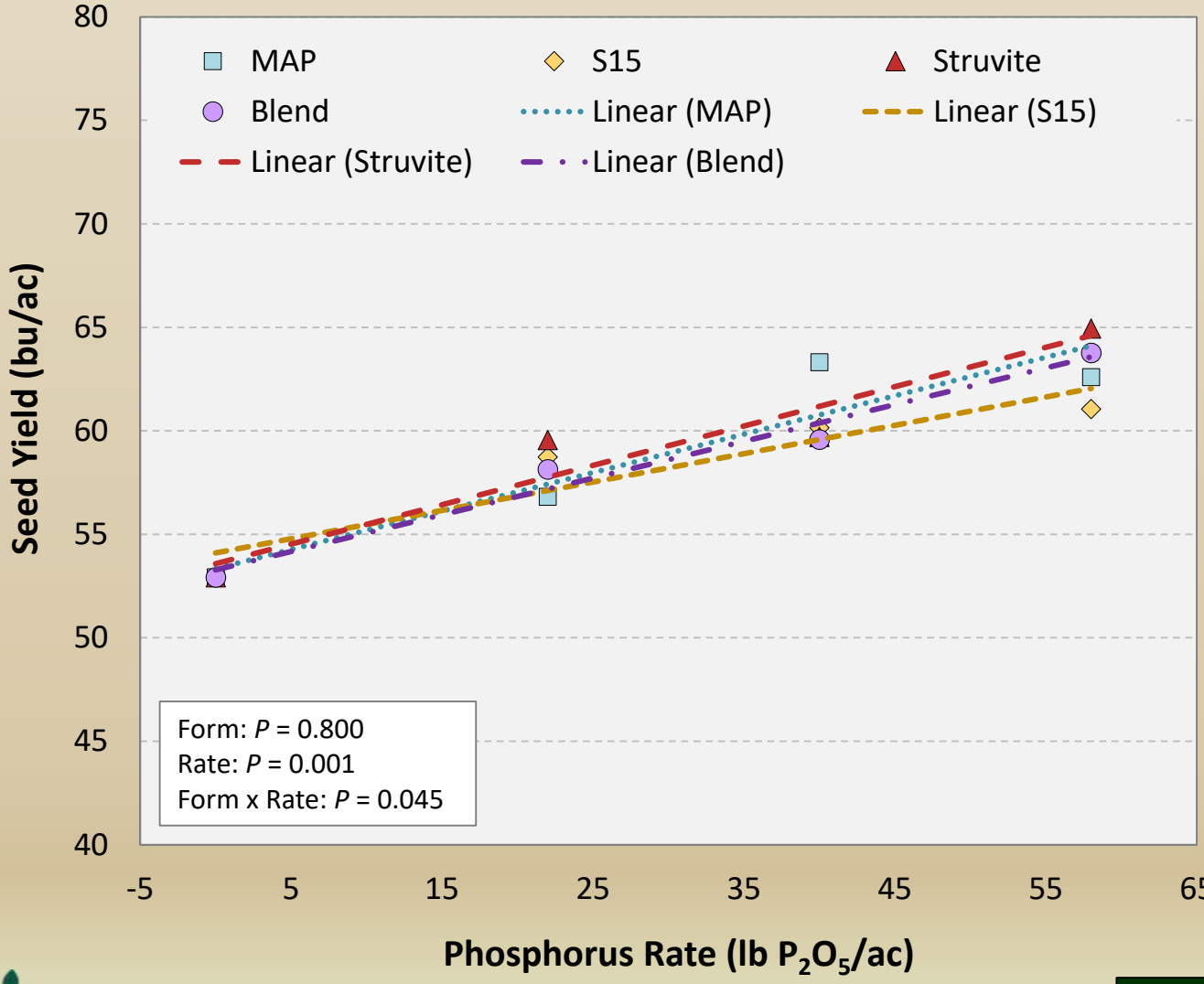


Seed-Placed P Form x Rate Effects on Canola Seed Yield at Melfort 2021



Contrast	Pr > F
MAP – lin	**<0.001**
MAP – quad	**0.082**
S15 – lin	**<0.001**
S15 – quad	**0.035**
Struv – lin	0.127
Struv – quad	0.315
Blend – lin	**<0.002**
Blend – quad	**0.038**

Seed-Placed P Form x Rate Effects on Canola Seed Yield at Scott 2020



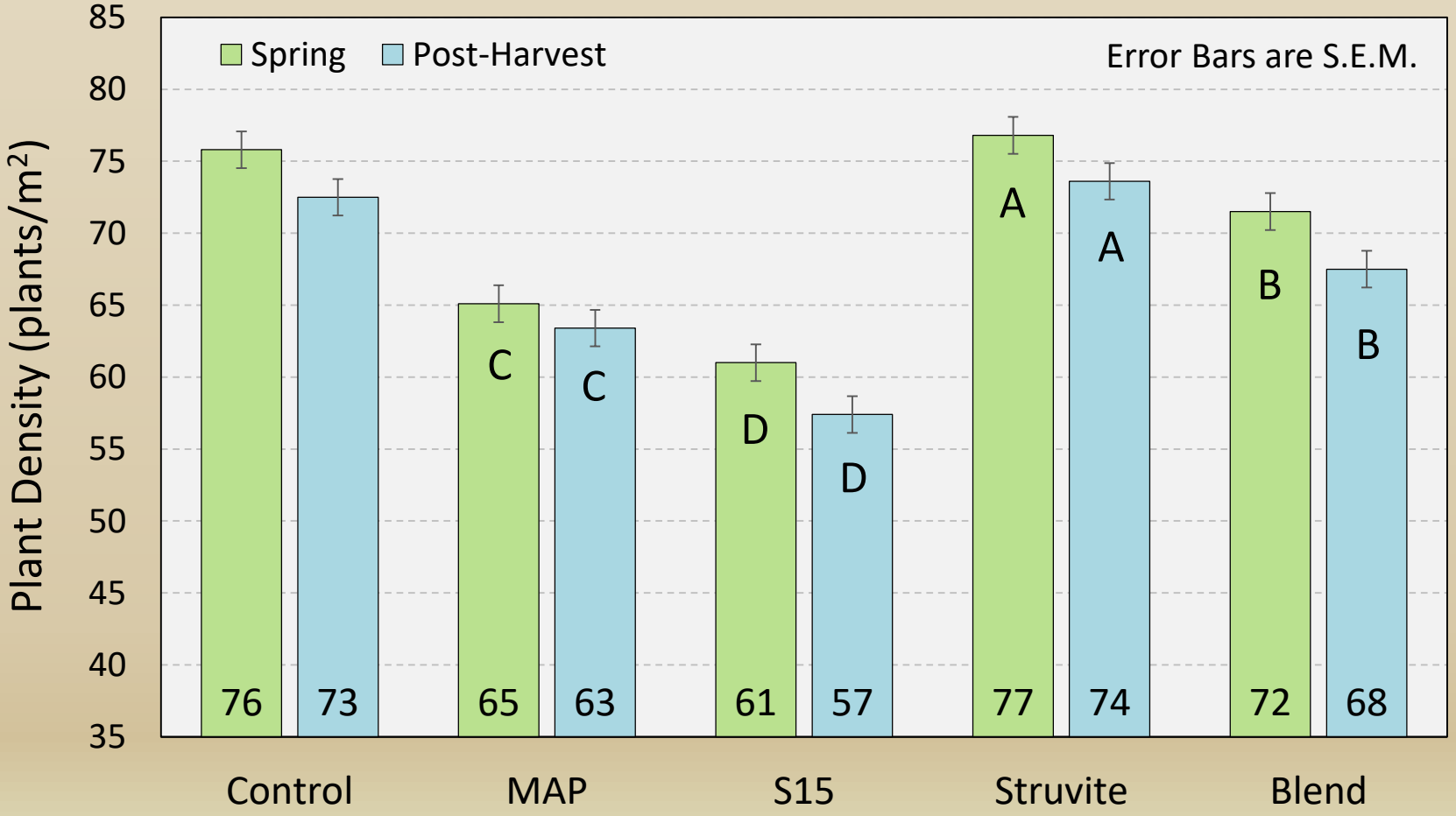
Contrast	Pr > F
MAP – lin	**<0.001**
MAP – quad	0.339
S15 – lin	**0.001**
S15 – quad	0.222
Struv – lin	**<0.001**
Struv – quad	0.805
Blend – lin	**<0.001**
Blend – quad	0.905

IHARF
INDIAN HEAD AGRICULTURAL RESEARCH FOUNDATION

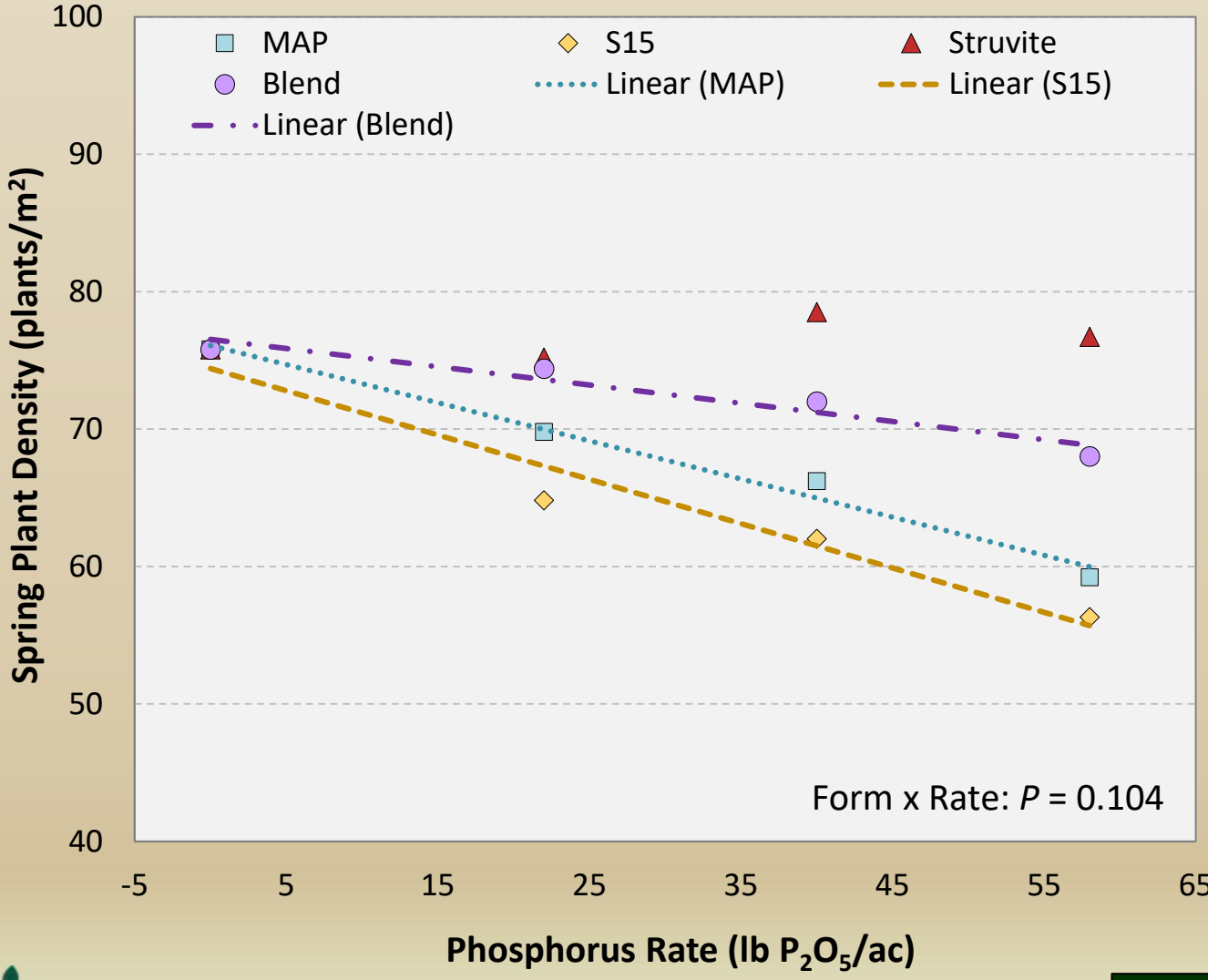
Canada

Seed-Placed P Form Effects on Canola Emergence & Final Densities (10 Site Average)

Averaged Across Rates of 22, 40, & 58 lb P_2O_5/ac



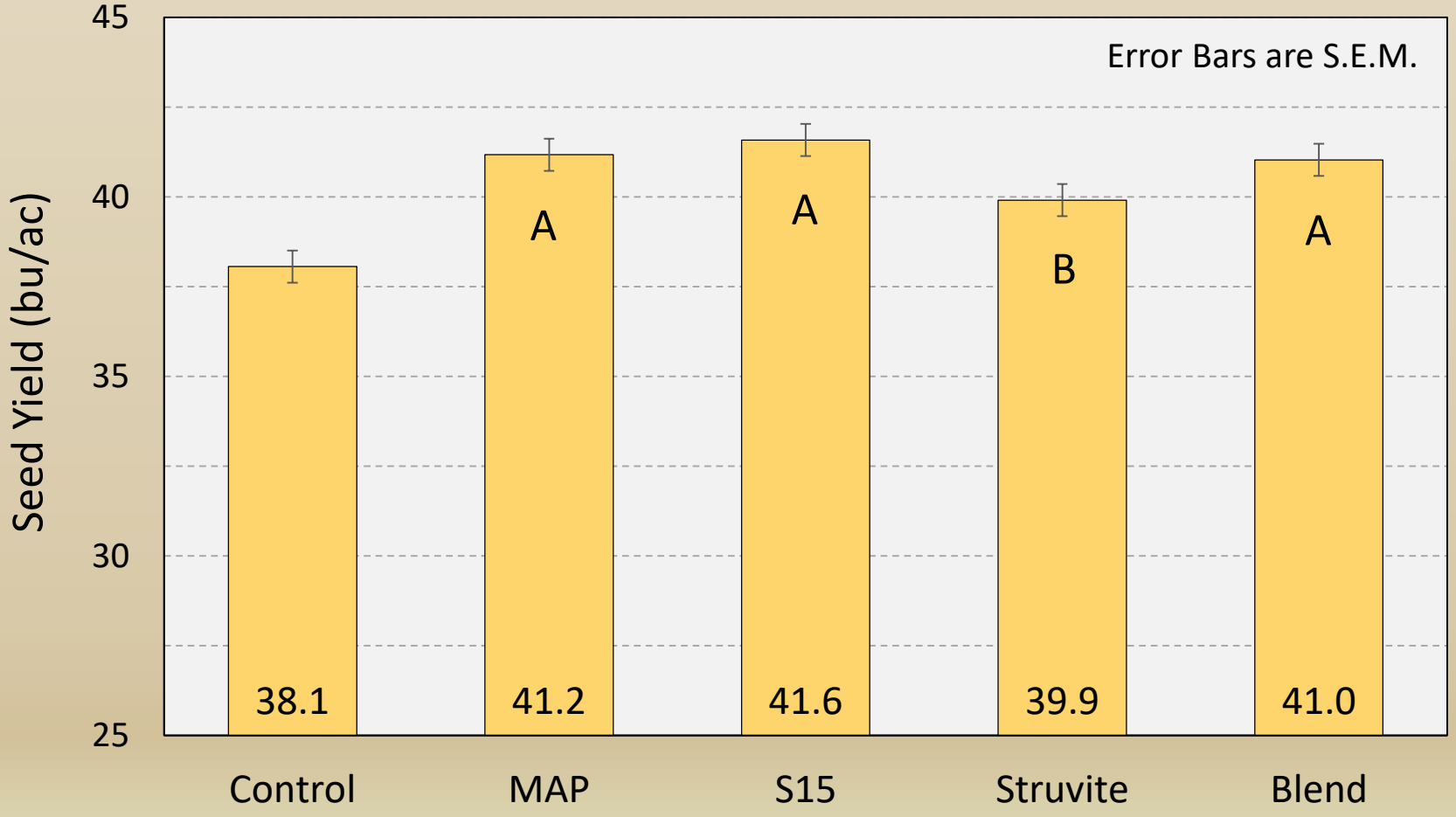
Seed-Placed P Form x Rate Effects on Spring Canola Emergence (10 Site Average)



Contrast	Pr > F
MAP – lin	**<0.001**
MAP – quad	0.603
S15 – lin	**<0.001**
S15 – quad	0.290
Struv – lin	0.491
Struv – quad	0.837
Blend – lin	**0.005**
Blend – quad	0.410

Seed-Placed P Form Effects on Canola Seed Yield (10 Site Average)

Averaged Across Rates of 22, 40, & 58 lb P_2O_5/ac



Relative Costs of Phosphorus Formulations & Associated Marginal Profits

Fertilizer Prices [Z]	MAP	S15	Struvite	50:50 MAP:CG
$/Mt [Z]	$1,250	$1,250	$1,500	$1,375
$/lb P_2O_5 [Y]	$0.97	$1.39	$2.37	$1.47
% of MAP	100%	144%	246%	153%
Fertilizer Rate	**---------- $/ac marginal profits [Y] ----------**			
0 P (control)	$779			
22 lb P_2O_5/ac	$795	$798	**$753**	$766
40 lb P_2O_5/ac	**$810**	**$818**	$705	$774
58 lb P_2O_5/ac	$807	$770	$705	**$803**
Average	**$804**	$795	$721	$781

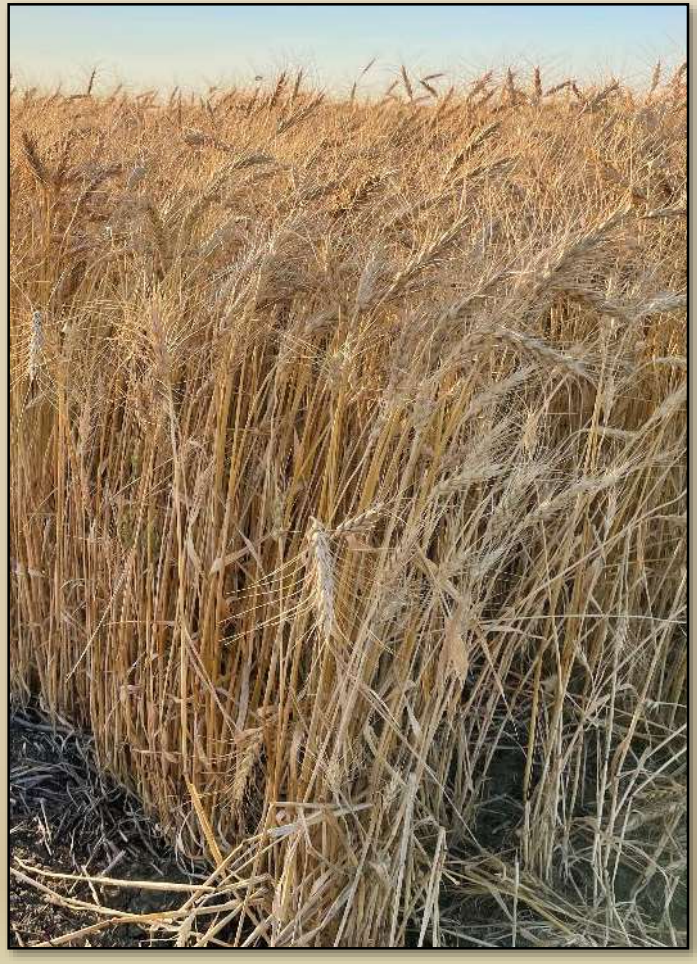
[Z] Fertilizer prices are based on retail quotes from Feb-3-2022 and actual P_2O_5 prices are adjusted for the N & S (where applicable) provided by each formulation. N & S prices are based on $1145/Mt urea (46-0-0) & $750/Mt ammonium sulfate (21-0-0-24), both of which were also quoted on Feb-3-2022.

[Y] Marginal profits are based on the quoted fertilizer prices, actual yields, & a canola price of $900/Mt ($20.41/bu). These values do not reflect absolute profits as they only take into account gross revenues and P_2O_5 costs, not accounting for other variable costs or any fixed costs.

Seed Safety & Yield Response to Various Phosphorus Forms: Conclusions

- Greatest risk of injury in coarse textured, lower organic matter soils (i.e., Swift Current, Outlook, Scott), especially if dry; while we often get away with high rates of seed-placed P on fine, black soils, this can be unpredictable & caution is advised
- Struvite (alone or in blends) has an undeniable seed-safety advantage – essentially no negative effects w/high rates of pure struvite
- For those who have the ability, side-banding is a safe & effective option for P fertilizer & will often be advantageous if high rates are utilized. Mid-row banding only a viable option if combined with seed-placement. Avoid surface applications.
- Yield responses showed that all forms performed similarly in most cases; however, pure struvite has low solubility & may not always meet demands in the year of application if applied alone, particularly in dry, low P soils
- MAP is the lowest cost P option & is also very effective, S15 is convenient (i.e. for storage, handling, & as an S source) & effective, struvite is advantageous from a seed safety &, depending on the source, environmental perspective but expensive
- On average, P rates that match crop exports are also profitable; consider P fertilizer a long-term investment, even if we do not see consistent responses every year

Demonstrating 4R Nitrogen Management Principles in Spring Wheat (2017-22)



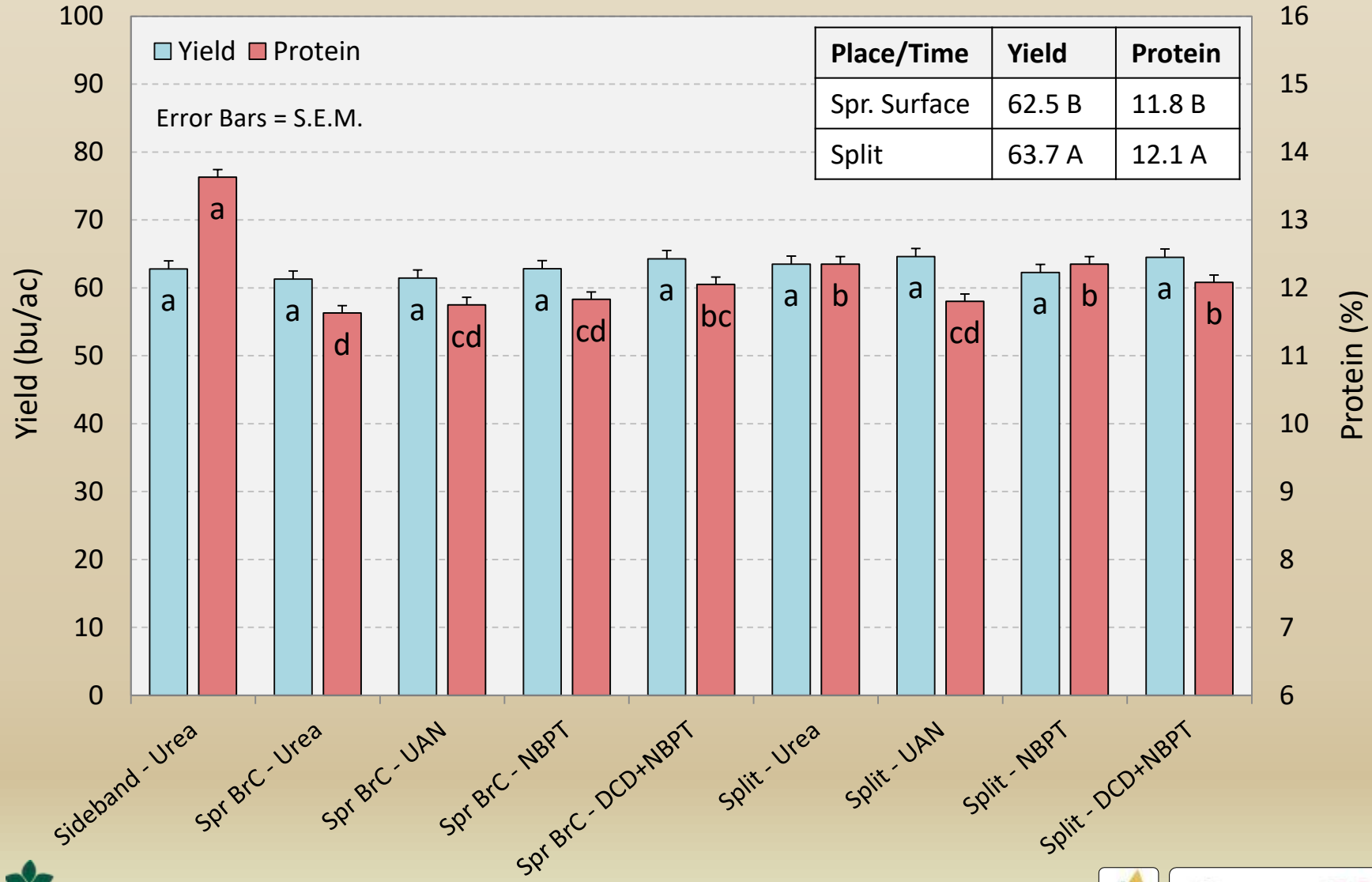
4R Nitrogen Treatments: Indian Head 2017

#	Form	Timing / Placement	Rate *	
1	Urea	Side-band	1.0x	May 5
2	Urea	Spring Surface Broadcast	1.0x	
3	UAN (Urea Ammonium-Nitrate)	Spring Surface Dribble-band	1.0x	May-4
4	NBPT (Agrotain®)	Spring Surface Broadcast	1.0x	
5	DCD+NBPT (SUPERU®)	Spring Surface Broadcast	1.0x	
6	Urea	50:50 Split (side-band : in-crop)	1.0x	
7	UAN (Urea Ammonium-Nitrate)	50:50 Split	1.0x	May-5/ Jun-20
8	NBPT (Agrotain®)	50:50 Split	1.0x	
9	DCD+NBPT (SUPERU®)	50:50 Split	1.0x	

* 1x = 116lb N/ac (soil + fertilizer)

N Management Effects on Wheat Yield

Indian Head 2017



Place/Time	Yield	Protein
Spr. Surface	62.5 B	11.8 B
Split	63.7 A	12.1 A

4R Nitrogen Treatments: Indian Head 2018

#	Form	Timing / Placement	Rate *
1	Urea	Side-band	1.0x
2	NBPT (Agrotain®)	Side-band	1.0x
3	DCD+NBPT (SUPERU®)	Side-band	1.0x
4	Urea	Fall Surface Broadcast	1.0x
5	NBPT (Agrotain®)	Fall Surface Broadcast	1.0x
6	DCD+NBPT (SUPERU®)	Fall Surface Broadcast	1.0x
7	Urea	Fall In-Soil Band	1.0x
8	NBPT (Agrotain®)	Fall In-Soil Band	1.0x
9	DCD+NBPT (SUPERU®)	Fall In-Soil Band	1.0x

May 16

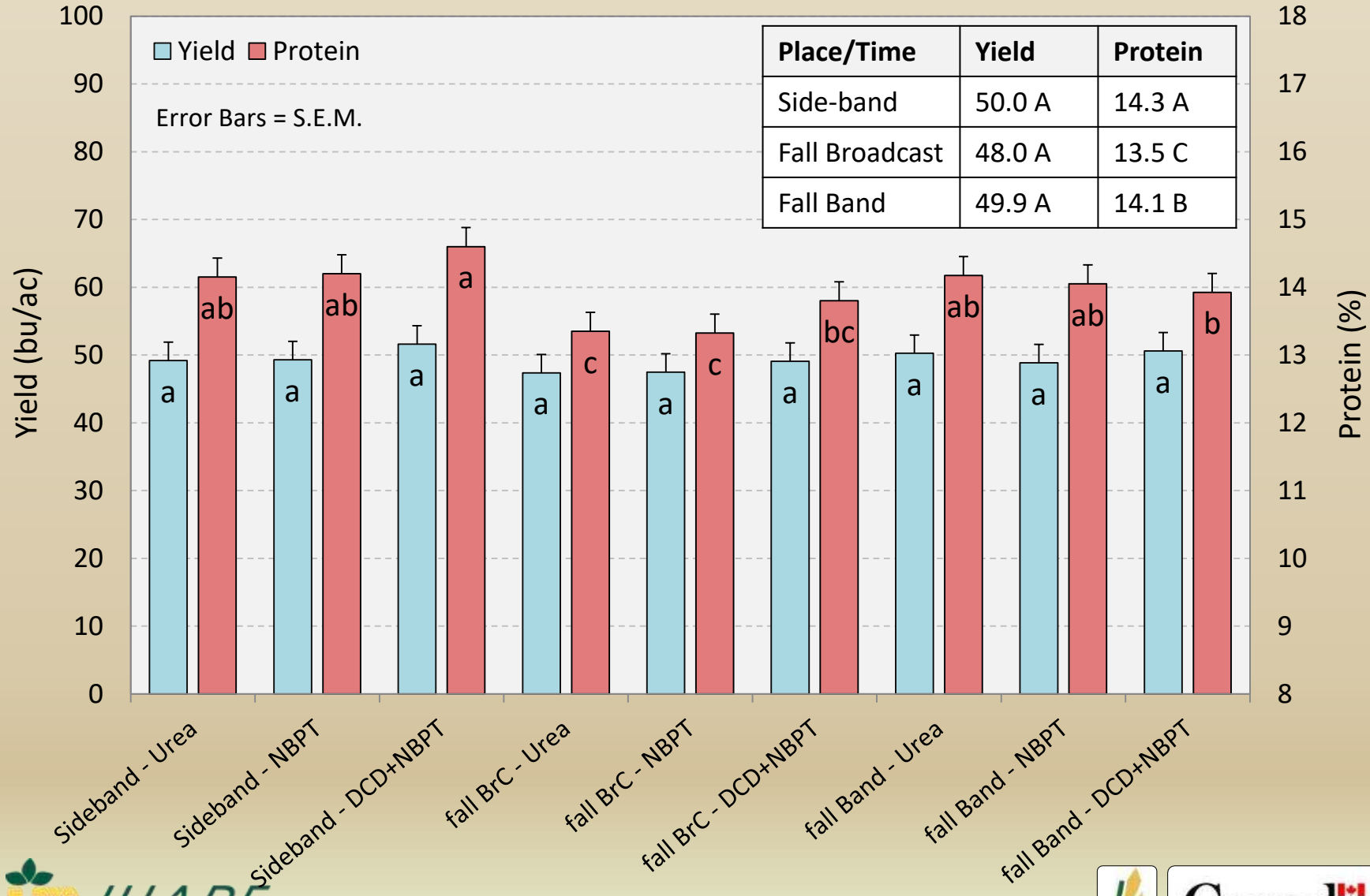
Oct 17

Oct 17

* 1x = 116 lb/ac (soil + fertilizer)

N Management Effects on Wheat Yield

Indian Head 2018



Place/Time	Yield	Protein
Side-band	50.0 A	14.3 A
Fall Broadcast	48.0 A	13.5 C
Fall Band	49.9 A	14.1 B

4R Nitrogen Treatments: Indian Head 2019

#	Form	Timing / Placement	Rate *
1	Urea	Side-band	1.0x
2	ESN® polymer coated urea	Side-band	1.0x
3	Agrotain® treated urea	Side-band	1.0x
4	SuperUrea®	Side-band	1.0x
5	Urea	Fall Surface Broadcast	1.0x
6	ESN® polymer coated urea	Fall Surface Broadcast	1.0x
7	Agrotain® treated urea	Fall Surface Broadcast	1.0x
8	SuperUrea®	Fall Surface Broadcast	1.0x
9	Urea	Spring Surface Broadcast (pre-seed)	1.0x
10	ESN® polymer coated urea	Spring Surface Broadcast	1.0x
11	Agrotain® treated urea	Spring Surface Broadcast	1.0x
12	SuperUrea®	Spring Surface Broadcast	1.0x

May 6

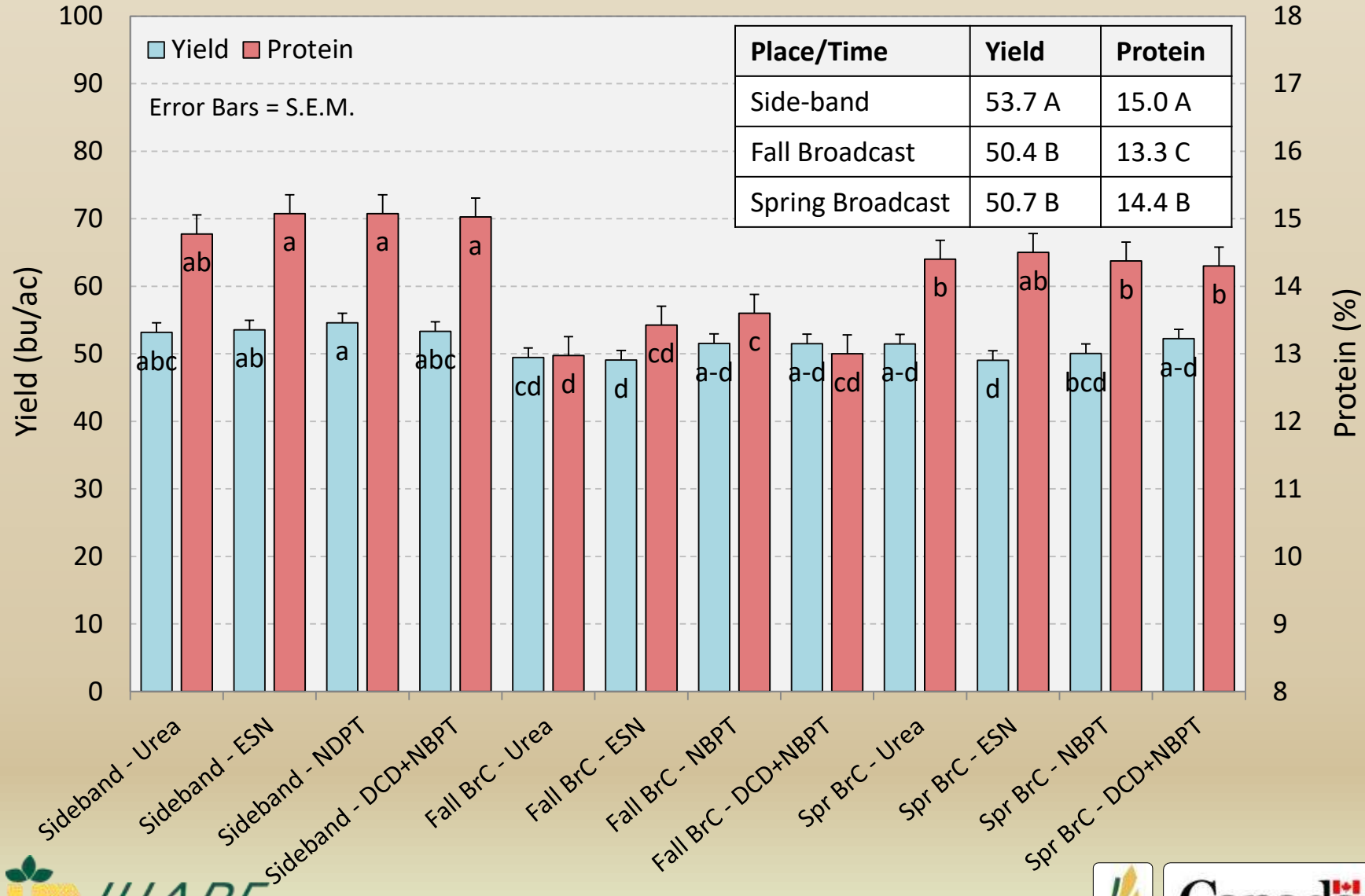
Oct 9

May 4

* 1x = 111 lb/ac (soil + fertilizer)

N Management Effects on Wheat Yield

Indian Head 2019



Place/Time	Yield	Protein
Side-band	53.7 A	15.0 A
Fall Broadcast	50.4 B	13.3 C
Spring Broadcast	50.7 B	14.4 B

4R Nitrogen Treatments: Indian Head 2020-22

#	Form	Timing / Placement	Rate (soil + fertilizer)
1	N/A	N/A	6 lb N/ac (from MAP) + Residual†
2	Untreated Urea	Side-Band (≈1.5” depth)	147 lb N/ac (High N – 1.5x rate)
3	Untreated Urea	Side-Band (≈1.5” depth)	98 lb N/ac (1.0x rate)
4	Untreated Urea	Fall Surface Broadcast	98 lb N/ac (1.0x rate)
5	Untreated Urea	Spring Surface Broadcast	98 lb N/ac (1.0x rate)
6	Untreated Urea	Fall Deep Band (≈2.3”)	98 lb N/ac (1.0x rate)
7	Untreated Urea	Fall Shallow Band (≈1”)	98 lb N/ac (1.0x rate)
8	DCD + NBPT (SUPERU®)	Side-Band (≈1.5” depth)	147 lb N/ac (High N – 1.5x rate)
9	DCD + NBPT	Side-Band (≈1.5” depth)	98 lb N/ac (1.0x rate)
10	DCD + NBPT	Fall Surface Broadcast	98 lb N/ac (1.0x rate)
11	DCD + NBPT	Spring Surface Broadcast	98 lb N/ac (1.0x rate)
12	DCD + NBPT	Fall Deep Band (≈2.3”)	98 lb N/ac (1.0x rate)
13	DCD + NBPT	Fall Shallow Band (≈1”)	98 lb N/ac (1.0x rate)

†Residual NO_3-N (0-24”): 8 lb/ac in 2019-20, 14 lb/ac in 2020-21, and 15 lb/ac in 2021-22

4R Nitrogen Treatments: Indian Head 2020-22

Relevant Weather & Soil Test Information

Year	Prev. Sep	Prev. Oct	May	June	July	August	May-Aug
	---------- Mean Temperature (°C) ----------						
2020	11.9	1.0	10.7	15.6	18.4	17.9	15.7 (101%)
2021	11.5	1.4	9.0	17.7	20.3	17.1	16.0 (103%)
2022	14.5	6.8	10.9	16.1	18.1	18.3	15.8 (101%)
LT	11.5	4.0	10.8	15.8	18.2	17.4	15.6
	---------- Total Precipitation (mm) ----------						
2020	120.8	10.4	27.3	23.5	37.7	24.9	113 (46%)
2021	15.0	3.8	81.6	62.9	51.2	99.4	295 (121%)
2022	0.4	43.0	97.7	27.5	114.5	45.9	286 (117%)
LT	35.3	24.9	51.8	77.4	63.8	51.2	244

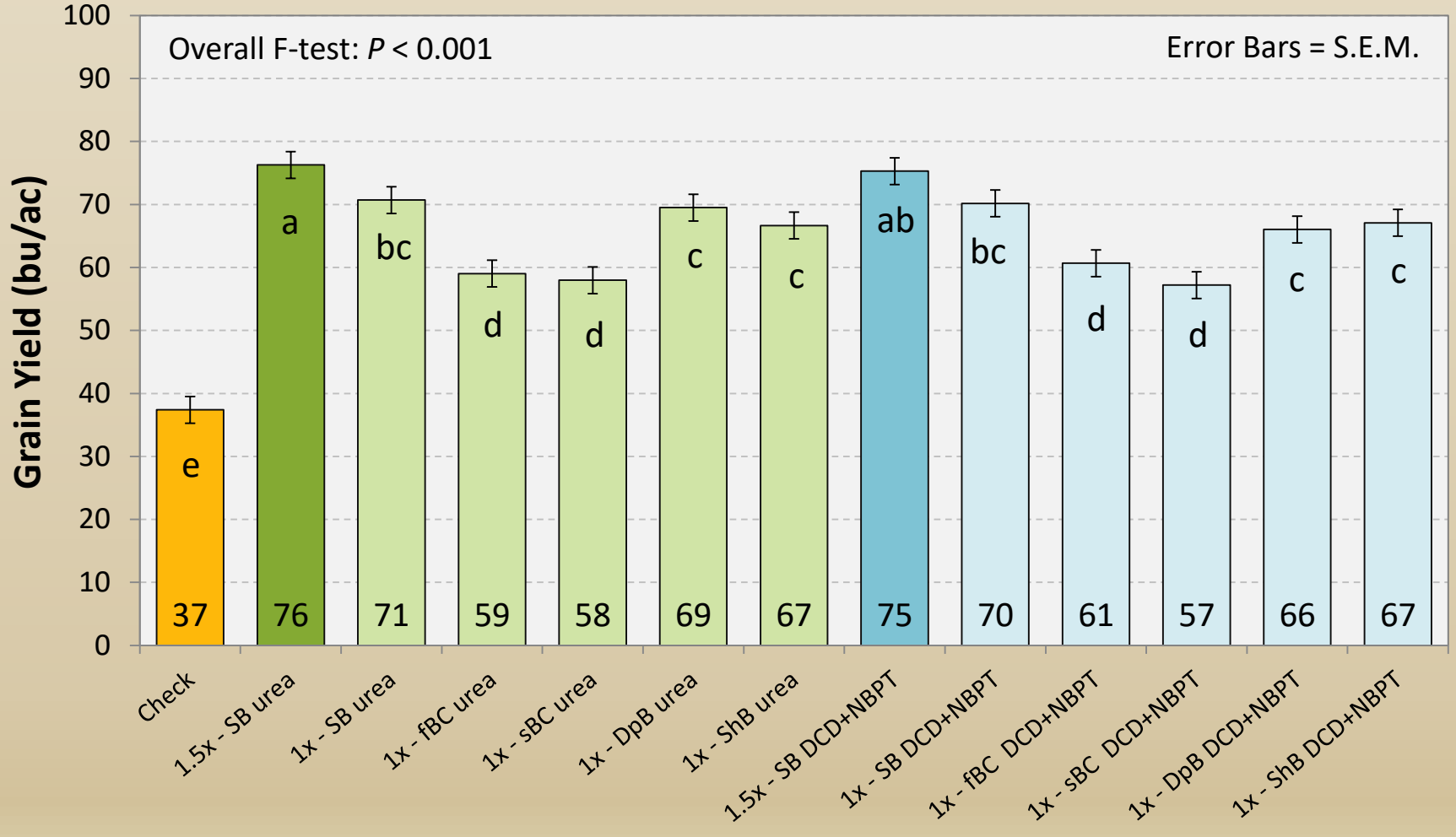
2019-20: Wet soil preceding fall N applications but limited precipitation following both fall the & spring applications – extremely dry growing season

2020-21: Extremely dry fall & early spring but 80 mm of rain received starting 12 days after spring broadcast applications – variable moisture conditions through the 2021 growing season

2021-22: Wetter than normal October & winter, late spring. Especially wet in May and July, timely rain following spring N applications

N Management Effects on Wheat Yield

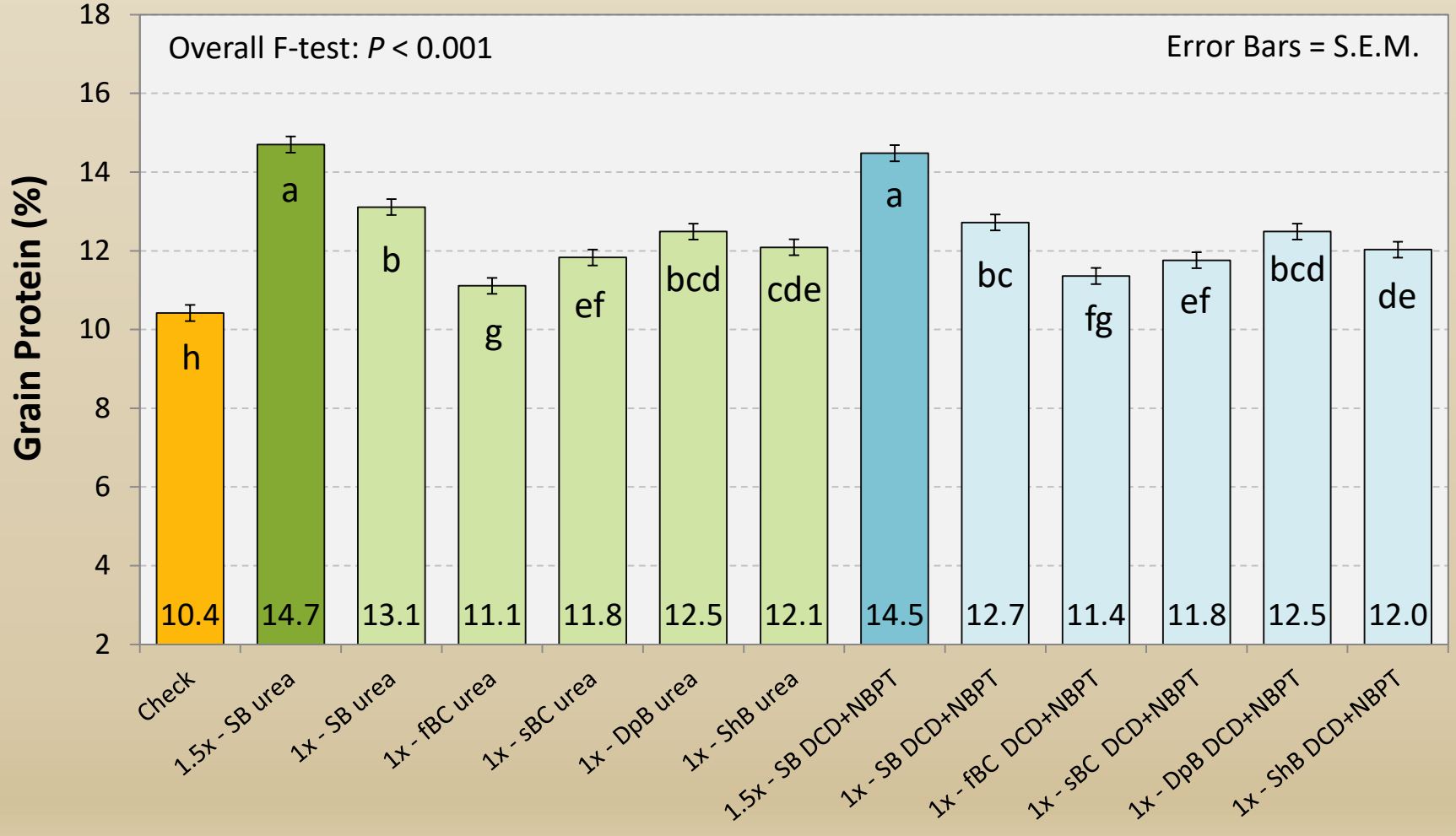
Indian Head 2020



SB – Side Band fBC – fall Broadcast sBC – spring Broadcast DpB – fall Deep Band ShB – fall shallow band

N Management Effects on Wheat Protein

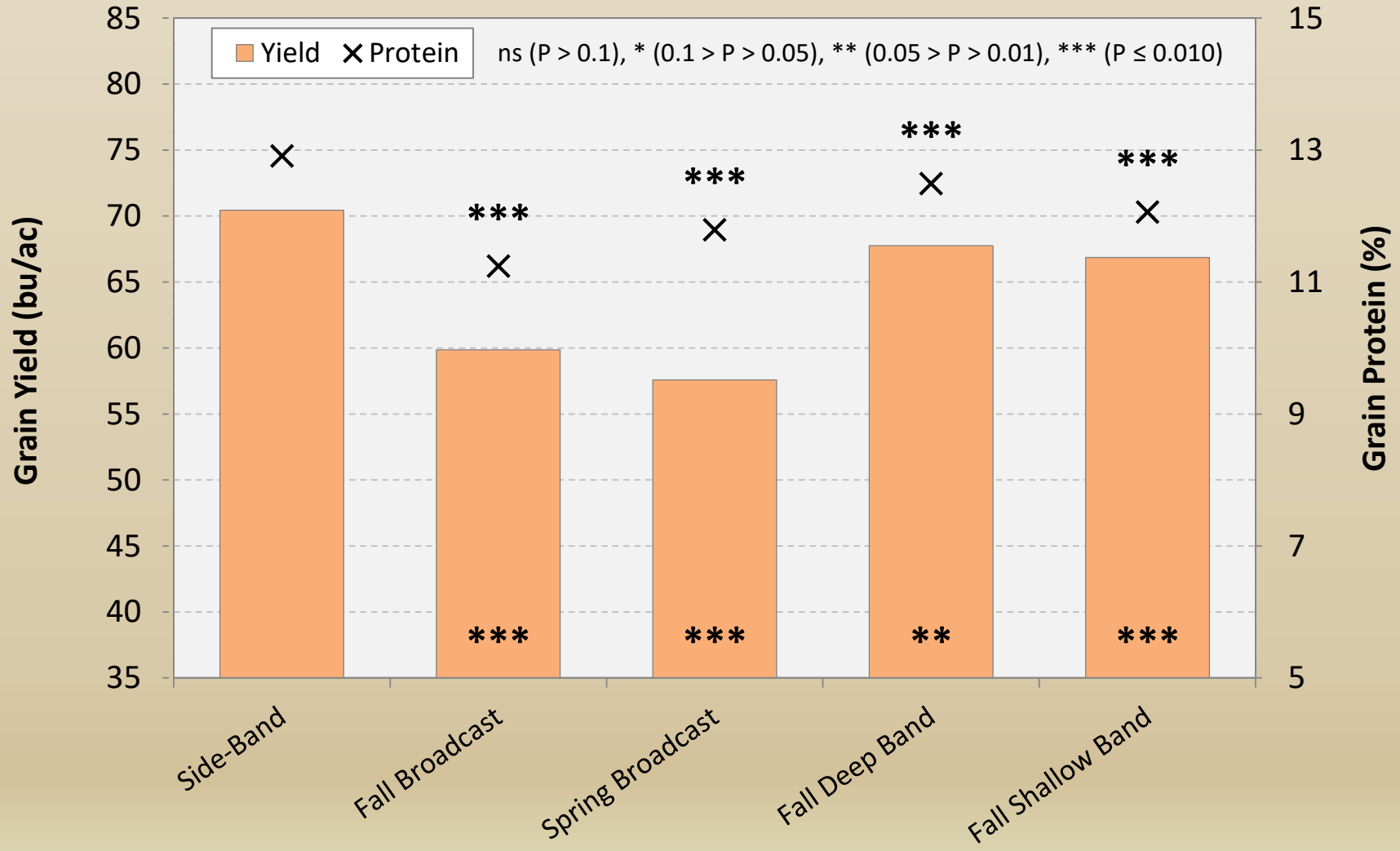
Indian Head 2020



SB – Side Band fBC – fall Broadcast sBC – spring Broadcast DpB – fall Deep Band ShB – fall shallow band

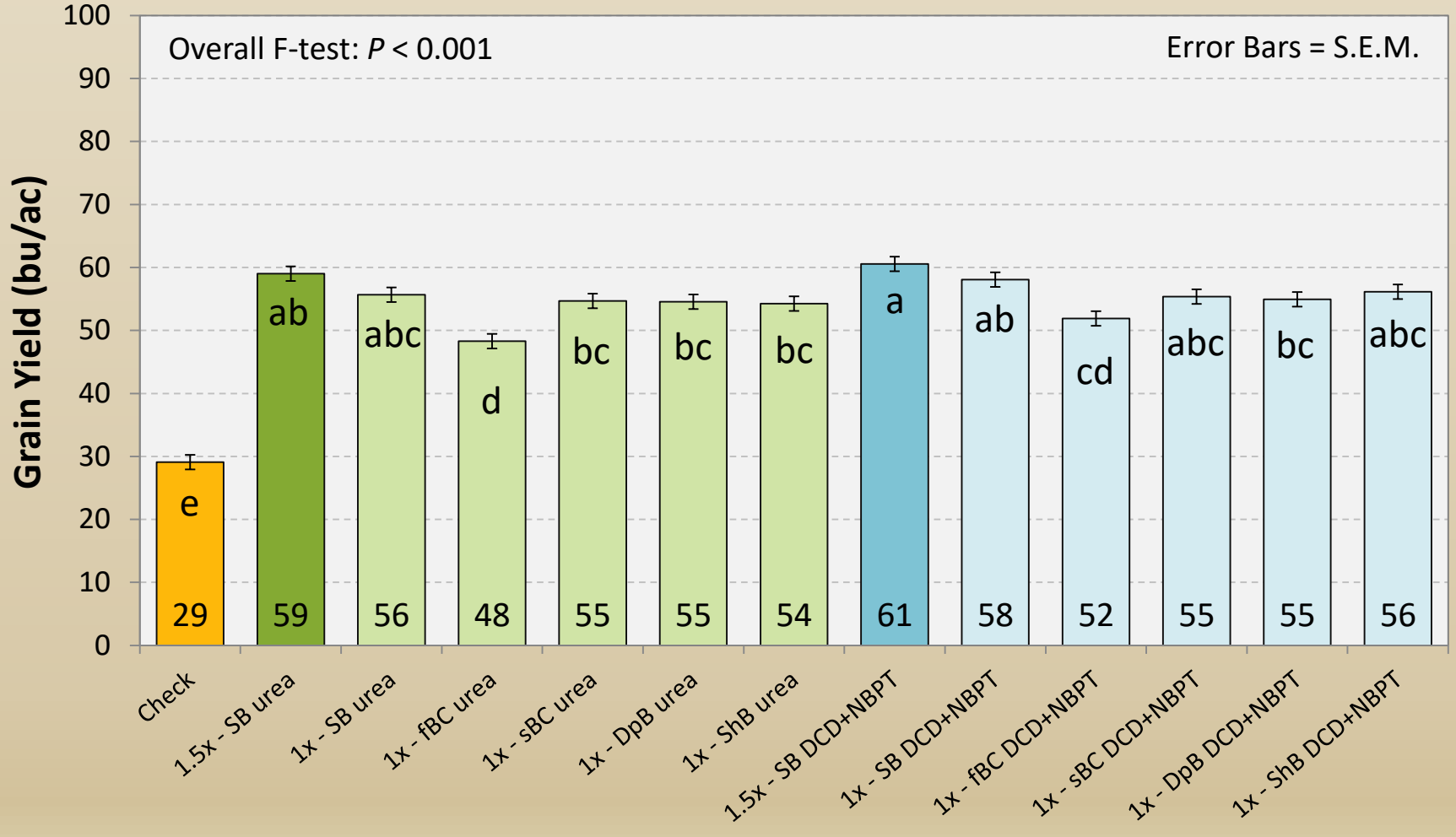
Predetermined Contrast Comparisons

Two-Pass vs. Sideband (2020)



N Management Effects on Wheat Yield

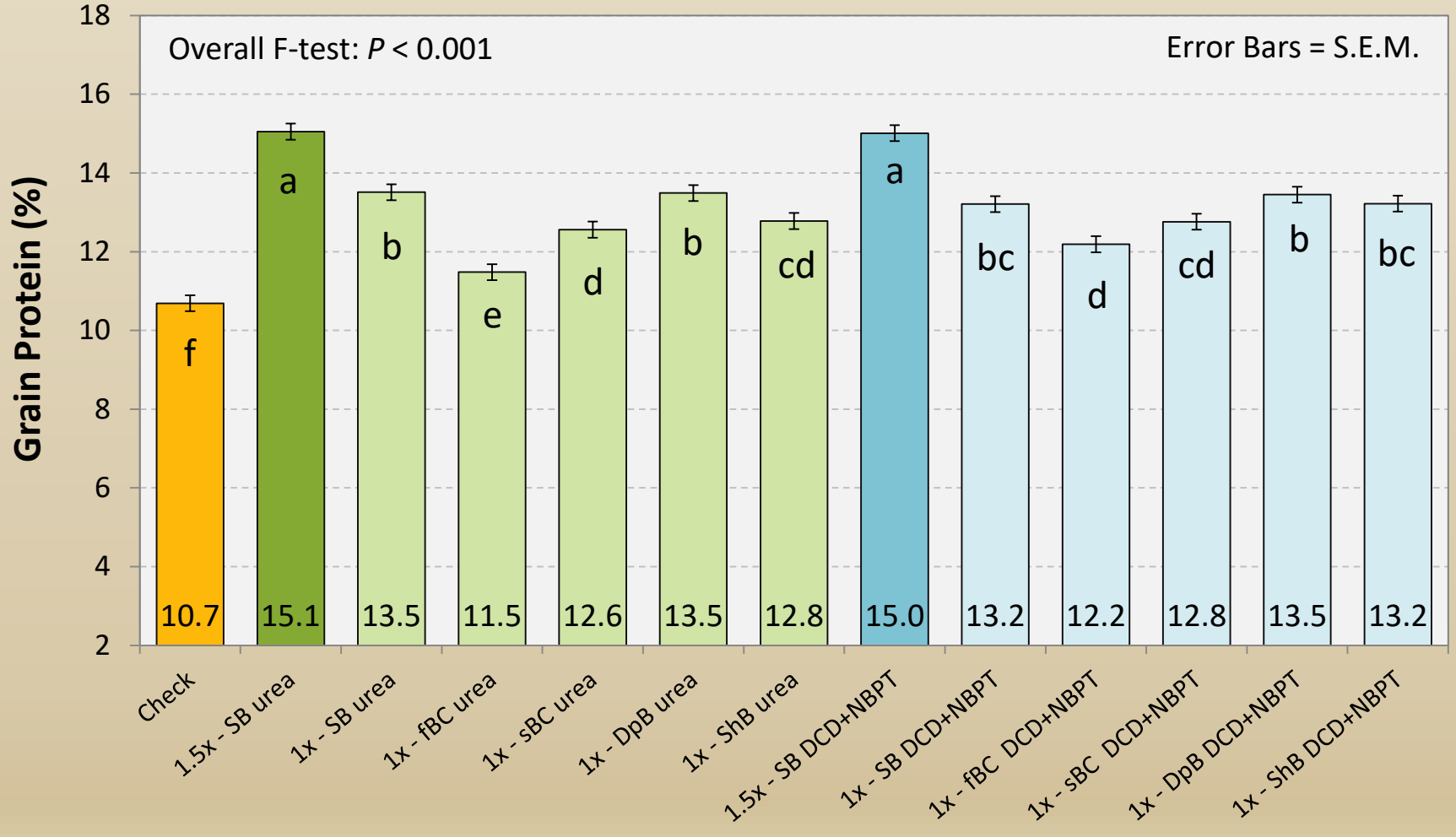
Indian Head 2021



SB – Side Band fBC – fall Broadcast sBC – spring Broadcast DpB – fall Deep Band ShB – fall shallow band

N Management Effects on Wheat Protein

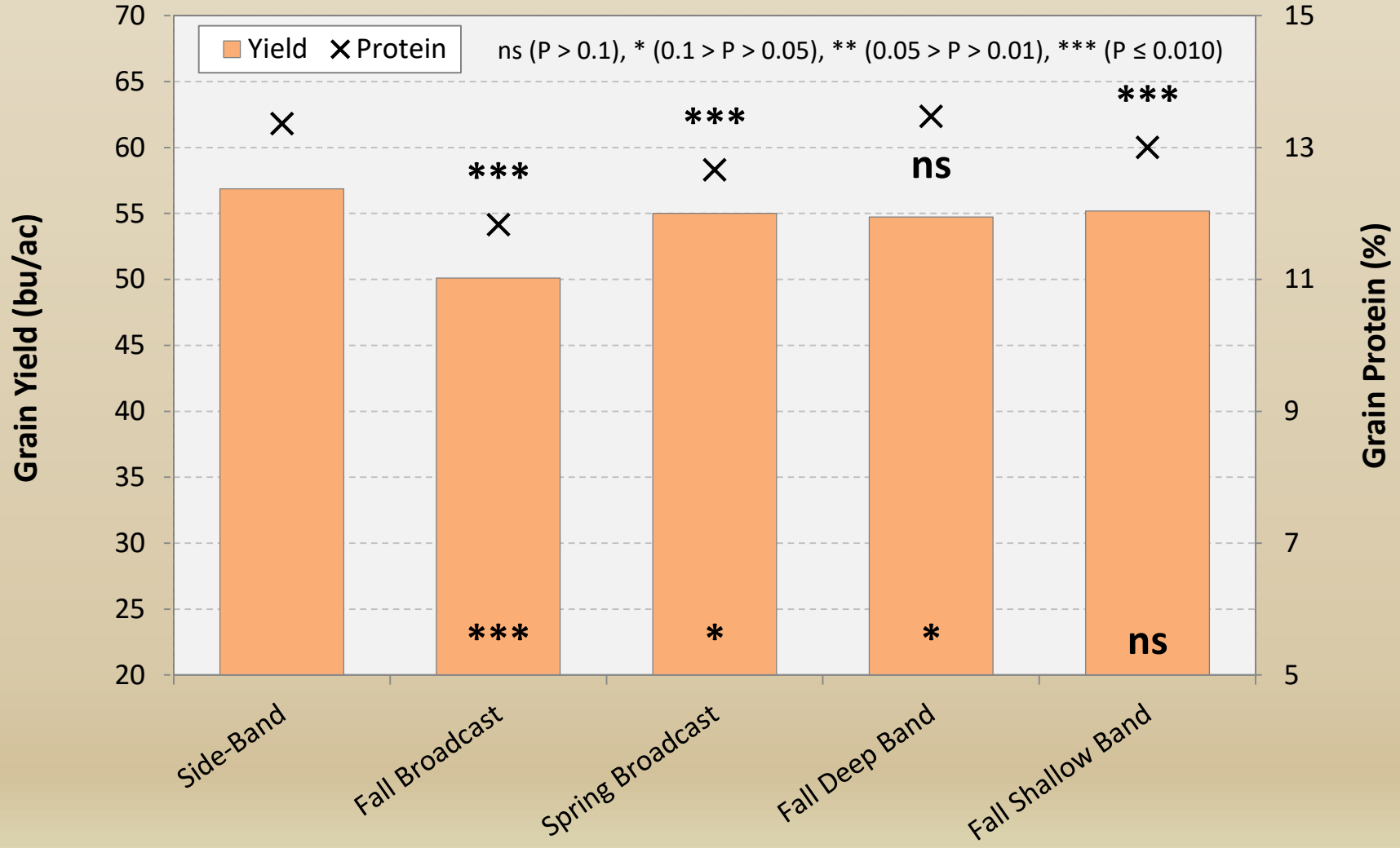
Indian Head 2021



SB – Side Band fBC – fall Broadcast sBC – spring Broadcast DpB – fall Deep Band ShB – fall shallow band

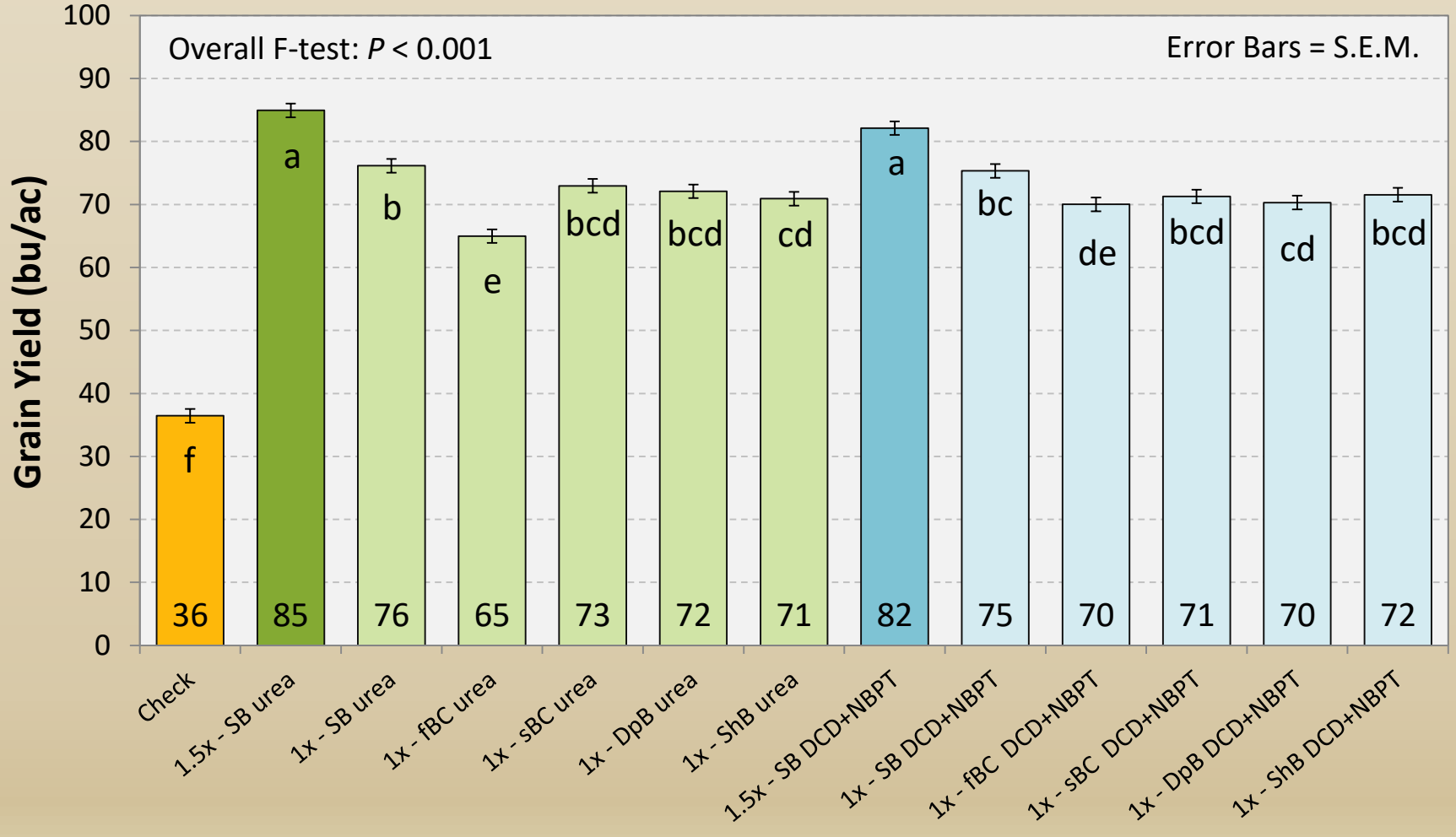
Predetermined Contrast Comparisons

Two-Pass vs. Sideband (2021)



N Management Effects on Wheat Yield

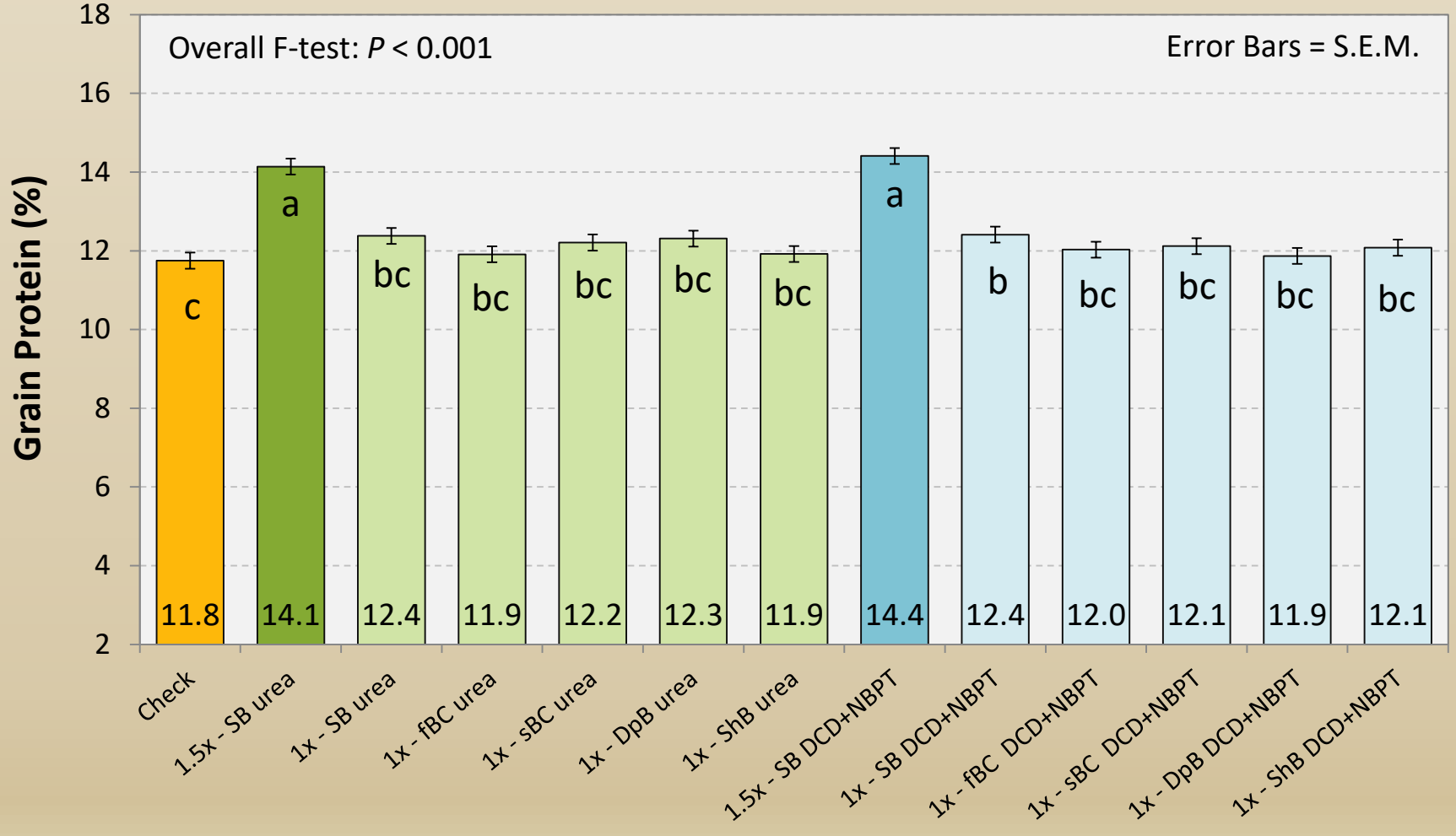
Indian Head 2022



SB – Side Band fBC – fall Broadcast sBC – spring Broadcast DpB – fall Deep Band ShB – fall shallow band

N Management Effects on Wheat Protein

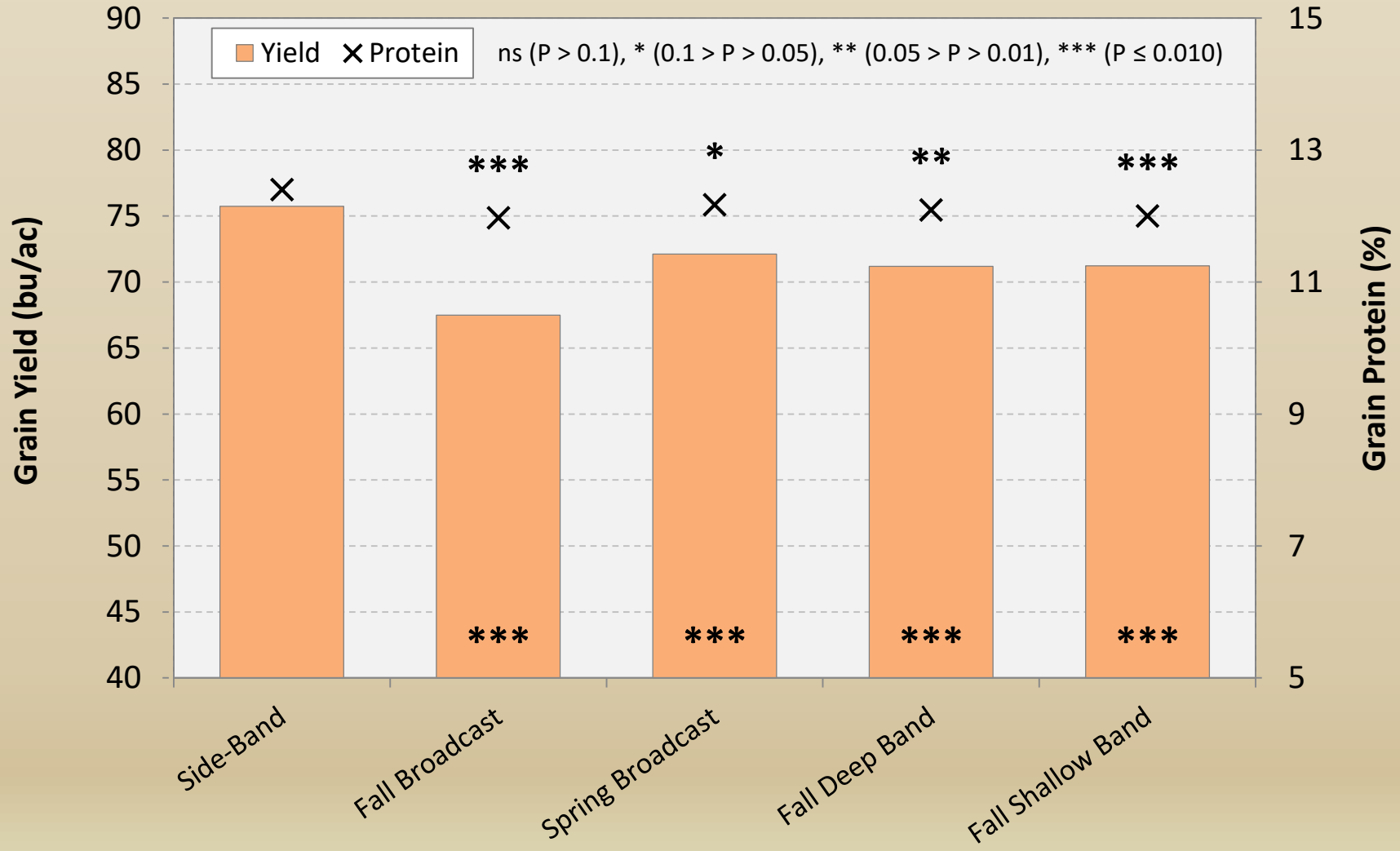
Indian Head 2022



SB – Side Band fBC – fall Broadcast sBC – spring Broadcast DpB – fall Deep Band ShB – fall shallow band

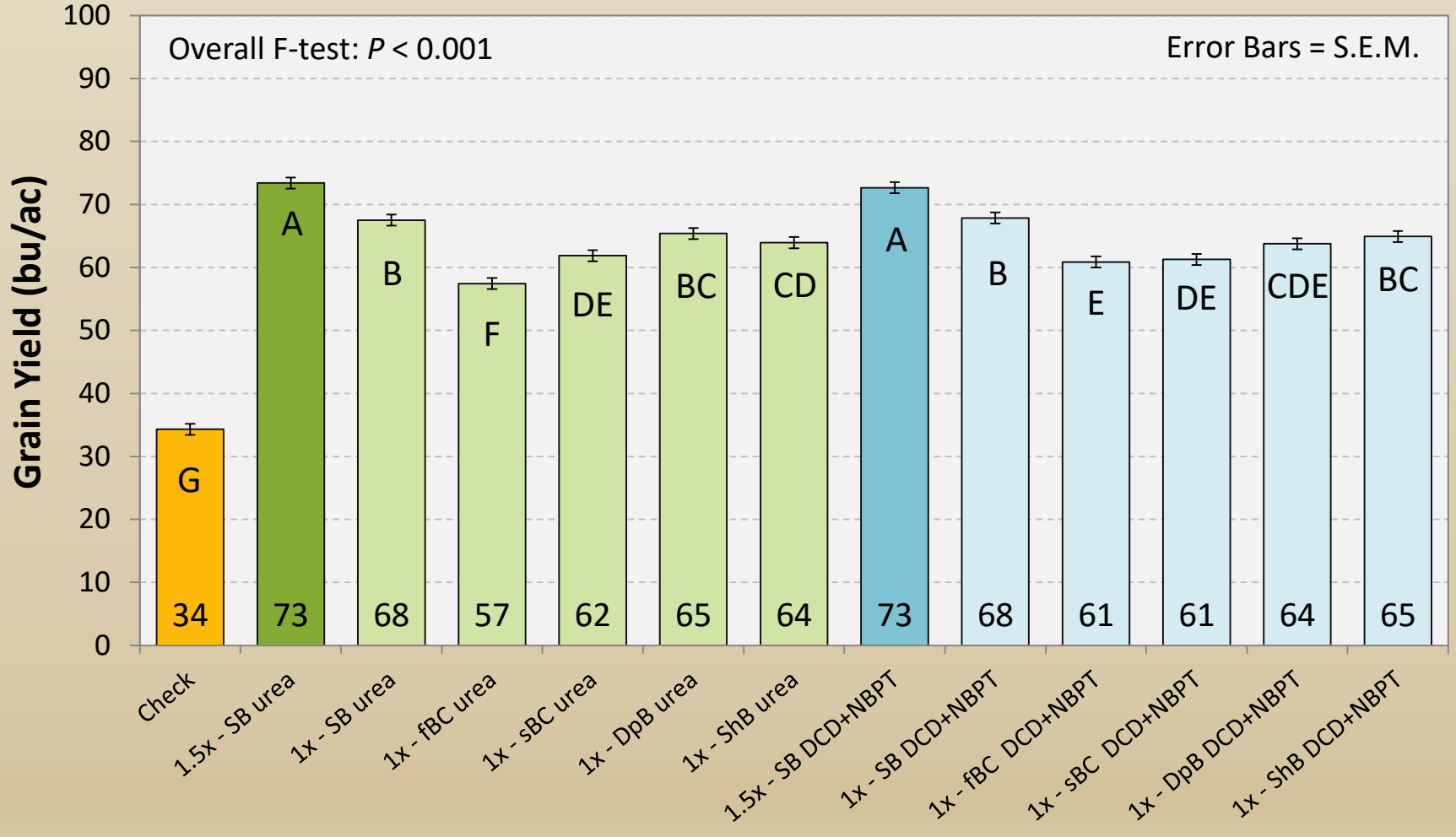
Predetermined Contrast Comparisons

Two-Pass vs. Sideband (2022)



N Management Effects on Wheat Yield

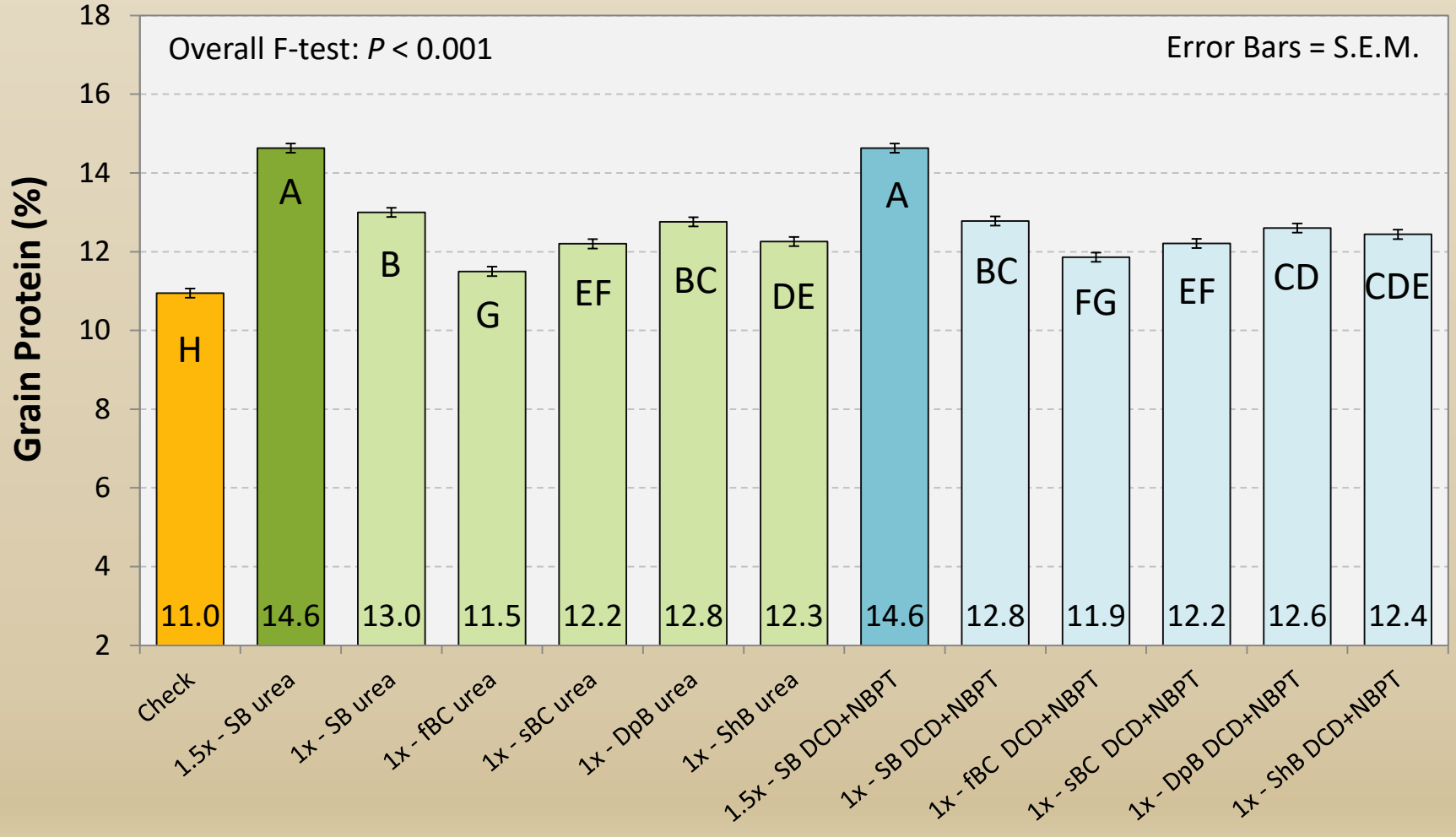
Three-Year Average



SB – Side Band fBC – fall Broadcast sBC – spring Broadcast DpB – fall Deep Band ShB – fall shallow band

N Management Effects on Wheat Protein

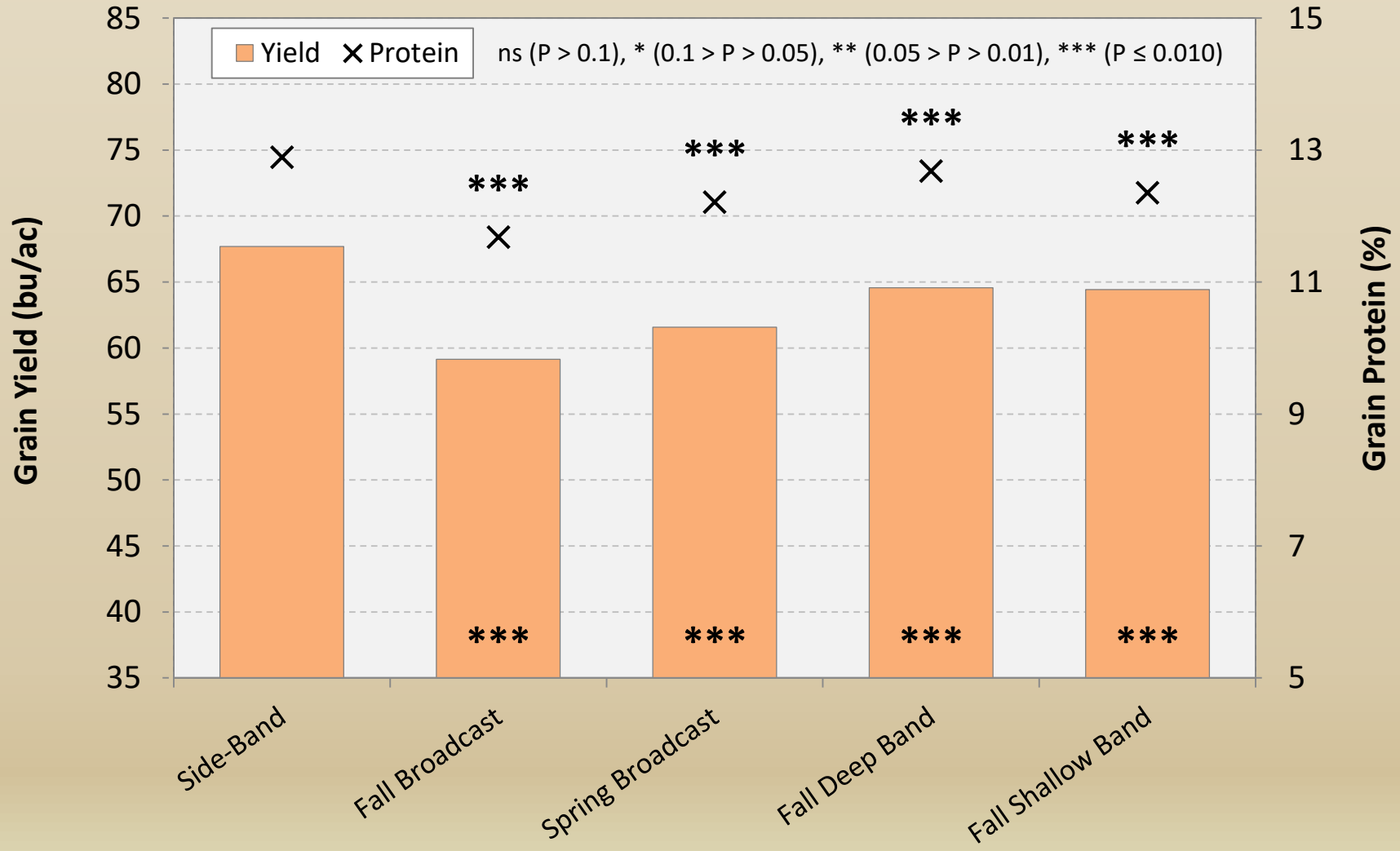
Three-Year Average



SB – Side Band fBC – fall Broadcast sBC – spring Broadcast DpB – fall Deep Band ShB – fall shallow band

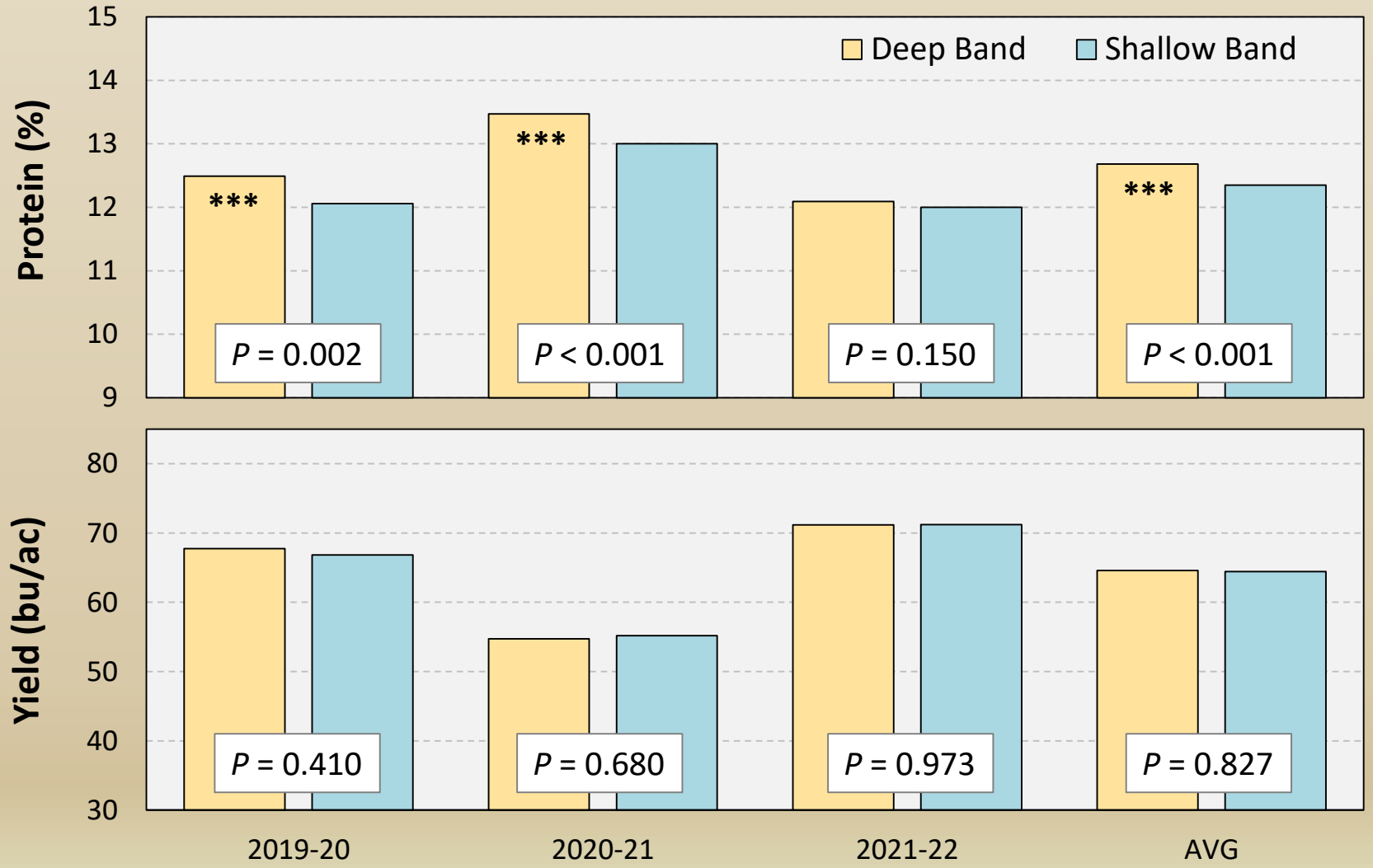
Predetermined Contrast Comparisons

Two-Pass vs. Sideband (Three-Year Average)



Predetermined Contrast Comparisons

Deep Band (6,12) versus Shallow Band (7,13)



Managing Drought Risk in Spring Wheat with Split Nitrogen Applications (2022)

Managing Drought Risk in Spring Wheat with Split Nitrogen Applications (2022)

Objectives: To demonstrate the efficacy of various rates and timings of split-applied N relative to applying all of the N at seeding

Locations: Yorkton (lead), Indian Head, Melfort, Outlook, Scott, & Swift Current

Treatments:

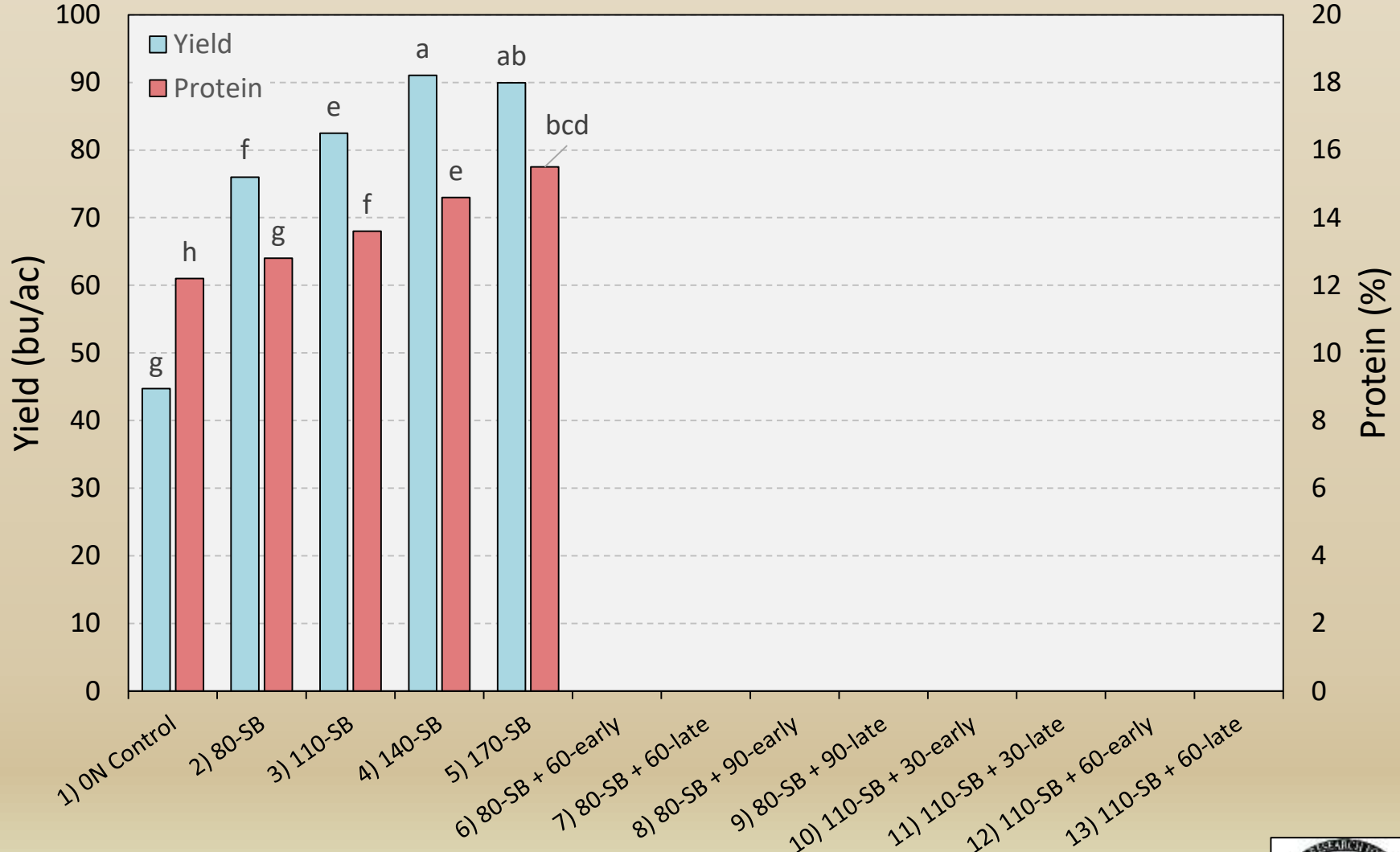
100% at Seeding	Split Applications	
1) Control (0 N)	(early – 3-5 leaf stage; late – early flag leaf stage)	
2) 80 lb N/ac	6) 80 N + 60 N early (140)	10) 110 N + 30 N early (140)
3) 110 lb N/ac	7) 80 N + 60 N late (140)	11) 110 N + 30 N late (140)
4) 140 lb N/ac	8) 80 N + 90 N early (170)	12) 110 N + 60 N early (170)
5) 170 lb N/ac	9) 80 N + 90 N late (170)	13) 110 N + 60 N late (170)

- N applied at seeding was side-banded urea, in-crop N was dribbled-banded UAN

Data Collection: 1) Plant density, 2) Grain Yield, and 3) Grain Protein

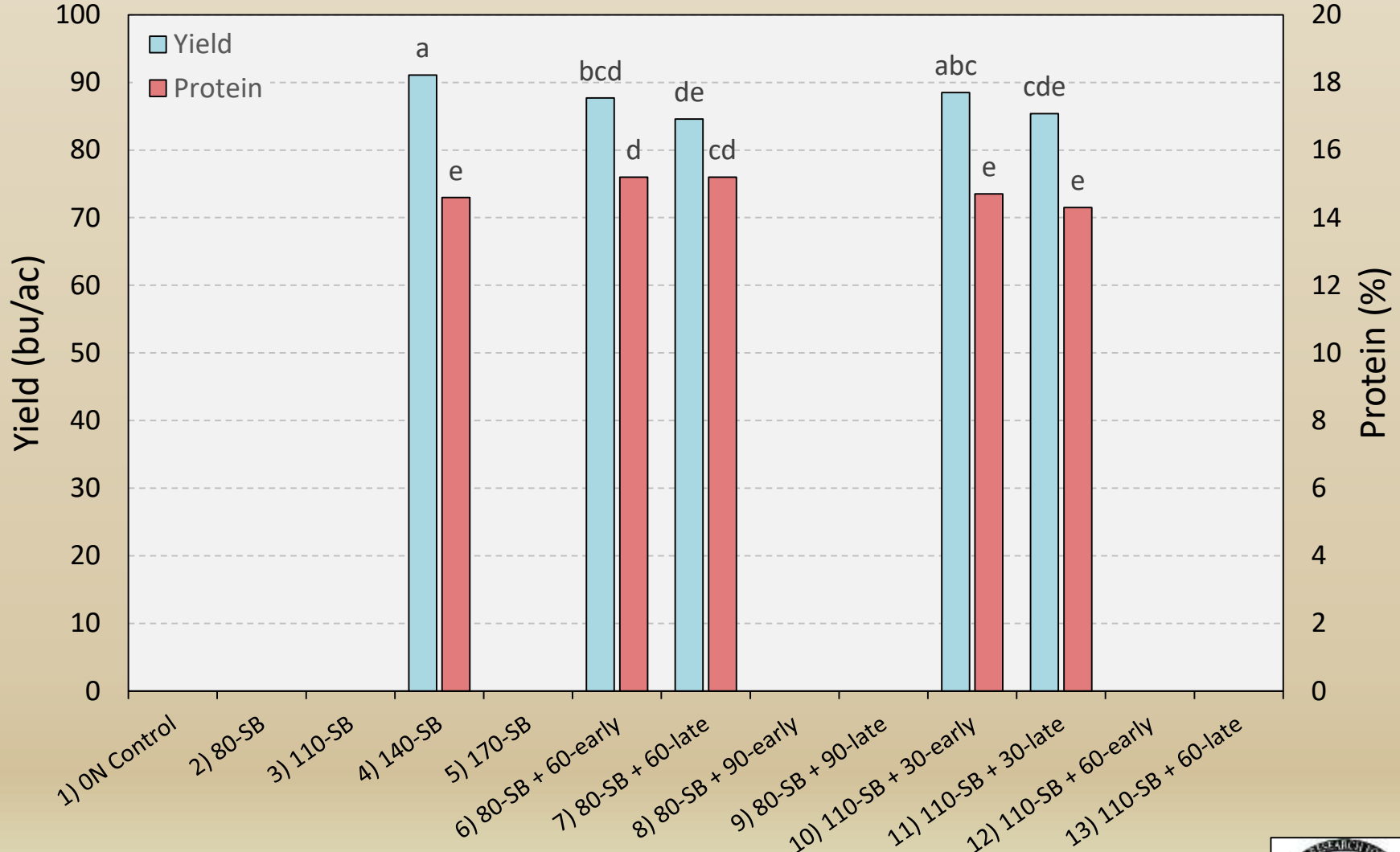
Indian Head 2022

Overall Response to Side-Banded N



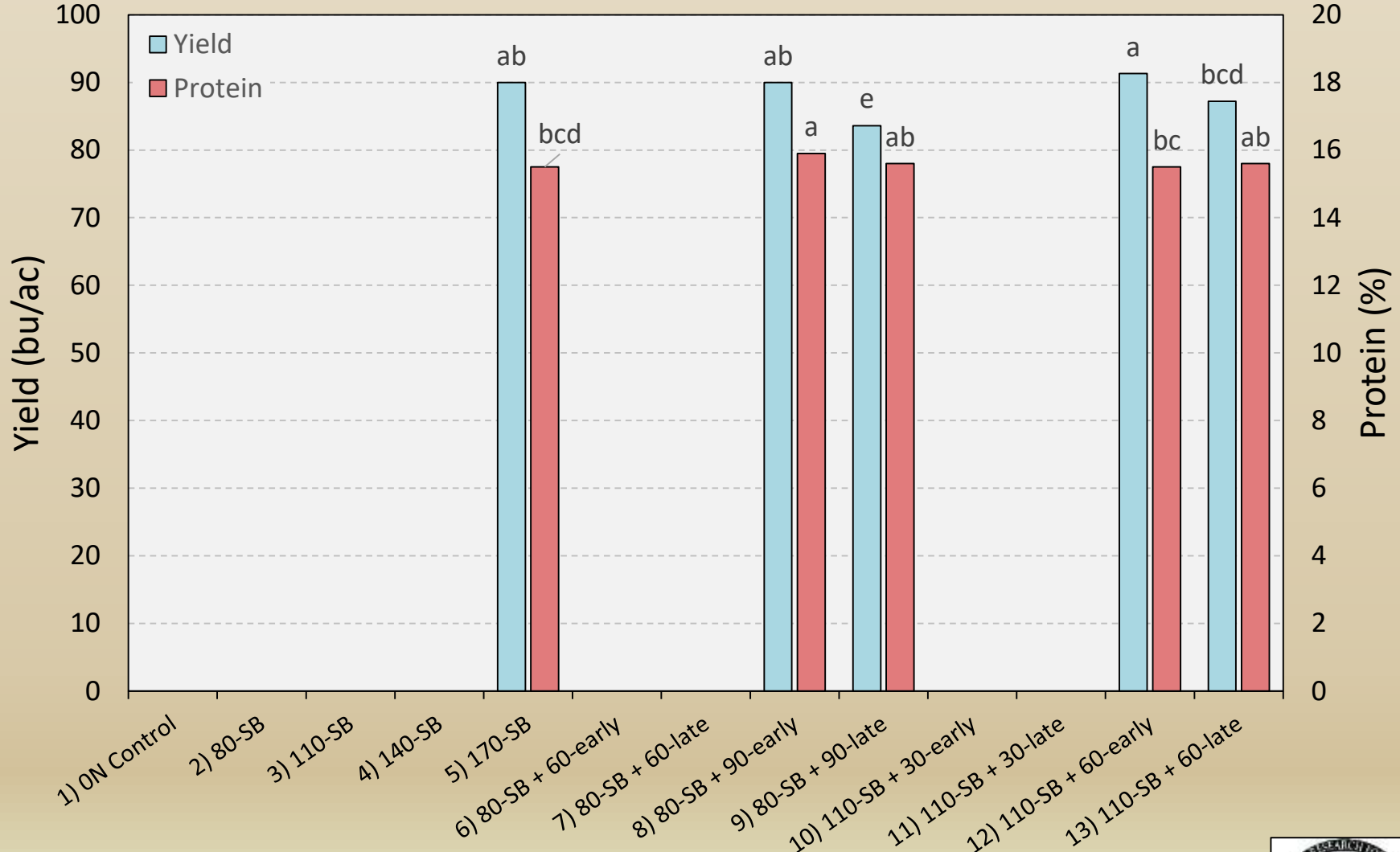
Indian Head 2022

Side-Band versus Split – 140 lb Total N/ac



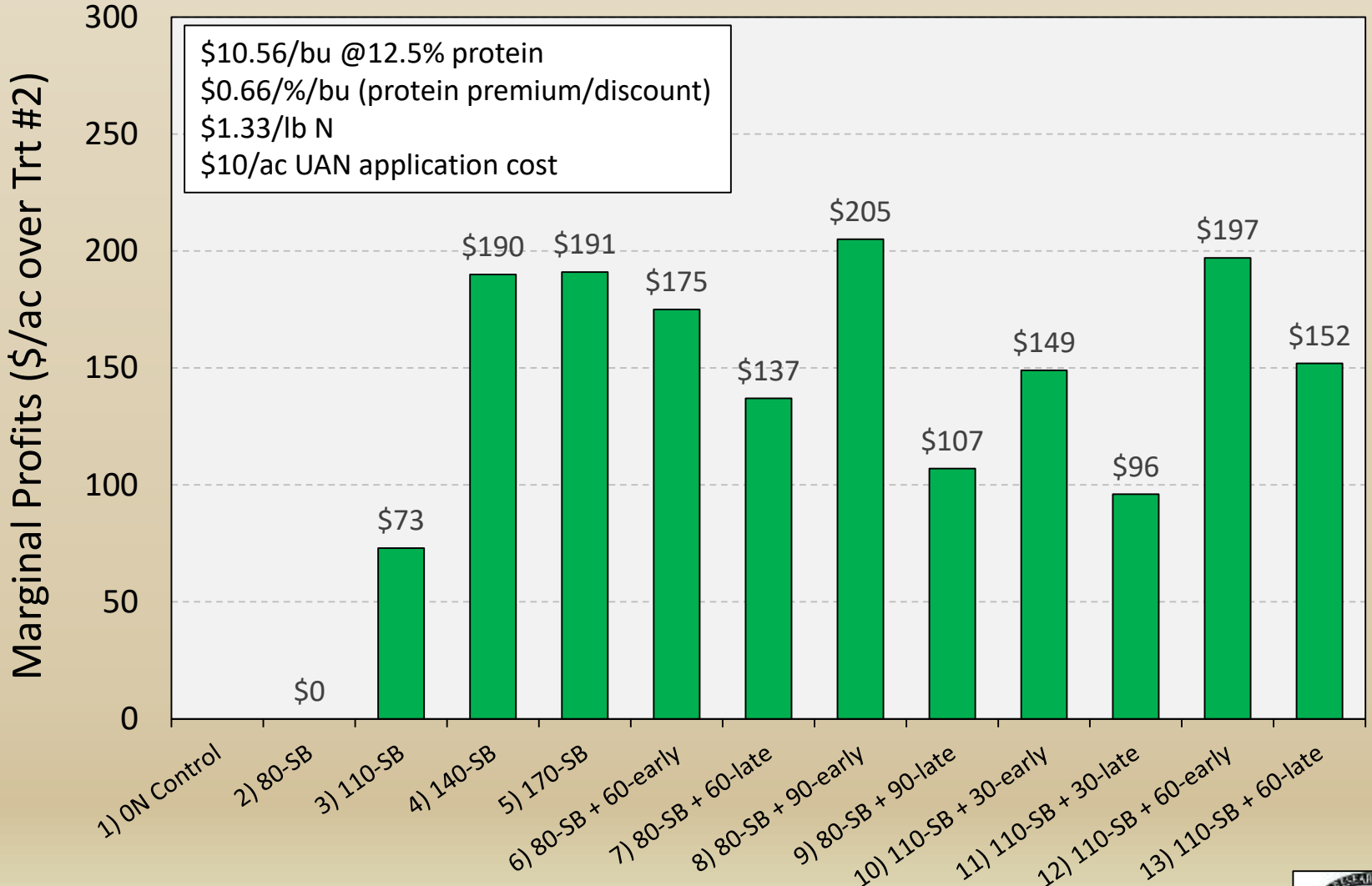
Indian Head 2022

Side-Band versus Split – 170 lb Total N/ac



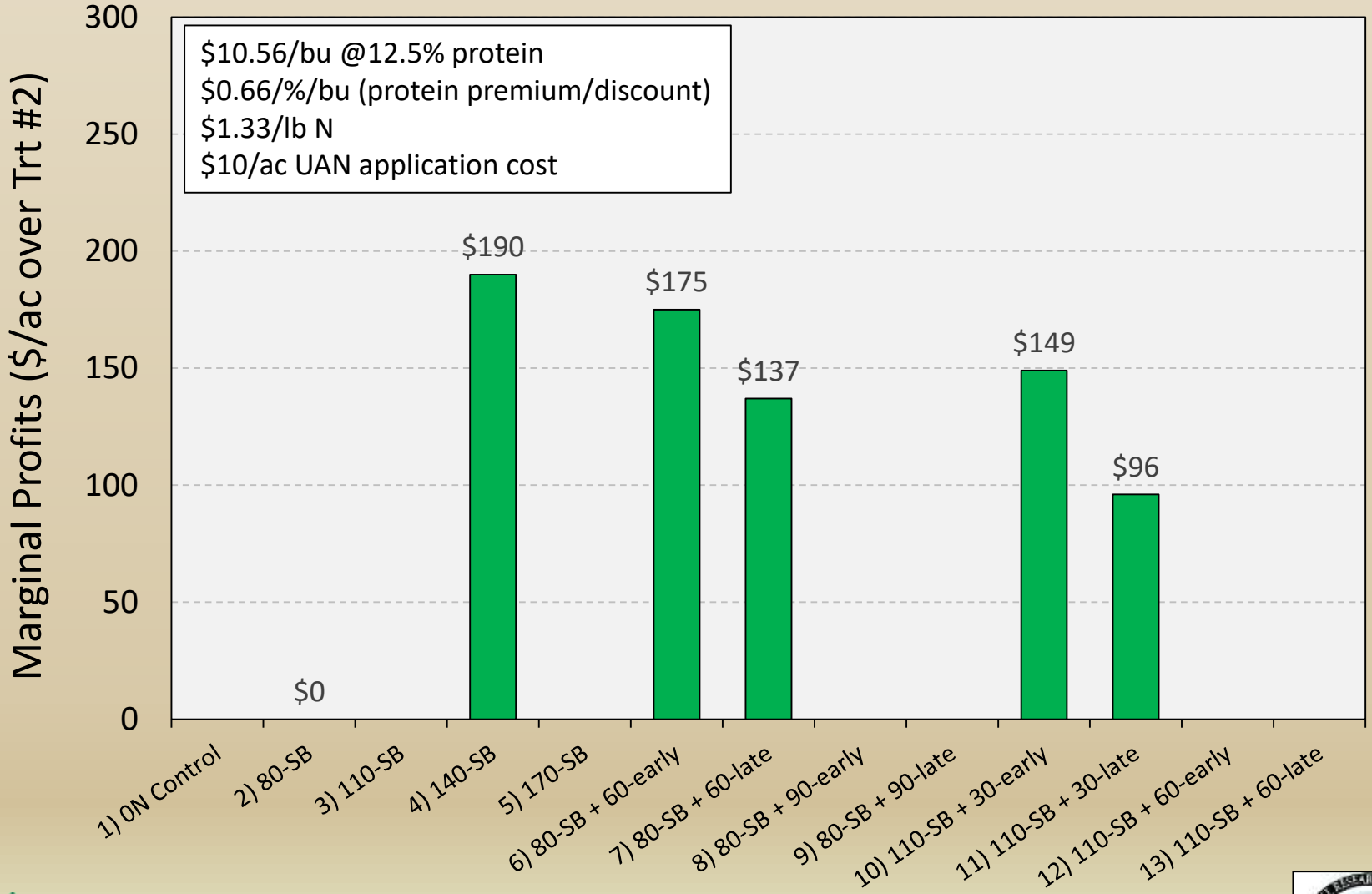
Indian Head 2022

Marginal Profits (relative to 80 lb total N/ac at seeding)



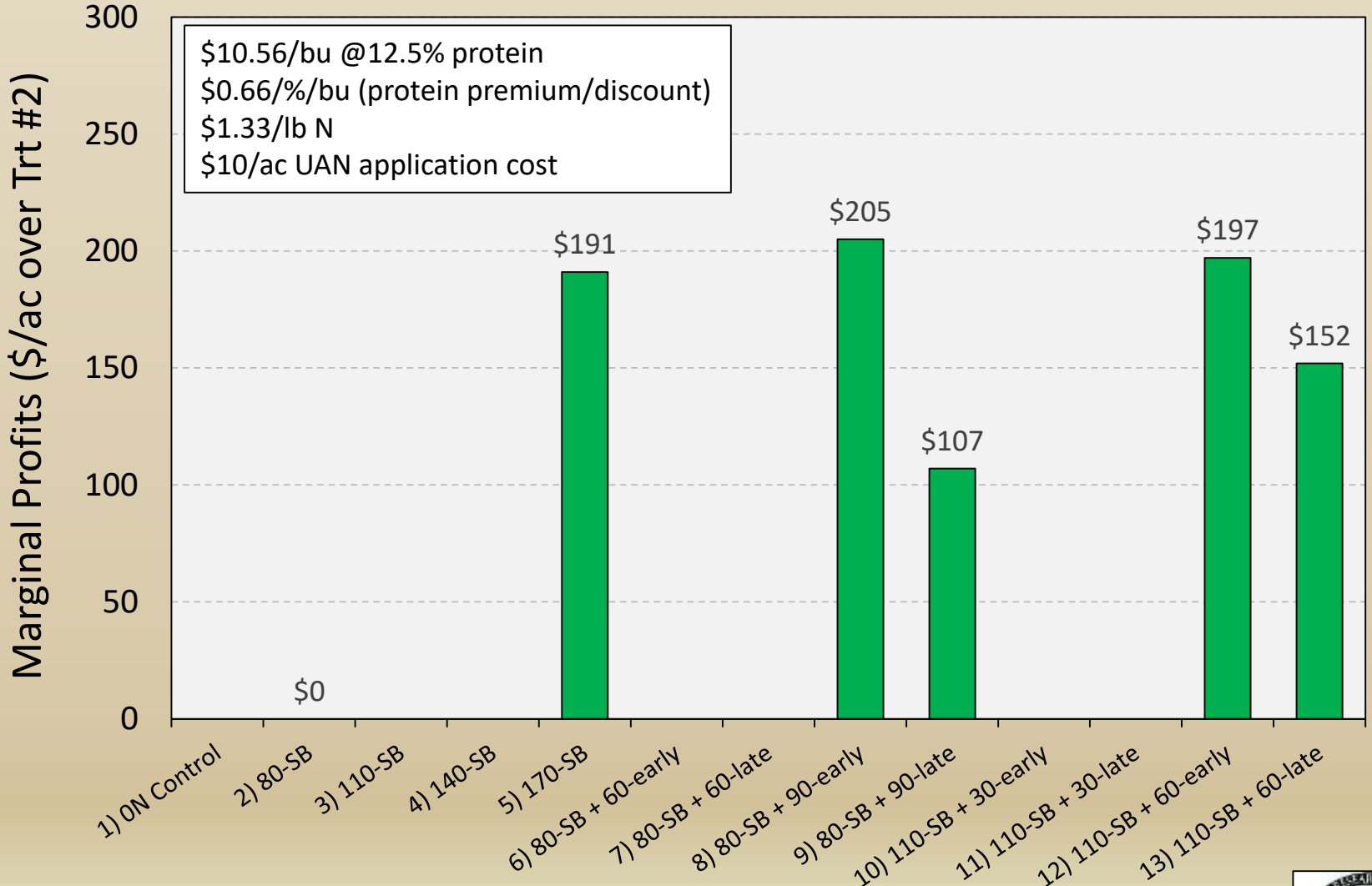
Indian Head 2022 (140 lb total N/ac)

Marginal Profits (relative to 80 lb total N/ac at seeding)



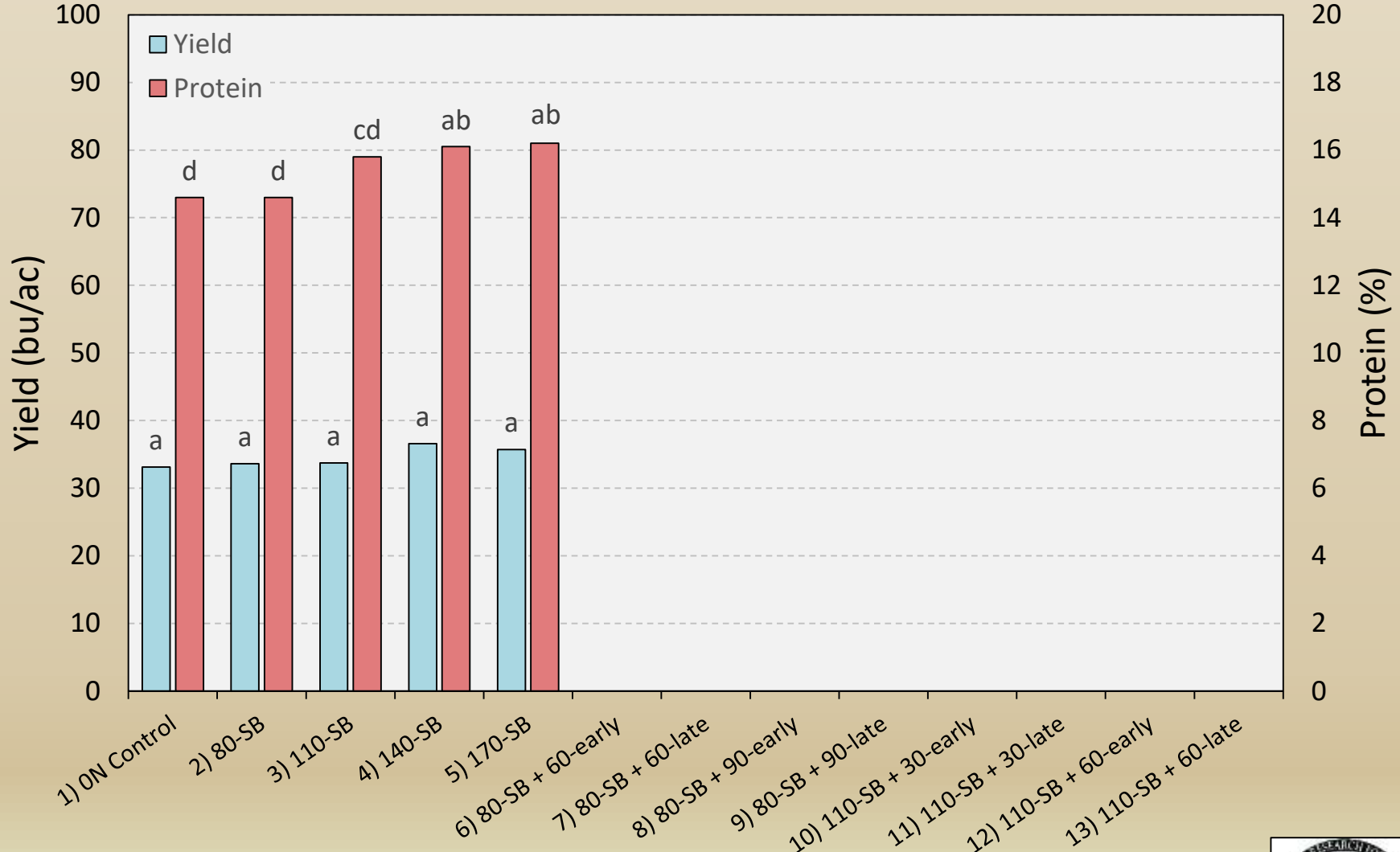
Indian Head 2022 (170 lb total N/ac)

Marginal Profits (relative to 80 lb total N/ac at seeding)



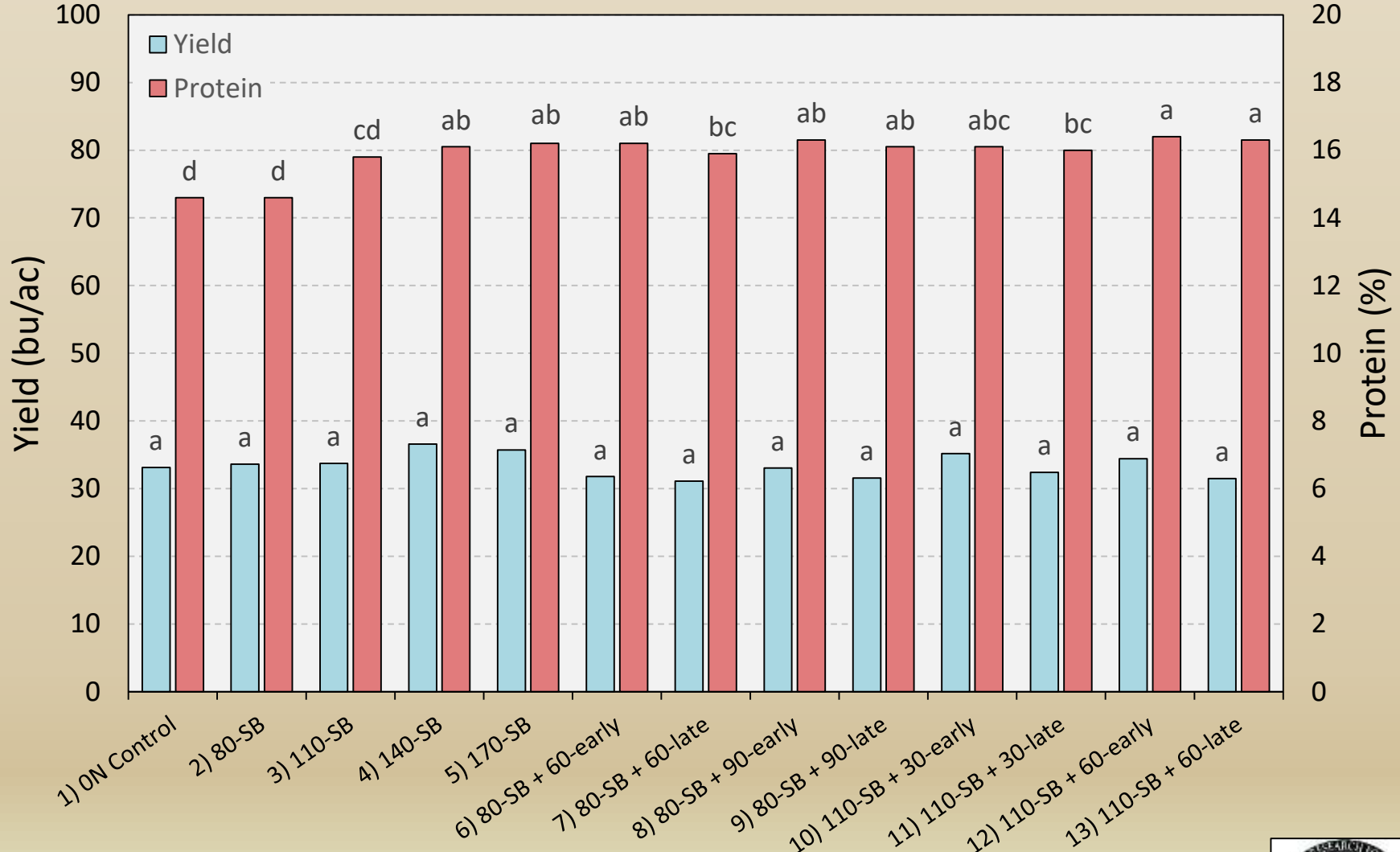
Swift Current 2022

Overall Response to Side-Banded N



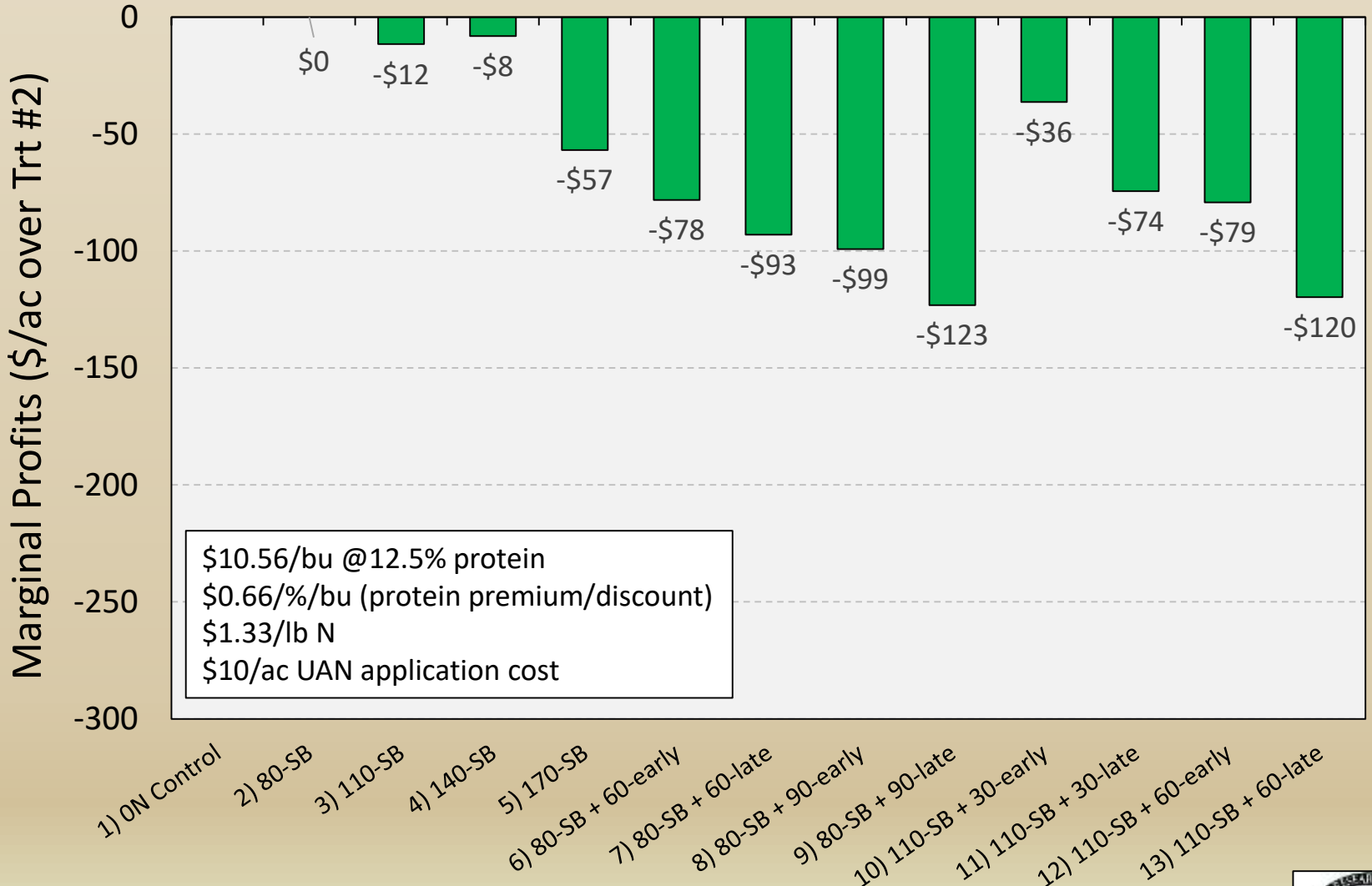
Swift Current 2022

Yield & Protein Results for All Treatments



Swift Current 2022

Marginal Profits (relative to 80 lb total N/ac at seeding)



4R N Management Principles: Conclusions

- Relative performance of N management strategies varies with environment, but it has been repeatedly shown that single-pass seeding-fertilization is hard to improve upon for spring crops in western Canada
- Reasons for utilizing alternative N management strategies have more to do with improving seeding logistics, taking advantage of lower fertilizer prices in the fall, & mitigating risk (i.e., deferring N application under severe drought) than agronomy; but flexibility is important for farmers in this regard
- Enhanced efficiency N forms can reduce the risks associated with less optimal timing/placement options, but do not usually close the gap entirely and agronomic benefits of such products with side or mid-row banding are relatively infrequent
- Deeper placement of banded fertilizer can be advantageous; however, the difference between shallow vs. deep banding is minor from an agronomic perspective – deep banding may be more important in dry, coarse soils
- Split-applications can have merit for risk management under drought conditions, but have the most potential to be truly beneficial in wetter and warmer environments where the potential for losses, yields, & total N requirements are all higher, the growing season is longer & the risks of in-crop N being stranded due to dry weather are lower

THANK YOU

Chris Holzapfel, MSc PAg
Phone: 306-695-7761
Email: cholzapfel@iharf.ca
Website: www.iharf.ca
Twitter: @CBHolz13