

2021 IHARF Agronomy Update

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Presentation Overview

1. **4R Nitrogen Management in Spring Wheat (2017-21)**
2. **Winter Wheat Response to Nitrogen Rate & Management (2019-21)**
3. **Fall Rye Cover Crop Effects on Canola Emergence & Nitrogen Response (2021)**
4. **Canola Seed Safety & Yield Response to Various Phosphorus Forms (multi-location, 2020-21)**
5. **Pre-harvest Herbicide Options for Improving Seed & Straw Drydown in Flax (2020-21)**
6. **Non-traditional Nitrogen Management Strategies for Improved Flax Establishment & Yield (multi-location, 2021)**
7. **Dry Bean Response to Nitrogen Fertilization & Overall Adaption to Dryland, Solid-Seeded Production (multi-location, 2020-2021)**



Demonstrating 4R Nitrogen Management Principles in Spring Wheat (2017-21)

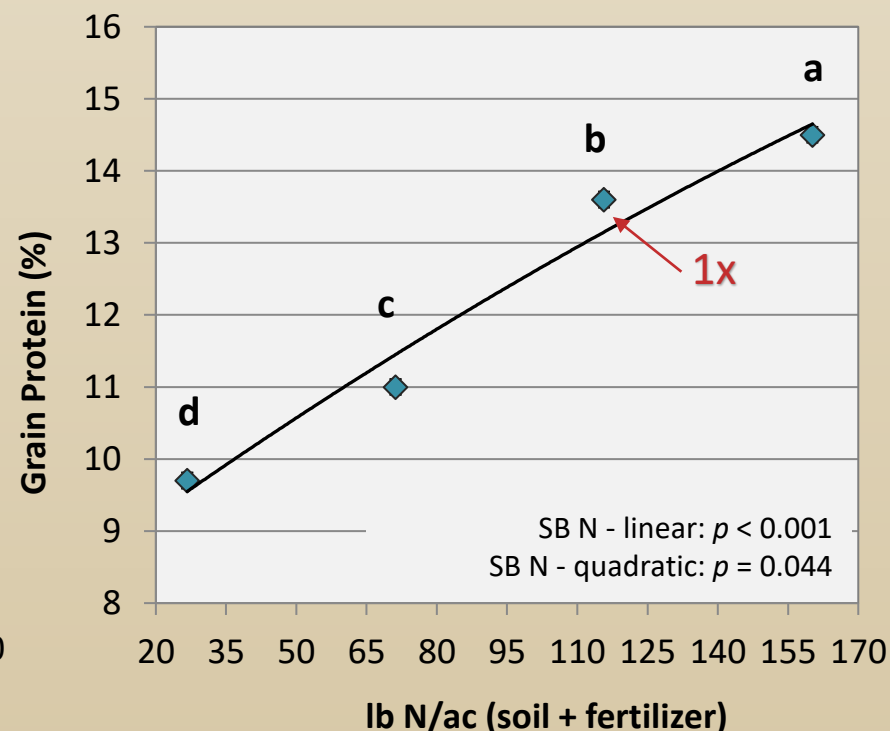
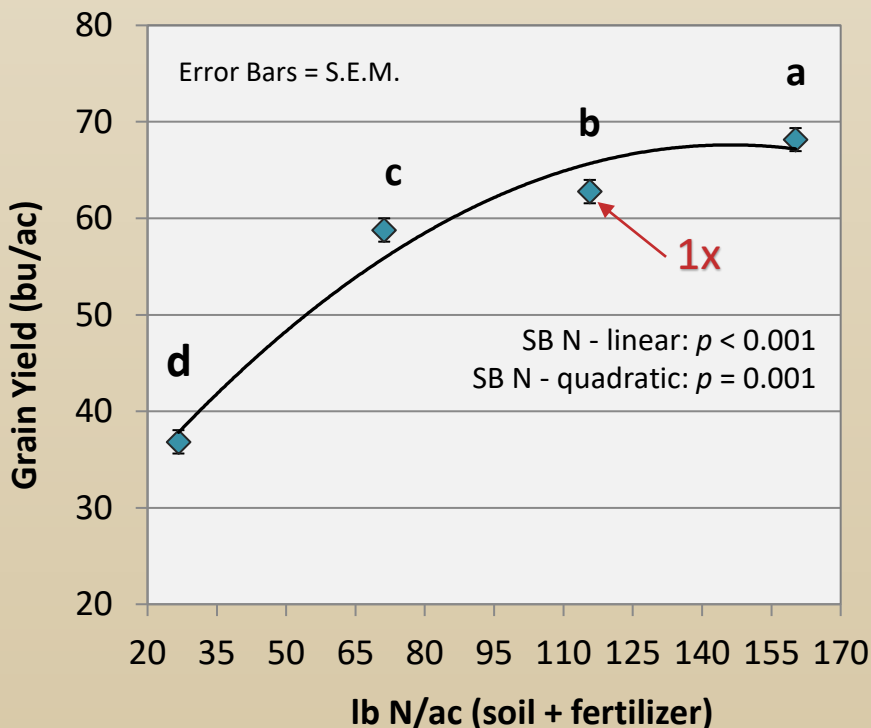


4R Nitrogen Treatments: Indian Head 2017

#	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)

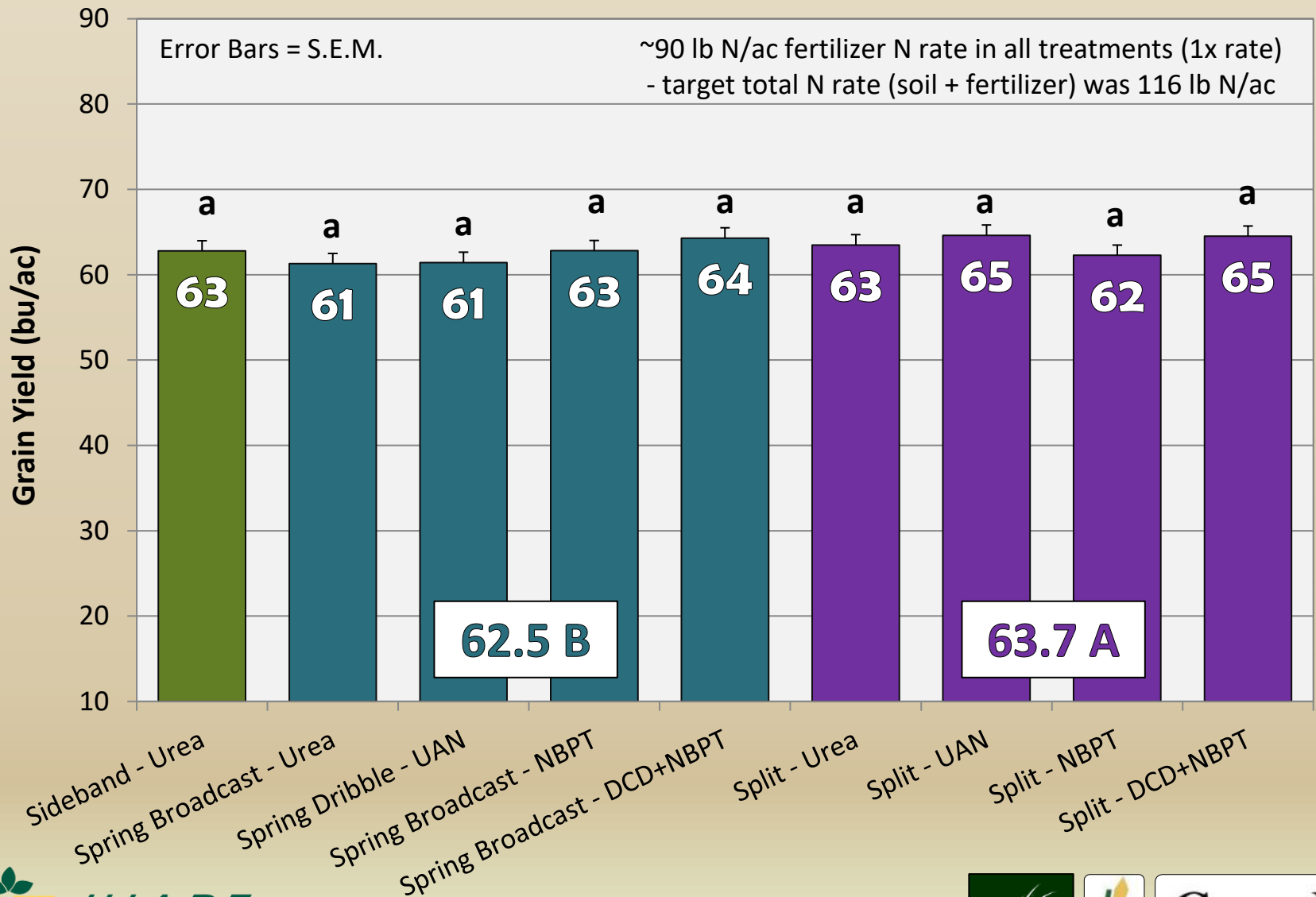
Nitrogen Rate Effects on Wheat Yield & Protein (Indian Head 2017)



N Source = Side-banded Urea
Residual $\text{NO}_3\text{-N}$ = 27 lb/ac (fall composite)

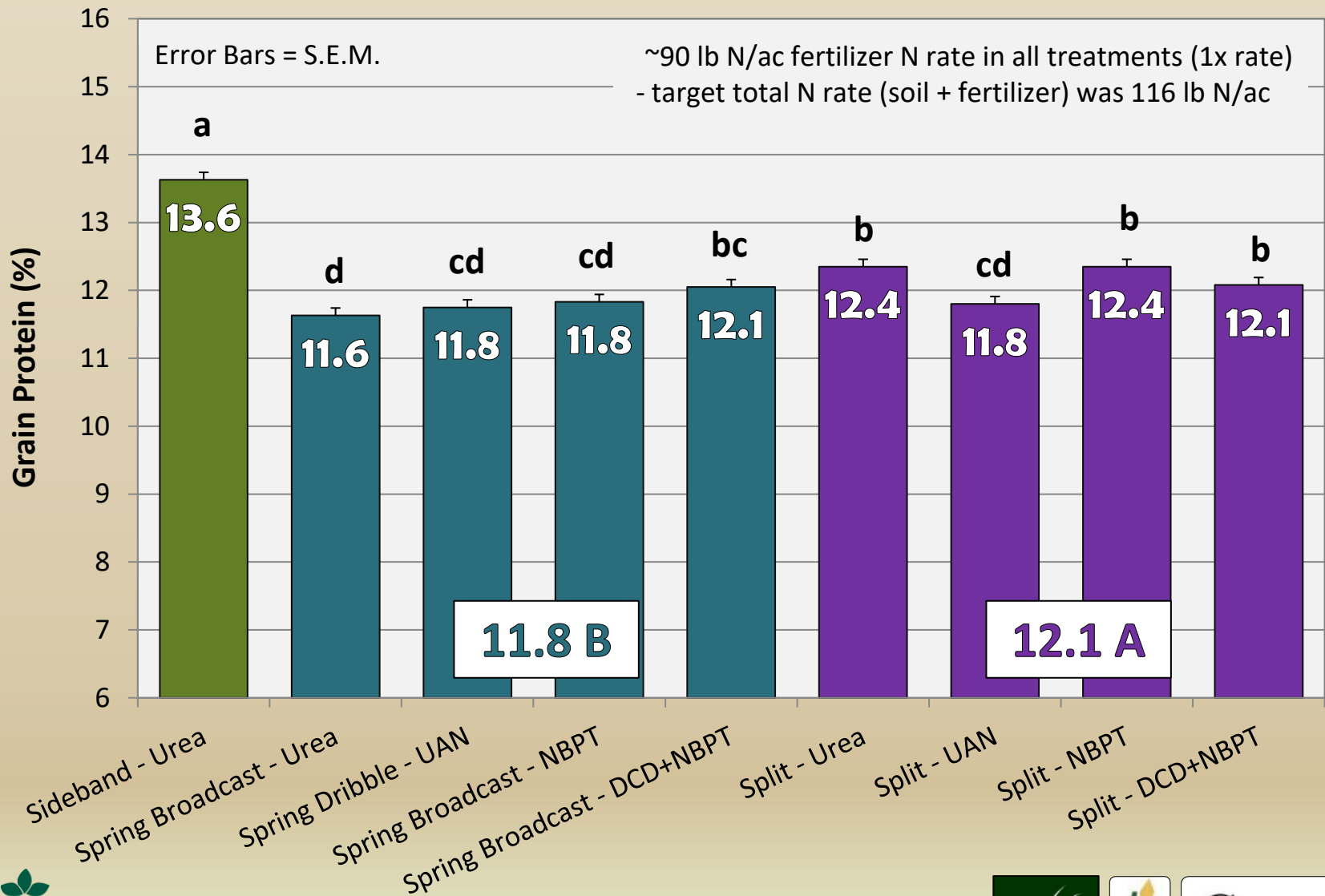
N Management Effects on Wheat Yield

Indian Head 2017



N Management Effects on Wheat Protein

Indian Head 2017

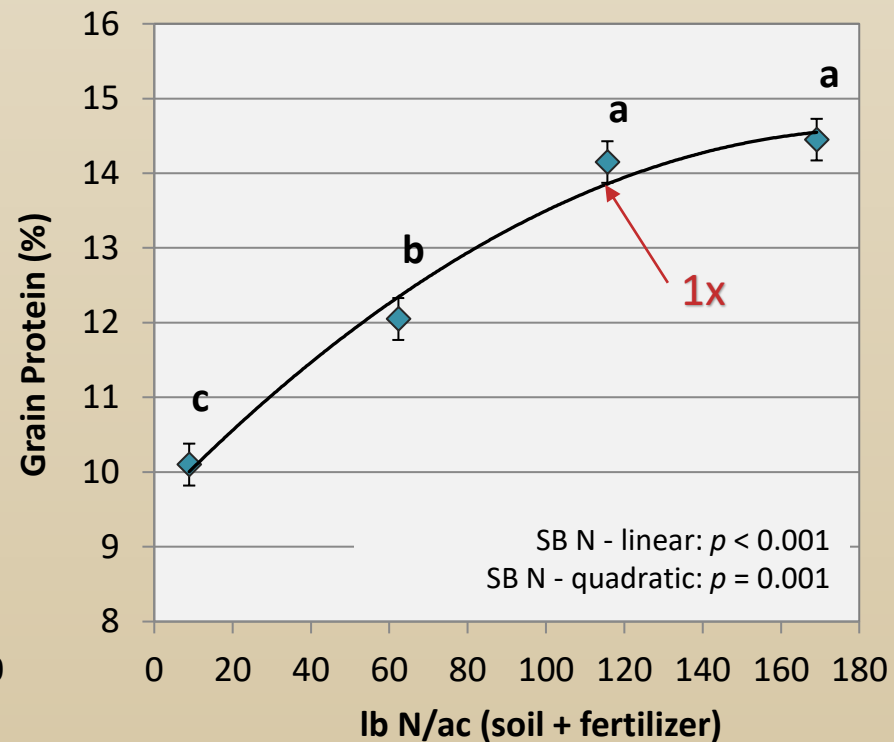
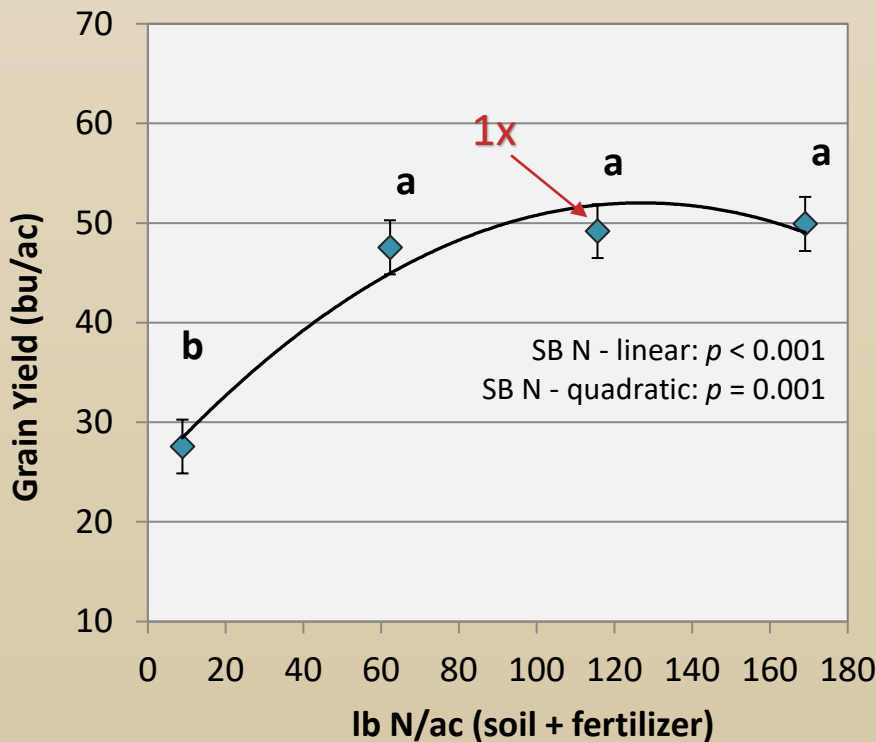


4R Nitrogen Treatments: Indian Head 2018

#	Form	Timing / Placement	Rate *	
1	Urea	Side-band	1.0x	May 16
2	NBPT (Agrotain®)	Side-band	1.0x	
3	DCD+NBPT (SUPERU®)	Side-band	1.0x	
4	Urea	Fall Surface Broadcast	1.0x	Oct 17
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	Oct 17
8	NBPT (Agrotain®)	Fall In-Soil Band	1.0x	
9	DCD+NBPT (SUPERU®)	Fall In-Soil Band	1.0x	

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

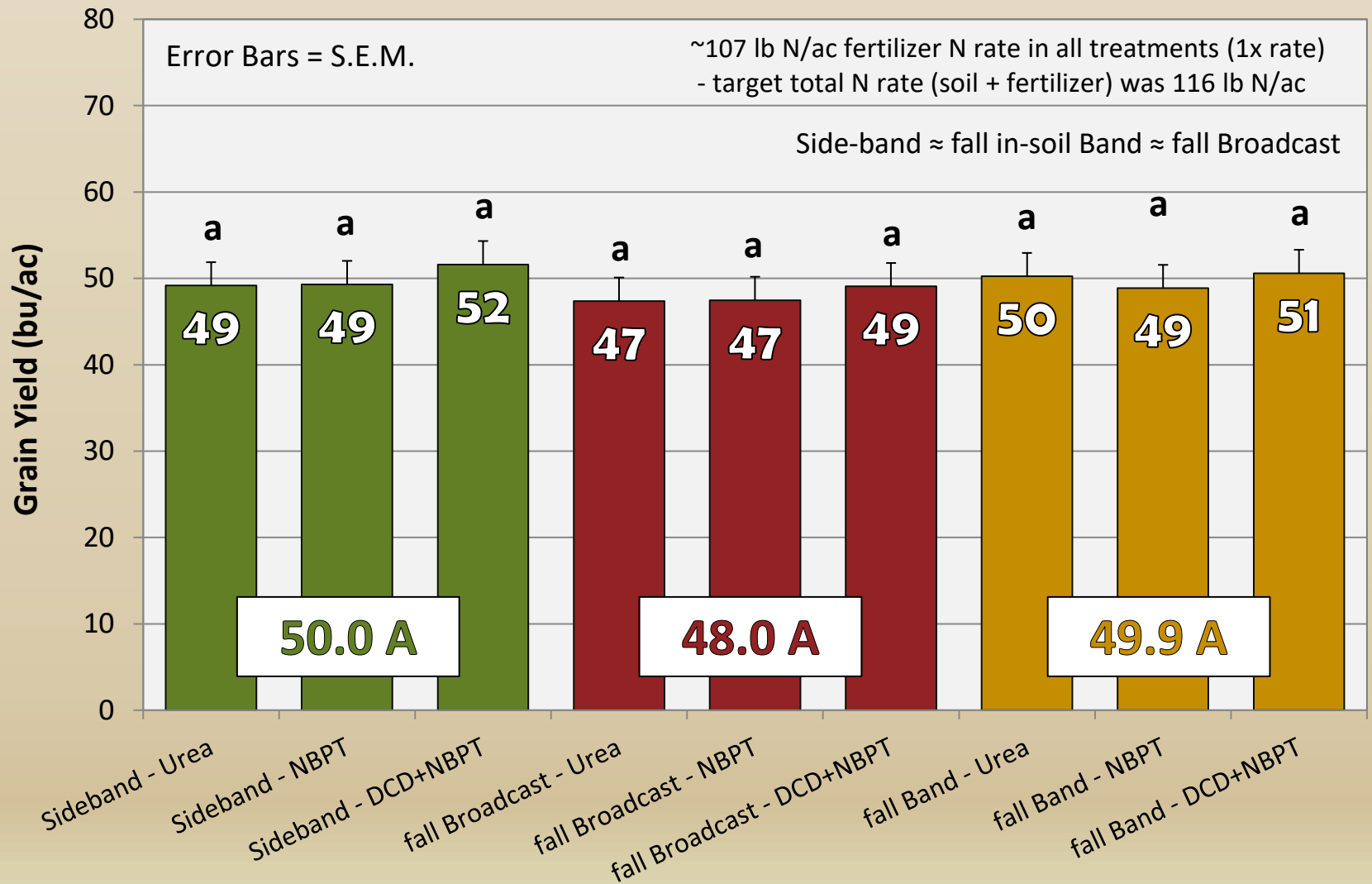
Nitrogen Rate Effects on Wheat Yield & Protein (Indian Head 2018)



N Source = Side-banded Urea
Residual $\text{NO}_3\text{-N} = 9 \text{ lb/ac}$ (fall composite)

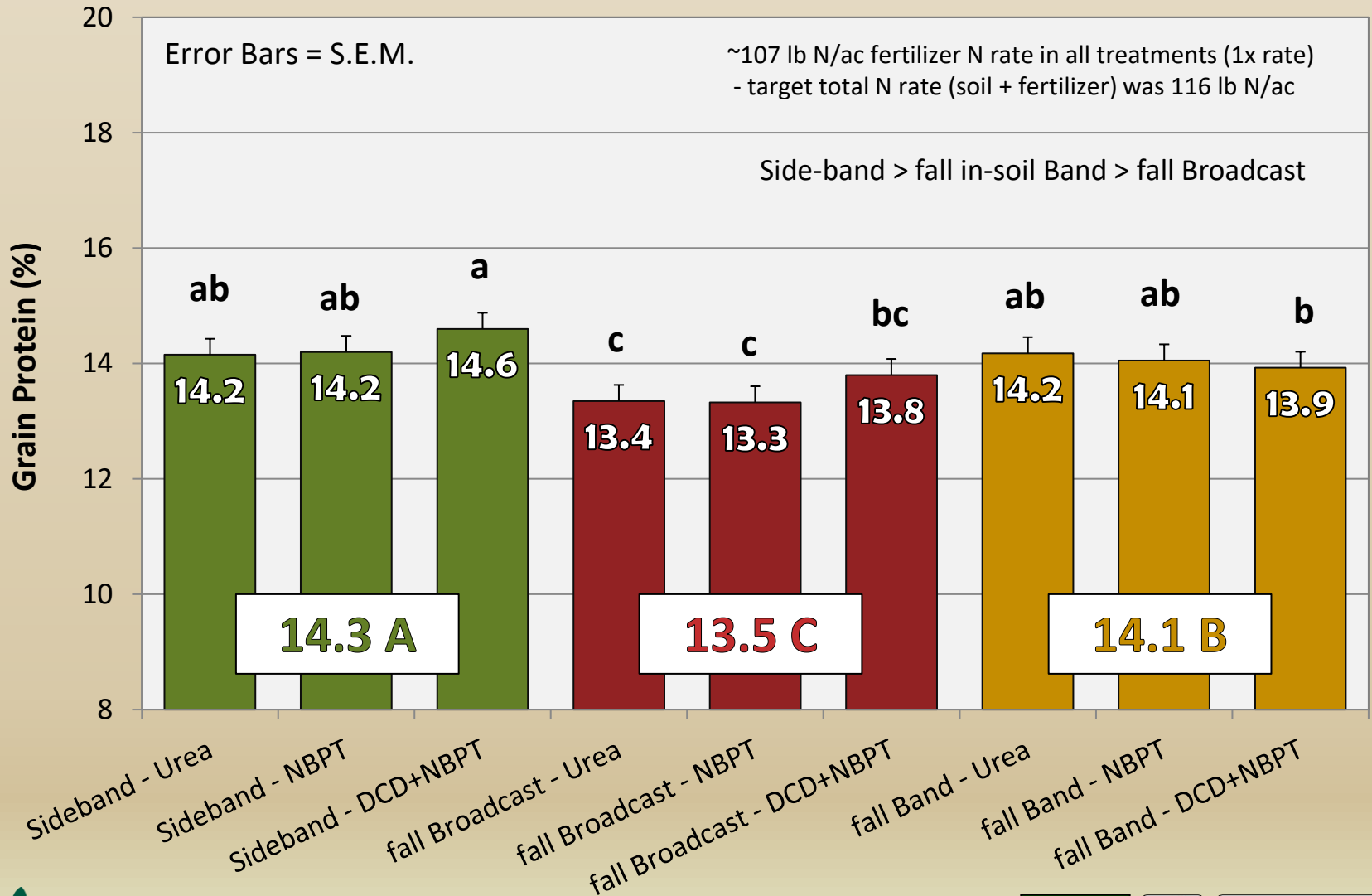
N Management Effects on Wheat Yield

Indian Head 2018



N Management Effects on Wheat Protein

Indian Head 2018

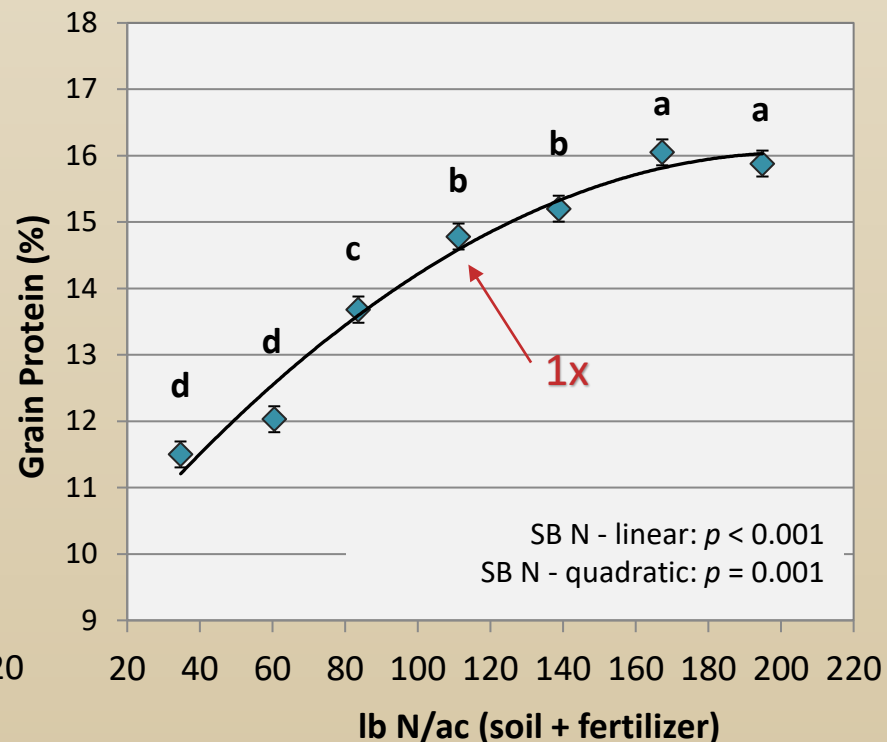
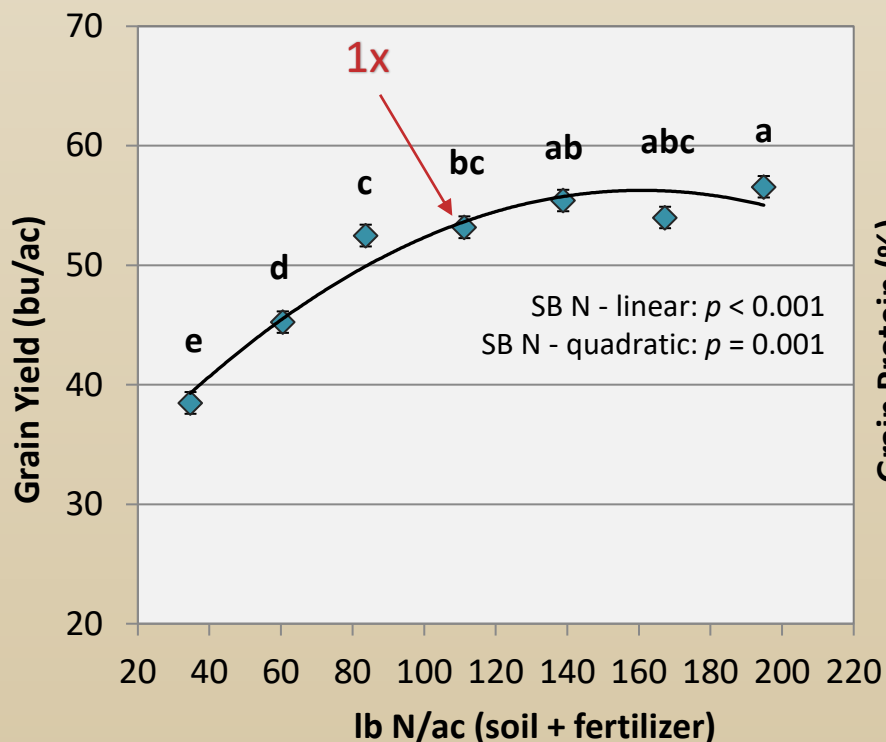


4R Nitrogen Treatments: Indian Head 2019

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

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

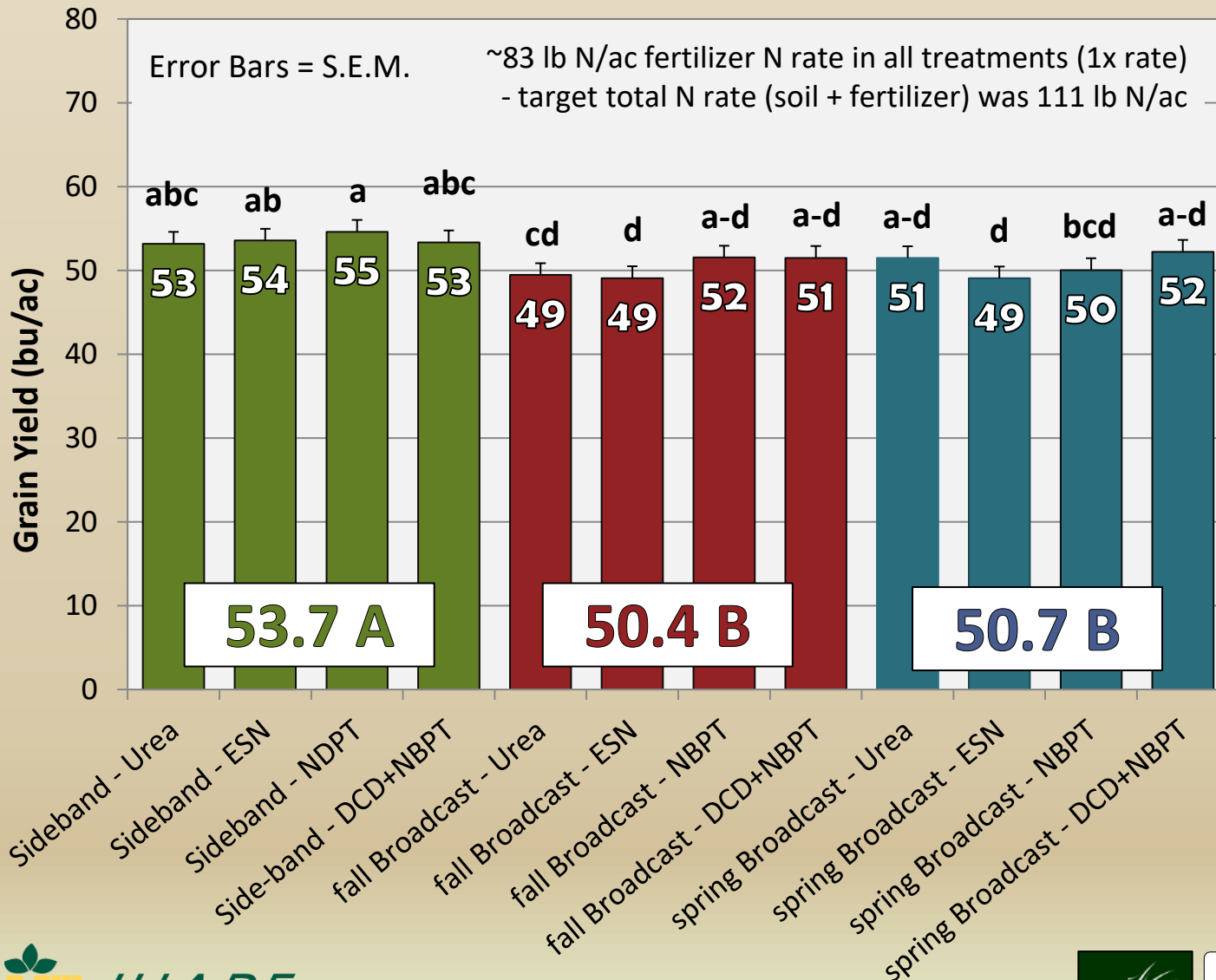
Nitrogen Rate Effects on Wheat Yield & Protein (Indian Head 2019)



N Source = Side-banded Urea
 Residual NO₃-N = 35 lb/ac (fall composite, includes N from MAP)

N Management Effects on Wheat Yield

Indian Head 2019

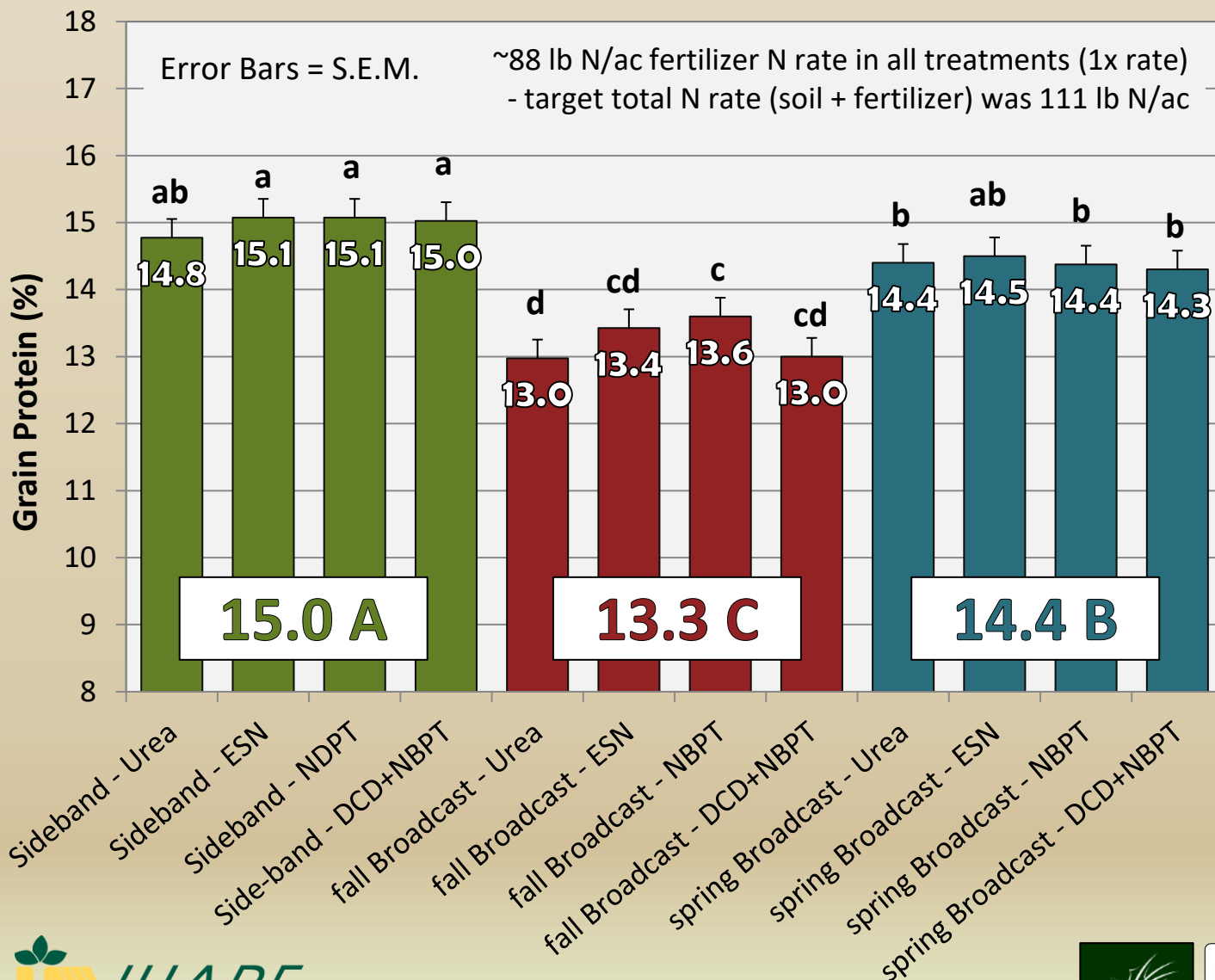


Source	Pr > F
Form (F)	0.392
Time / Place (TP)	0.003
F x TP	0.719



N Management Effects on Wheat Protein

Indian Head 2019



Source	Pr > F
Form (F)	0.232
Time / Place (TP)	<0.001
F x TP	0.750



4R Nitrogen Treatments: Indian Head 2020-21

#	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 NO₃-N (0-24"): 8 lb/ac in 2019-20 and 14 lb/ac in 2020-21

4R Nitrogen Treatments: Indian Head 2020-21

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%)
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%)
LT	35.3	24.9	51.8	77.4	63.8	51.2	244

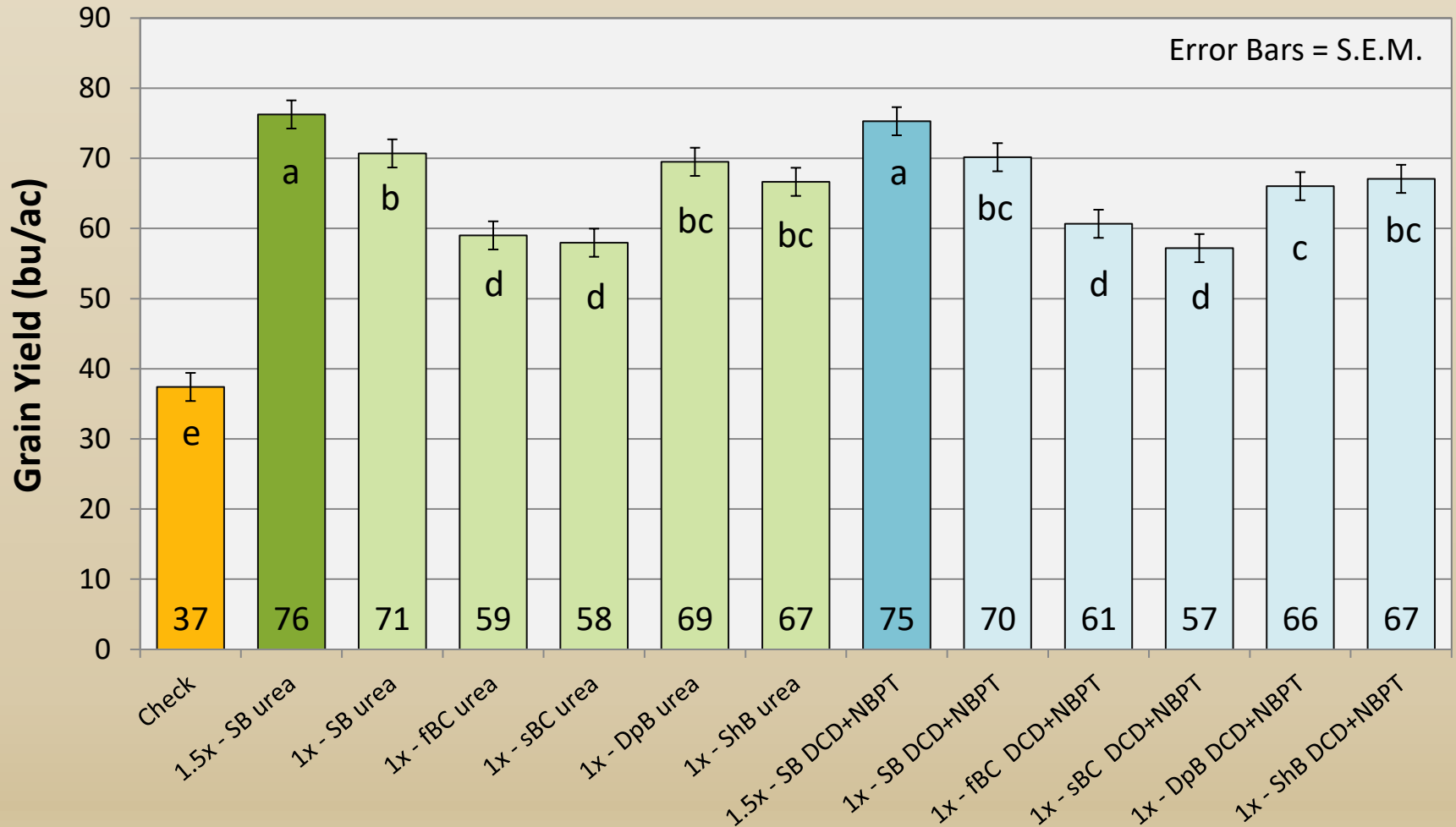
2019-20: Wet soil preceding fall N applications but limited precipitation following both fall the & spring applications – extremely dry growing season

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

Residual N: Consistently low with 8-14 lb NO₃-N/ac in fall composites

N Management Effects on Wheat Yield

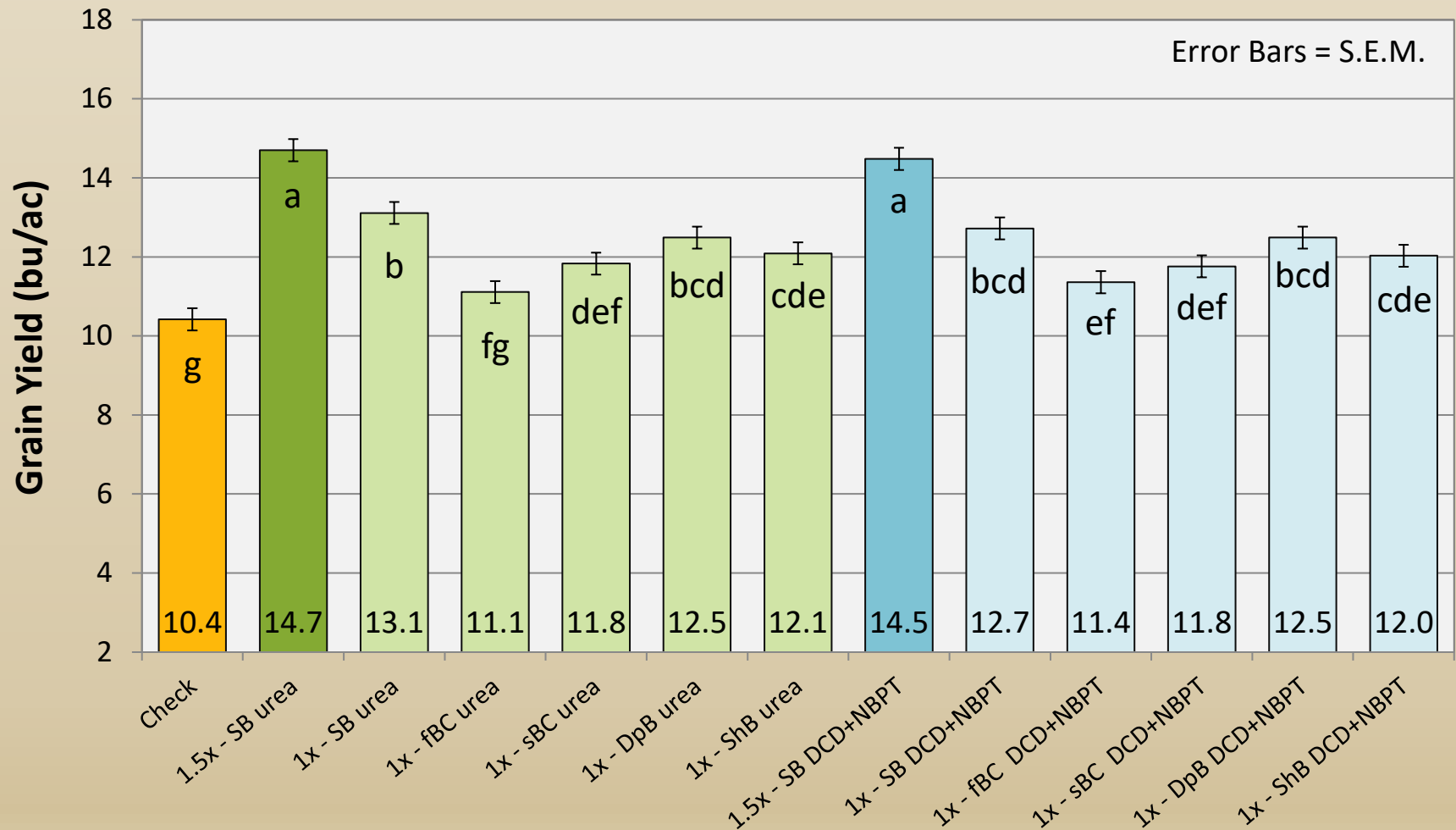
Indian Head 2020



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

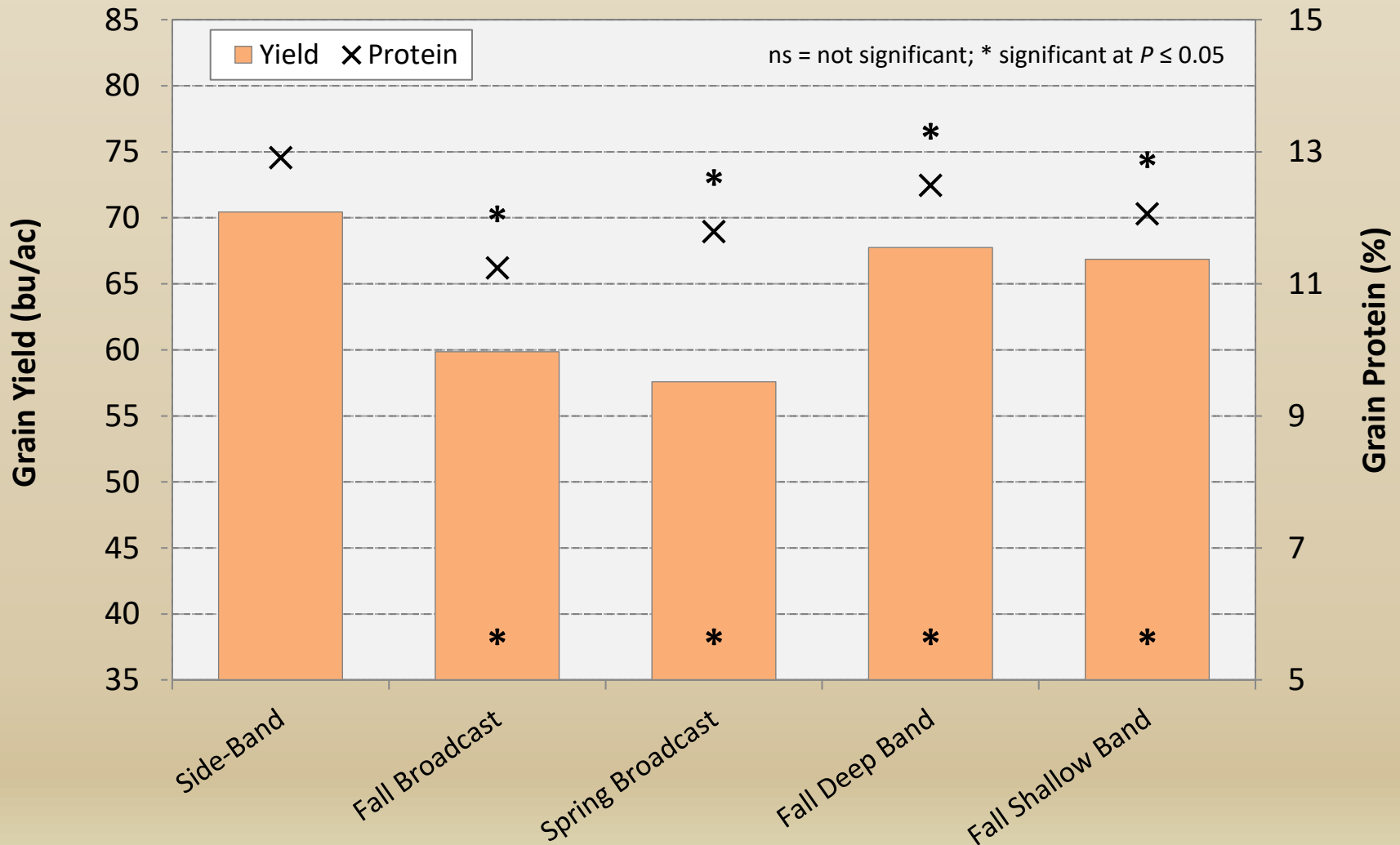
N Management Effects on Wheat Protein

Indian Head 2020



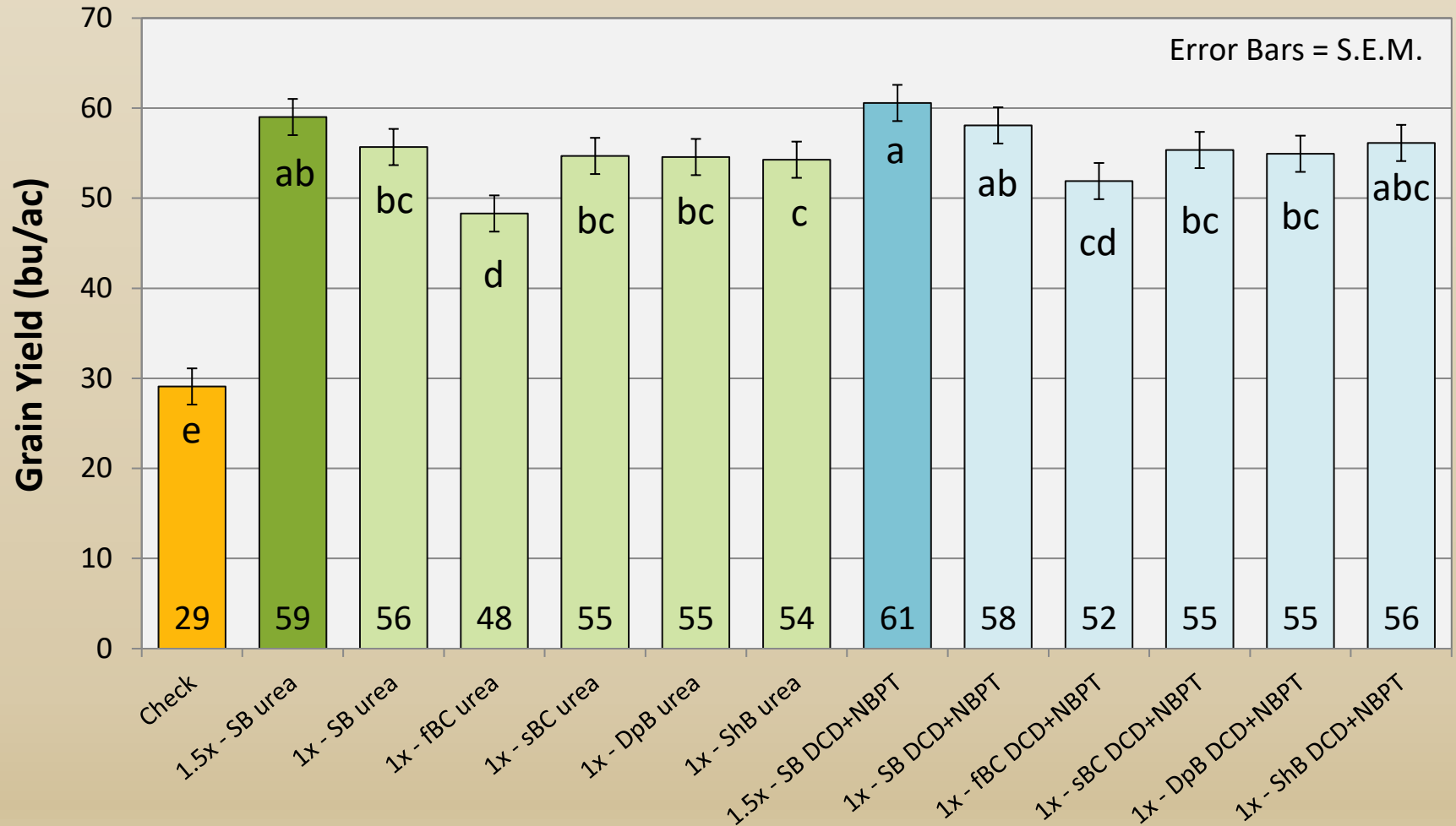
SB – Side Band fBC – fall Broadcast sBC – spring Broadcast DpB – fall Deep Band ShB – fall shallow band

Predetermined Contrast Comparisons Two-Pass vs. Sideband (2020)



N Management Effects on Wheat Yield

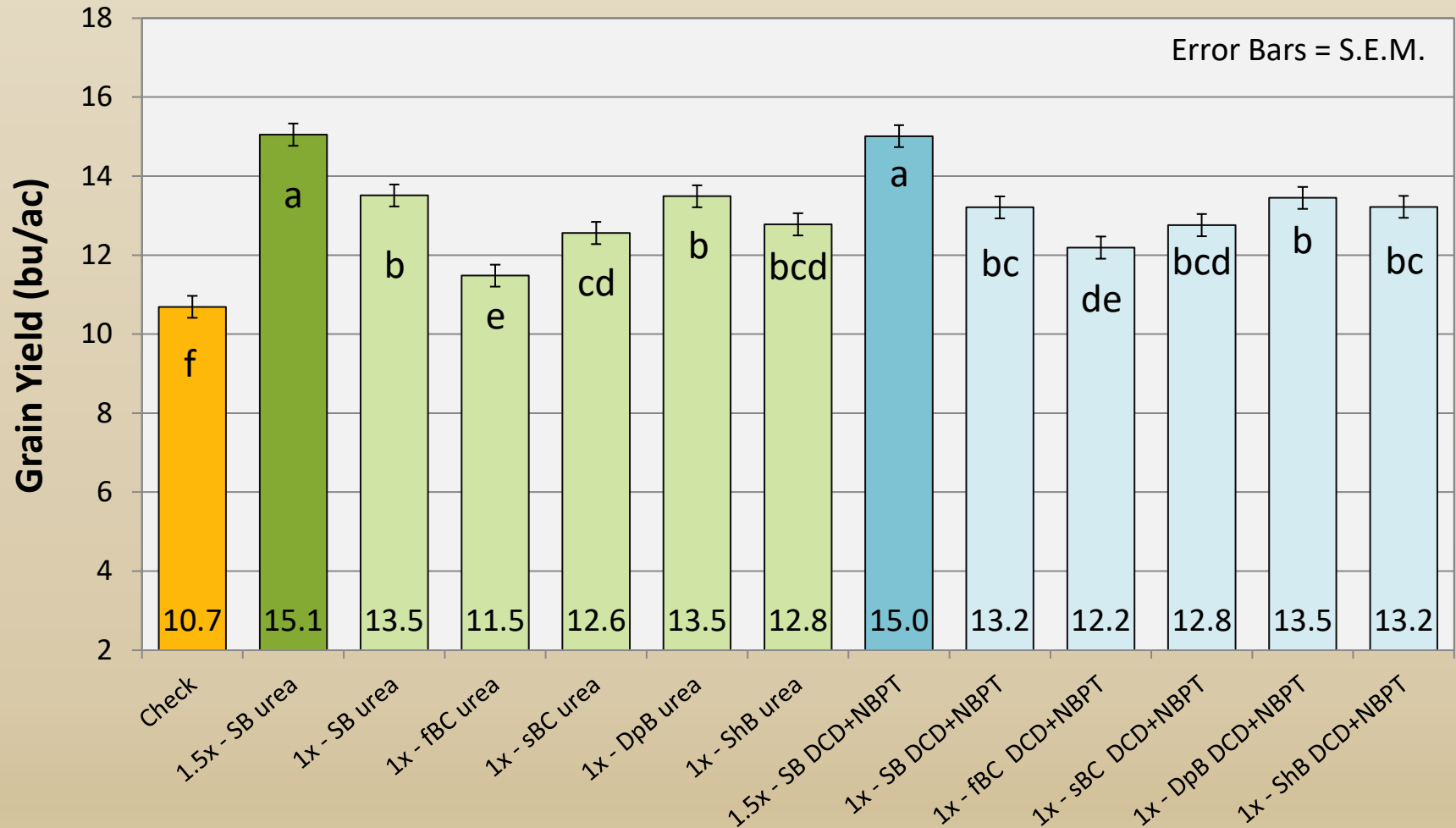
Indian Head 2021



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

N Management Effects on Wheat Protein

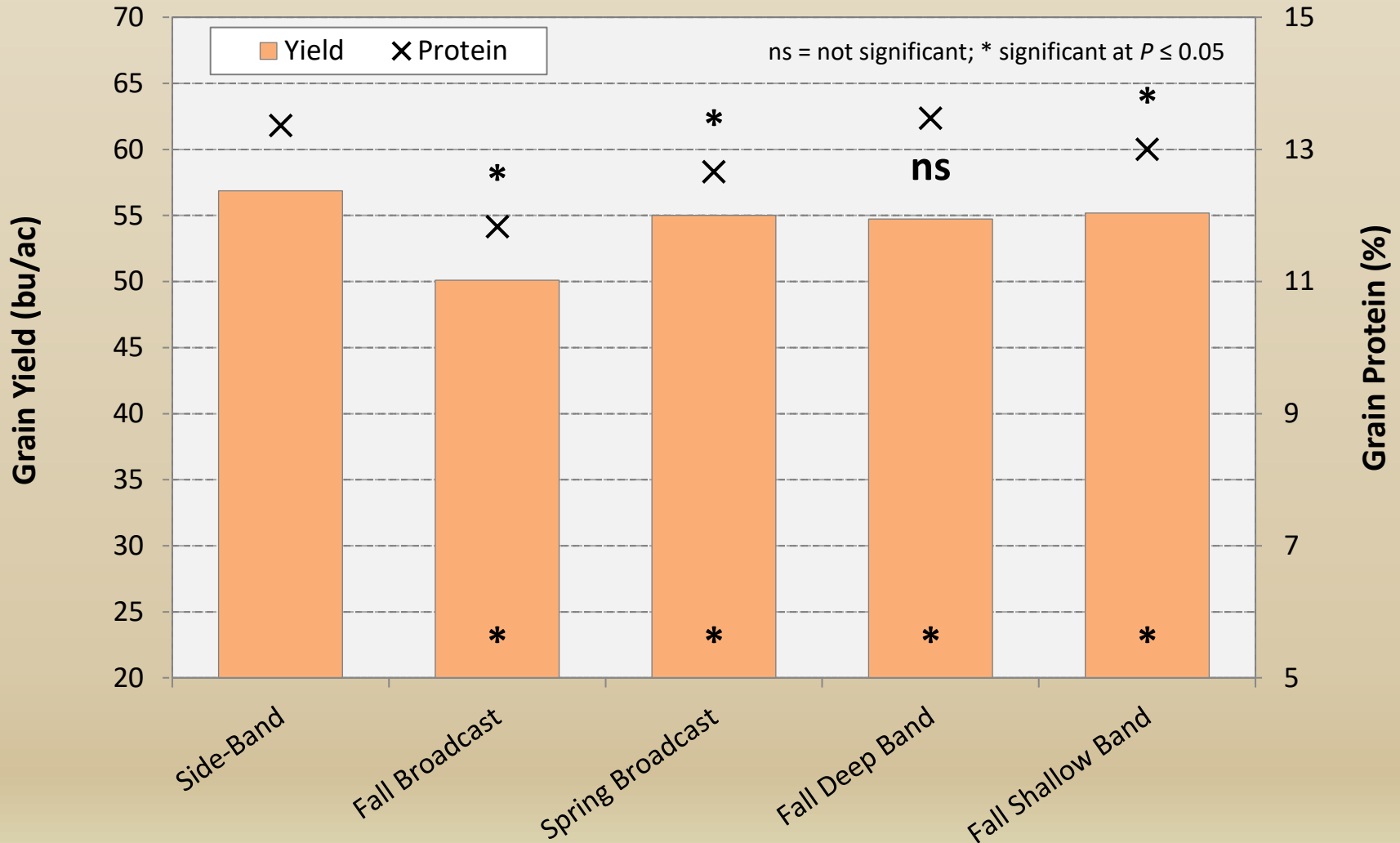
Indian Head 2021



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

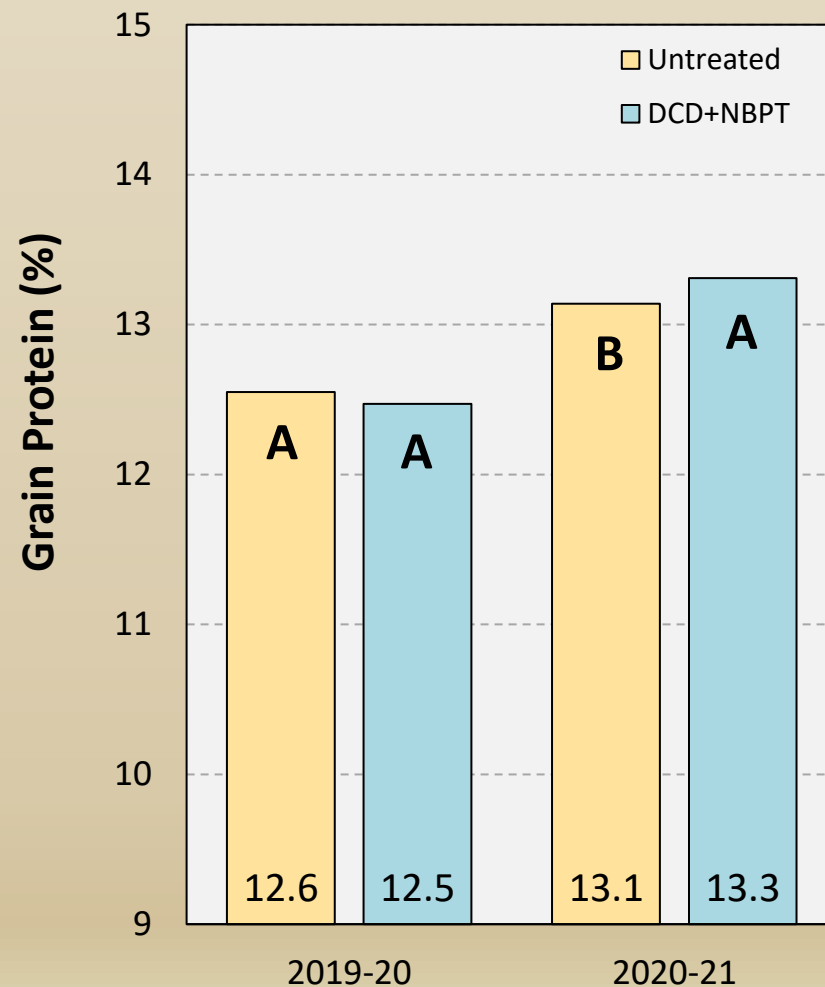
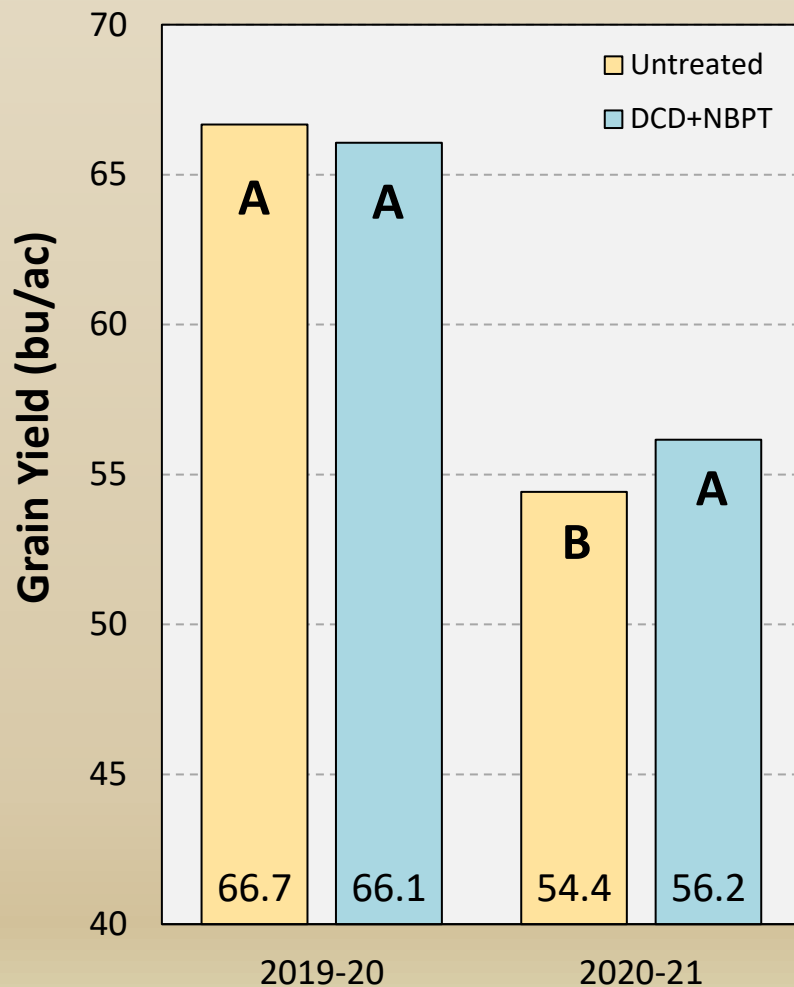
Predetermined Contrast Comparisons

Two-Pass vs. Sideband (2021)



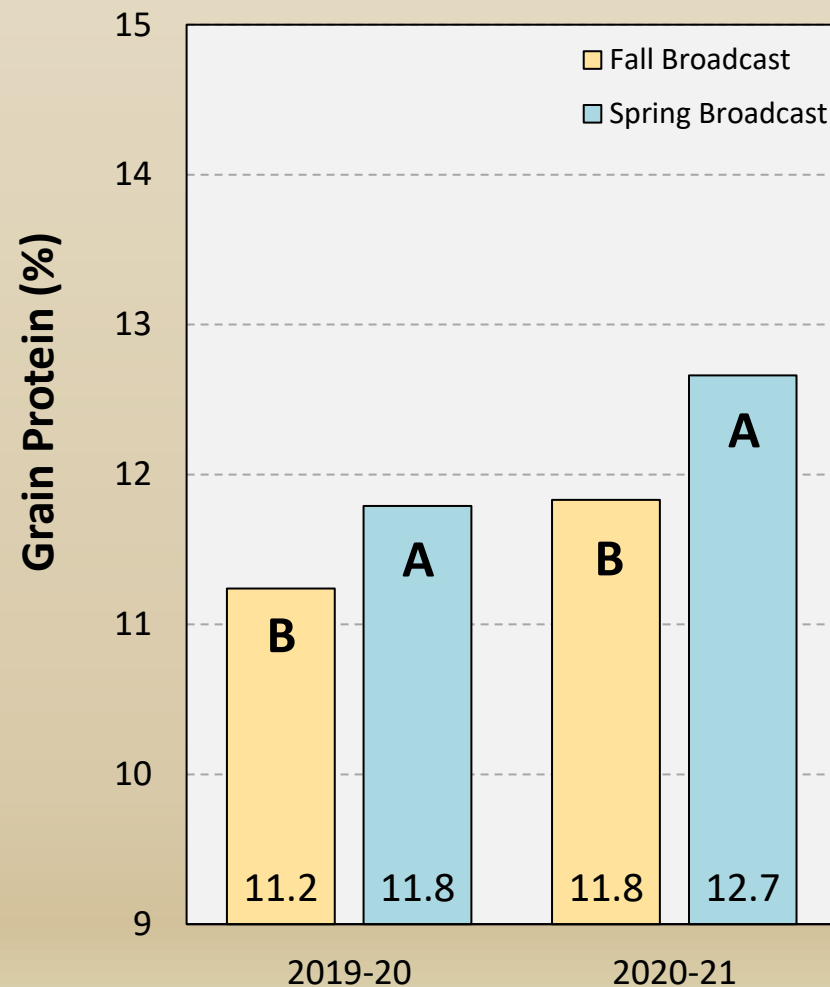
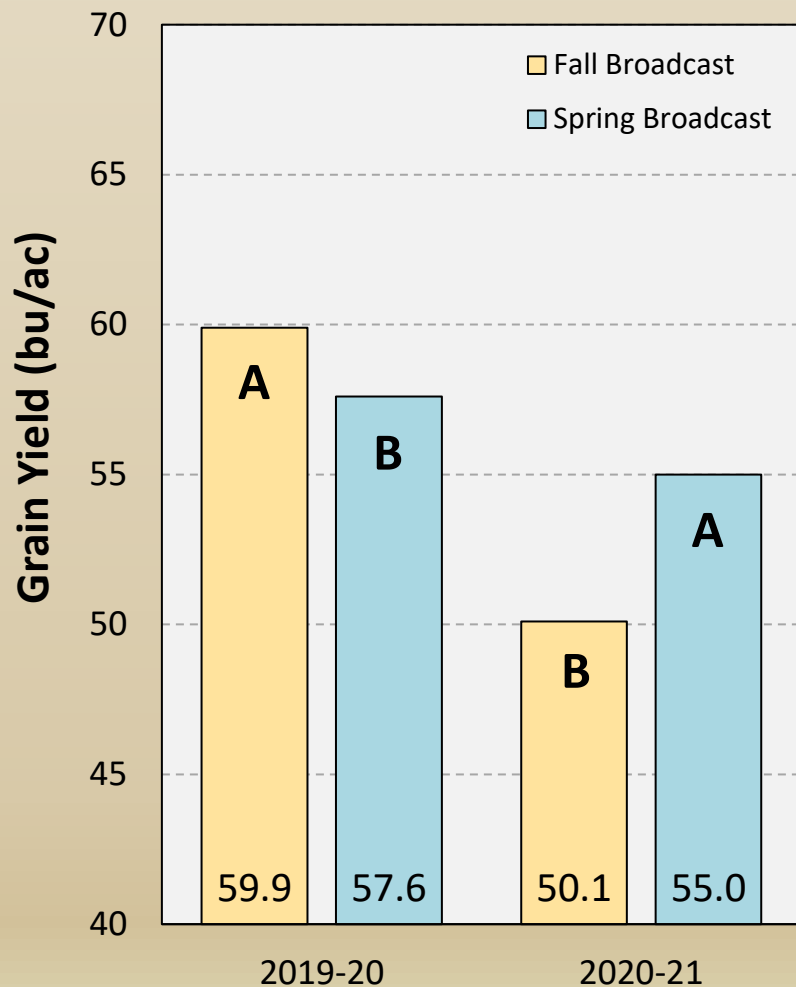
Predetermined Contrast Comparisons

Untreated Urea (2-7) versus DCD+NDPT (8-13)



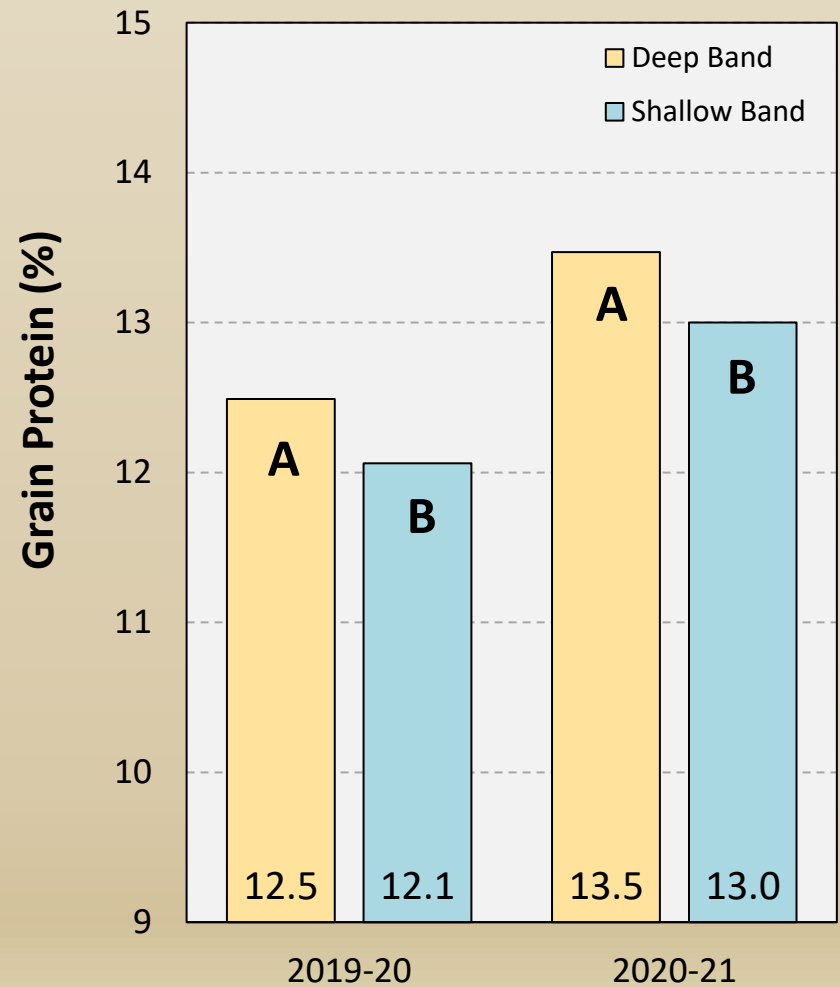
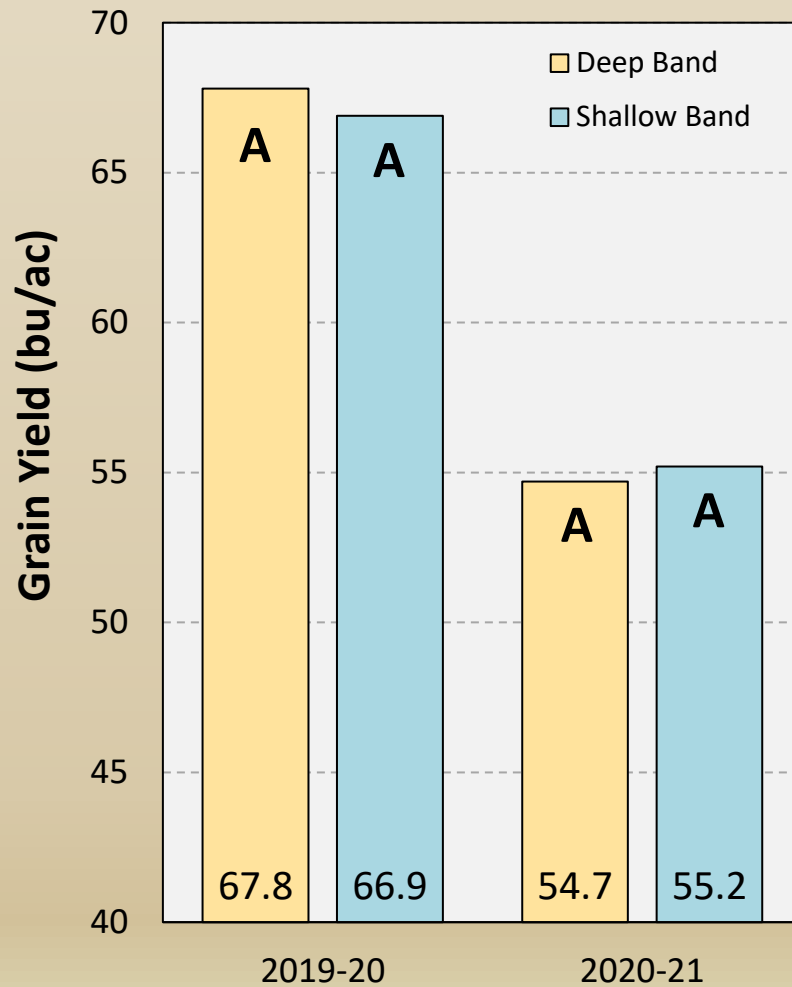
Predetermined Contrast Comparisons

Spring Broadcast (5,11) versus Fall Broadcast (4,10)



Predetermined Contrast Comparisons

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



Winter Wheat Nitrogen Rate, Timing, & Placement Options (2019-2021)



Winter Wheat Nitrogen Rate, Timing, & Placement (3 Years: 2019-21)

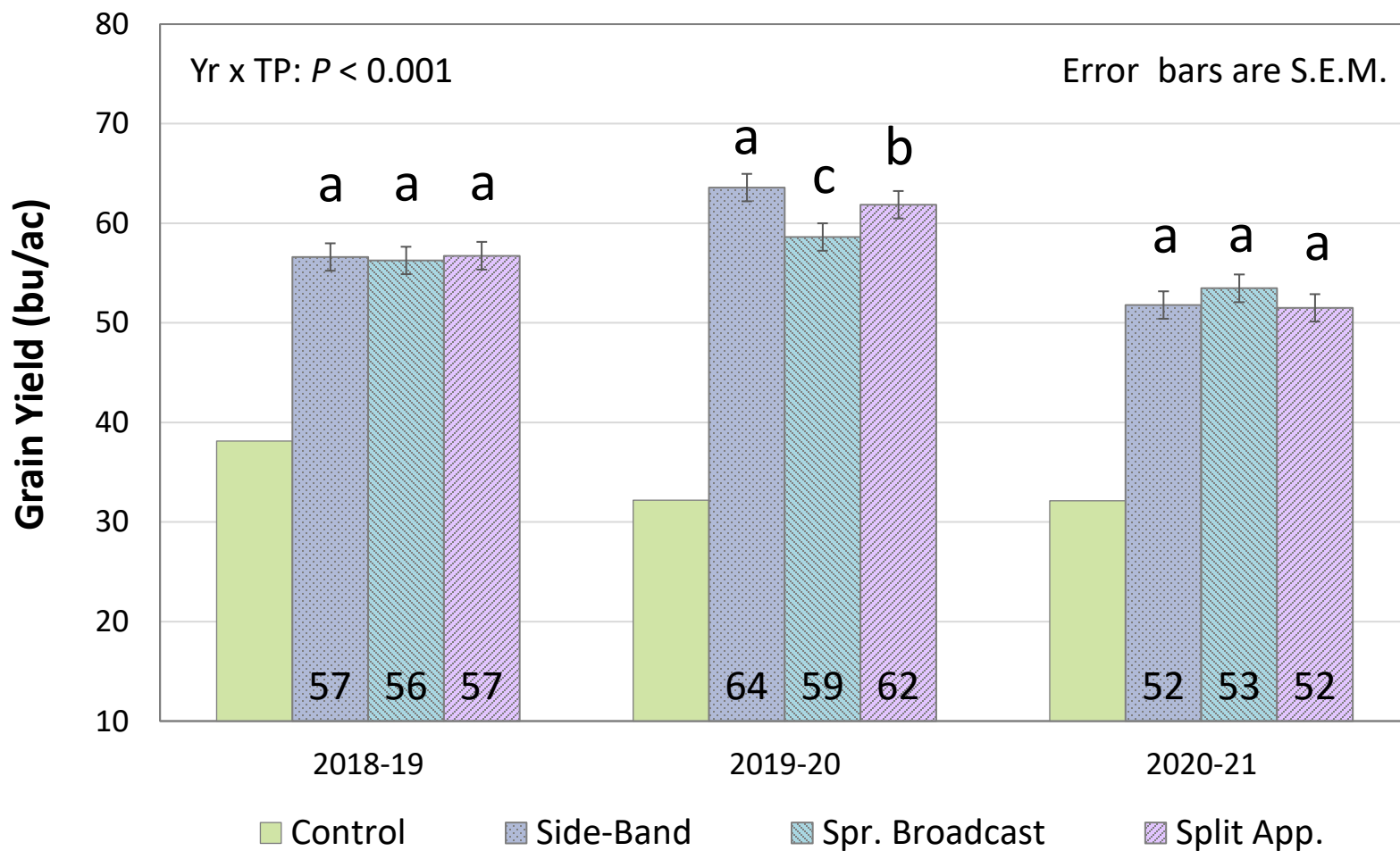
Objectives: To demonstrate winter wheat response to urea supplied using contrasting placement/timing options

Treatments: 0N control plus 53, 70, 107, 134, 160 lb N/ac (fertilizer + soil) applied as 100% side band, 100% early-spring broadcast, or 50:50 split-application

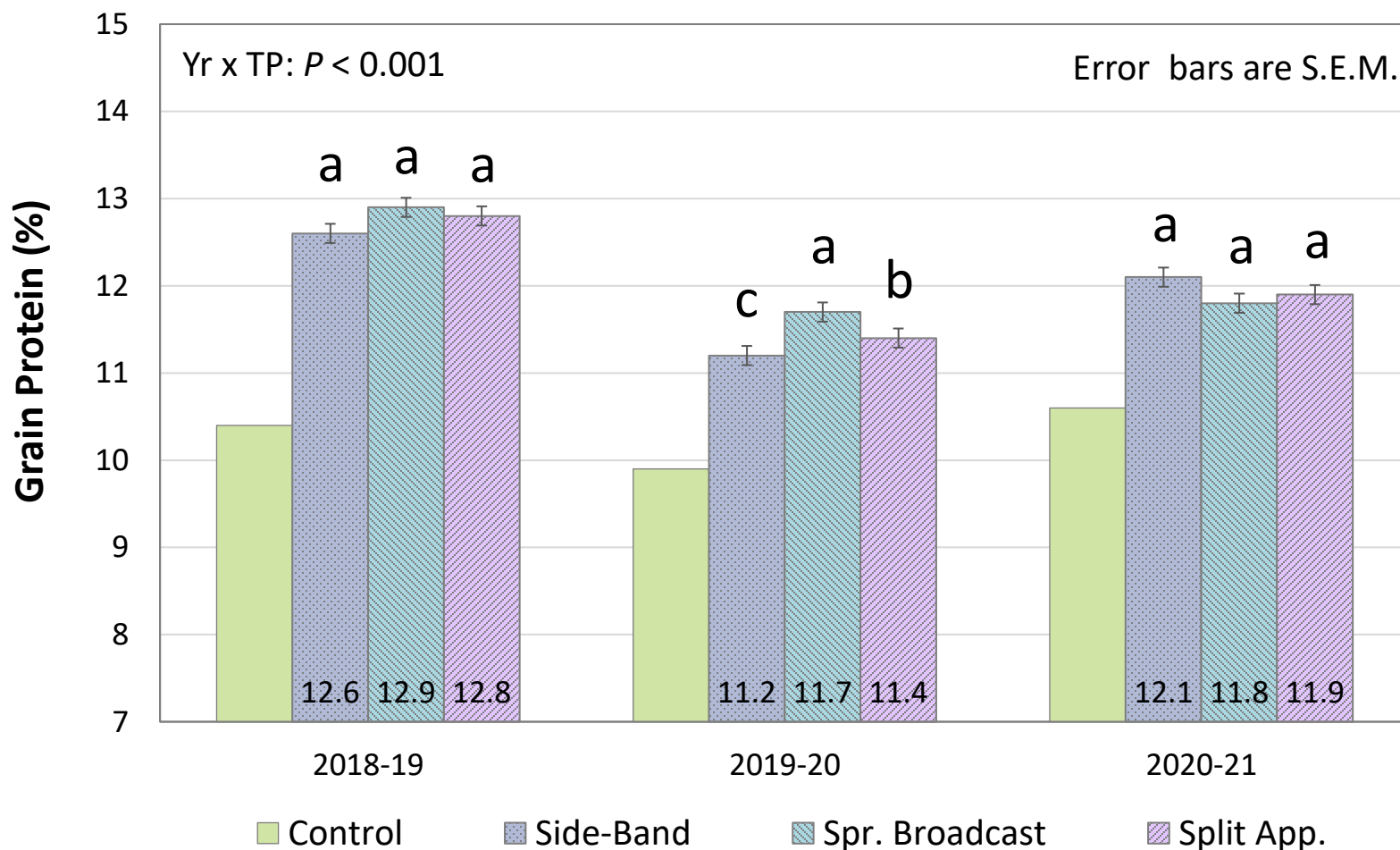
General Growing Season Information

- Seeding/Side-banding: Winter wheat was seeded into moisture the first two years & cool, dry weather followed. Seeded into extremely dry soil in the third year with essentially no emergence prior to freeze-up
- Spring Broadcast Applications: Approximately 0.5" of precipitation within 24 hours of the spring applications for the first two years, but dry growing seasons followed (51-66% of long-term average). Broadcast N onto extremely dry soil in the final year but received over 3" of precipitation starting 12 days after application. Variable moisture conditions & lots of heat over the course of the final season.
- Generally poor conditions for winter wheat production over the entire 3-year period

Year x Nitrogen Timing/Placement Effects on Winter Wheat Grain Yield

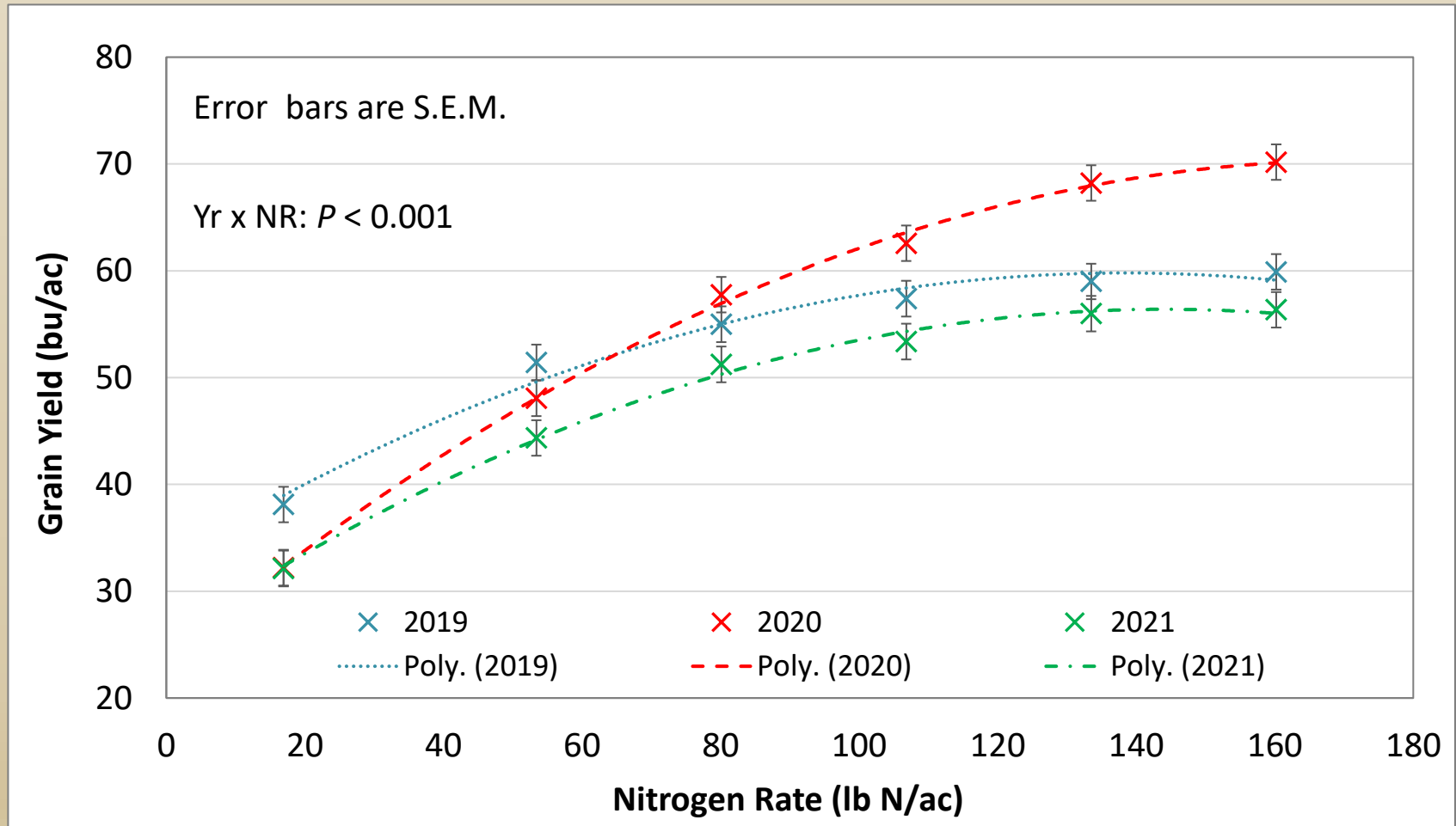


Year x Nitrogen Timing/Placement Effects on Winter Wheat Grain Protein



Year x Nitrogen Rate

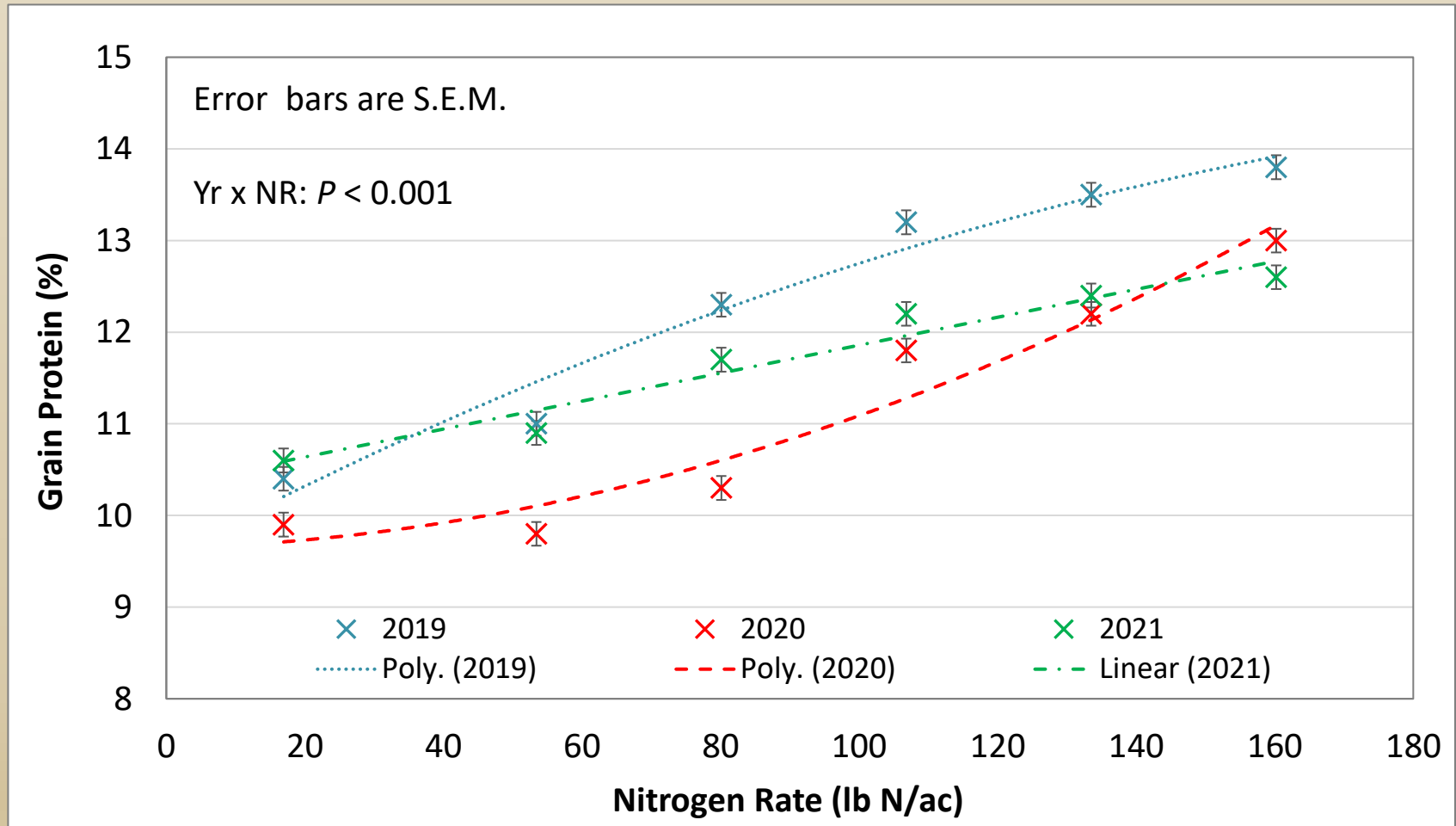
Effects on Winter Wheat Grain Yield



Residual $\text{NO}_3\text{-N}$ (0-24") was 11, 8, and 14 lb N/ac in 2019, 2020, & 2021, respectively

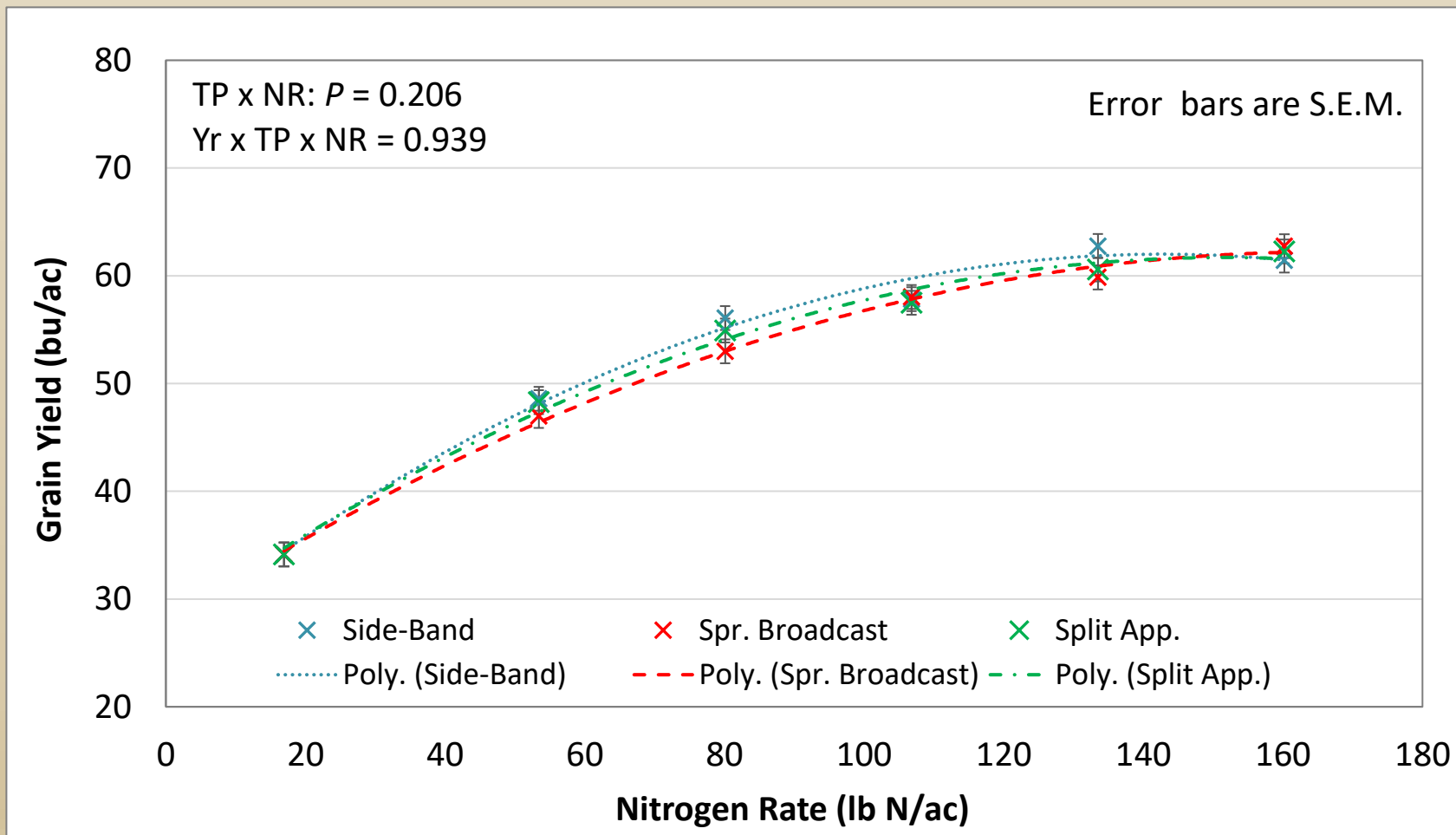
Year x Nitrogen Rate

Effects on Winter Wheat Grain Protein



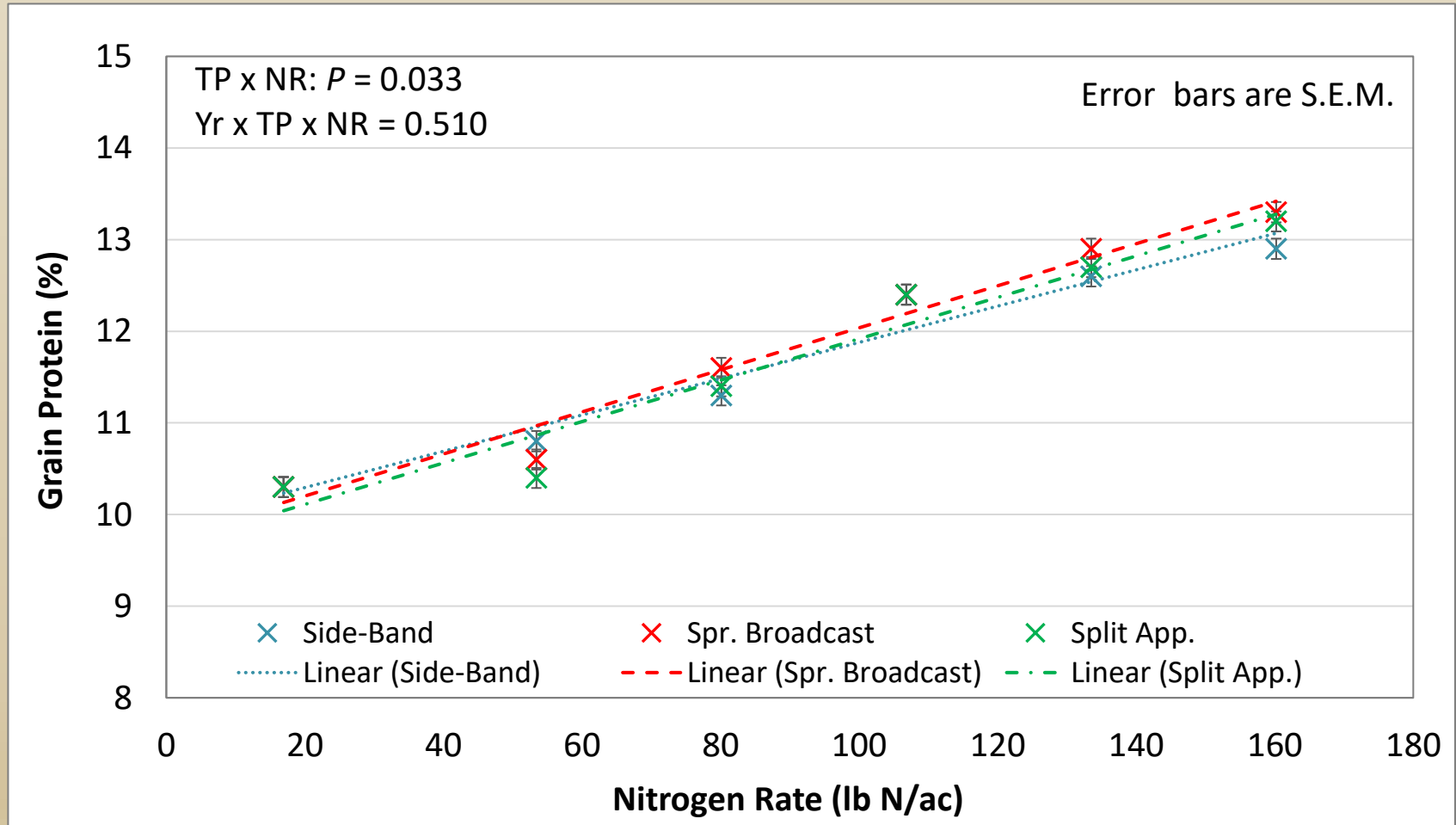
Residual $\text{NO}_3\text{-N}$ (0-24") was 11, 8, and 14 lb N/ac in 2019, 2020, & 2021, respectively

Nitrogen Timing/Placement x Rate Effects on Winter Wheat Grain Yield (3-yr Avg)



Residual $\text{NO}_3\text{-N}$ (0-24") was 11 lb N/ac when averaged over the 3 years (8-14 lb N/ac range)

Nitrogen Timing/Placement x Rate Effects on Winter Wheat Grain Protein (3-yr Avg)



Residual $\text{NO}_3\text{-N}$ (0-24") was 11, 8, and 14 lb N/ac in 2019, 2020, & 2021, respectively

Fall Rye Cover Crop Effects on Canola Establishment & N Response (2021)



Fall Rye Cover Crop Effects on Canola (Indian Head 2021)

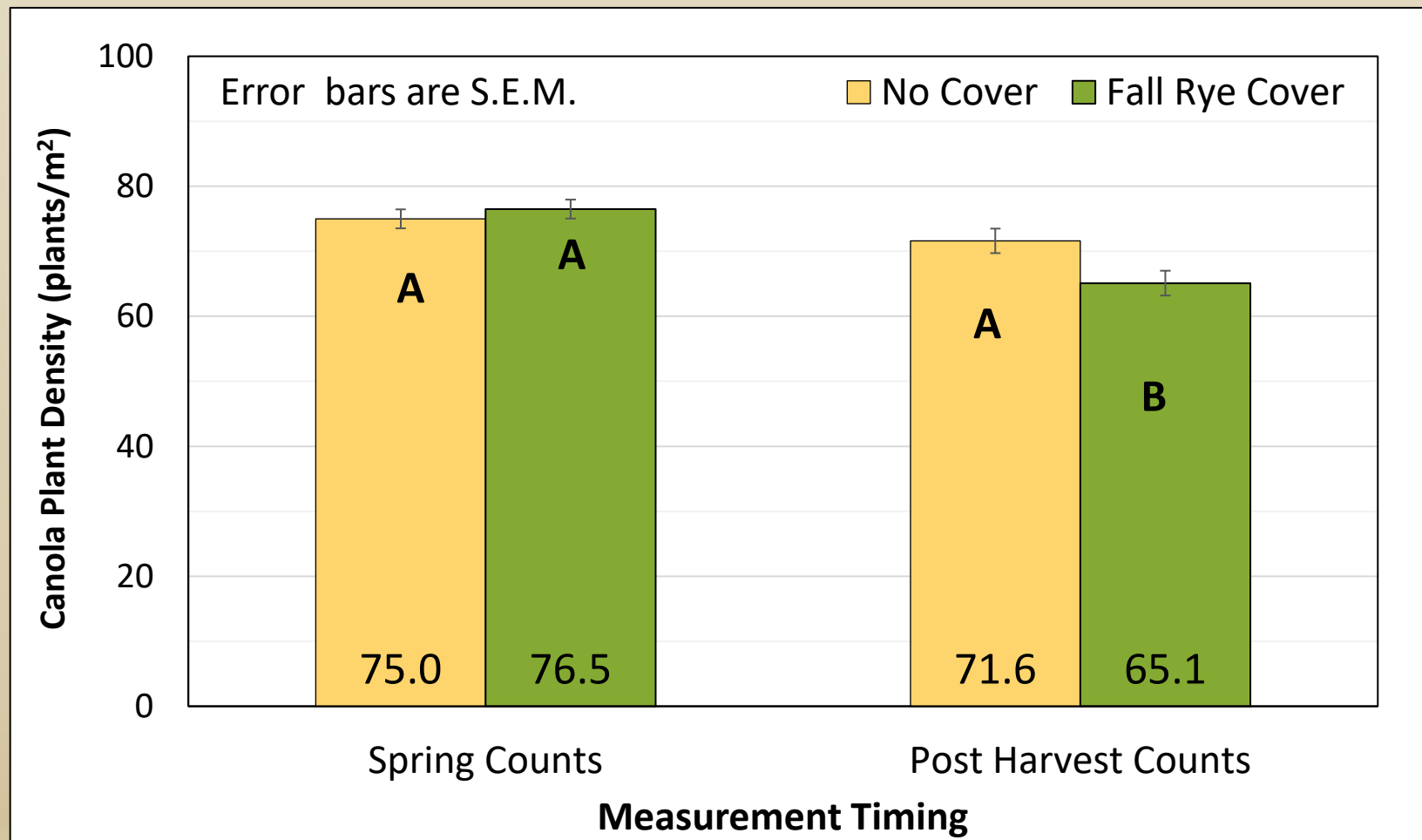
Objectives: To demonstrate fall rye cover crop effects on canola establishment, weed densities, & yield response to N fertilizer

Treatments: Combination of two cover crop treatments (none versus fall rye cover) & five rates of N fertilizer (22, 53, 93, 125, & 156 lb N/ac)

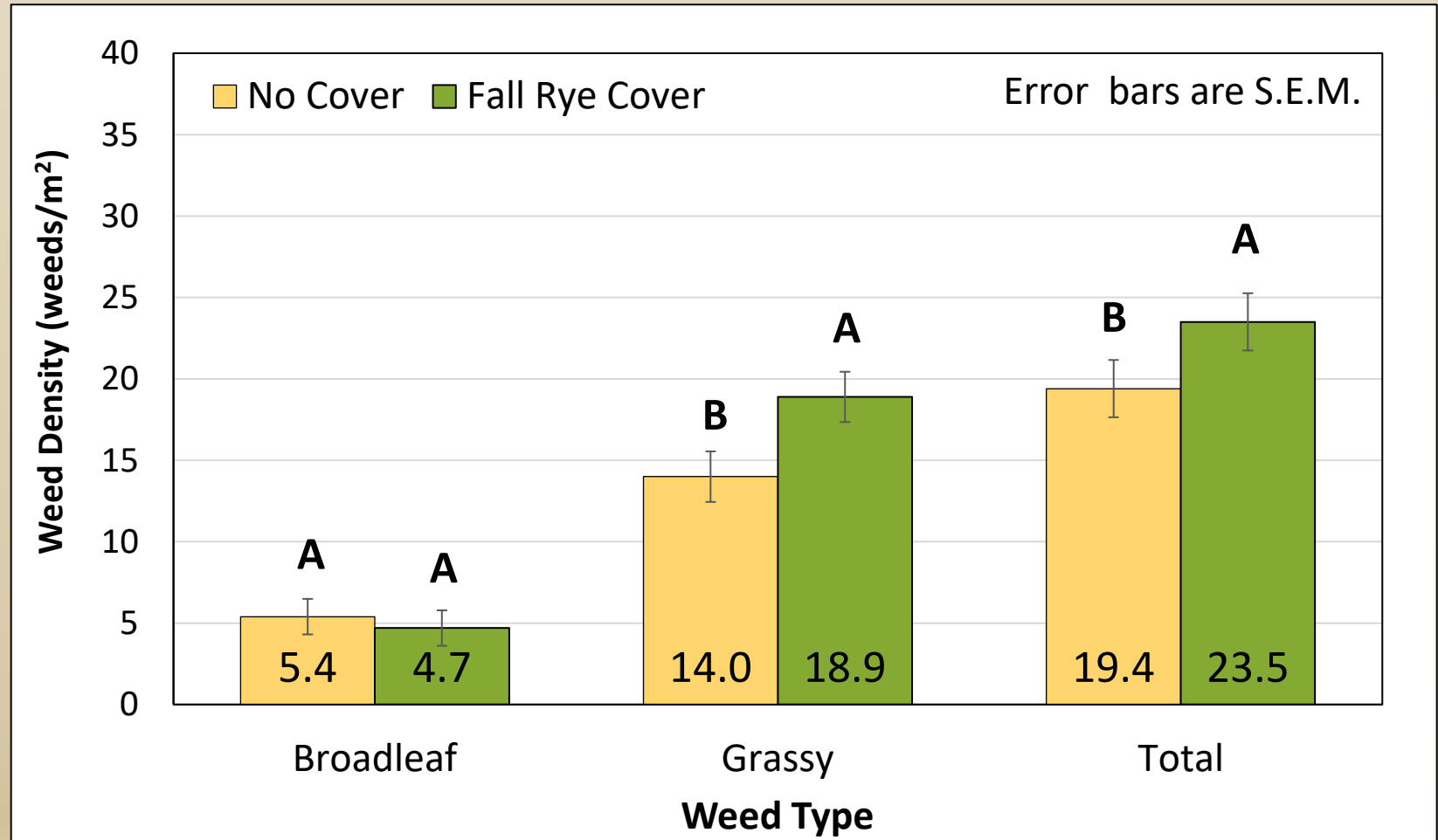
Growing Season Information

- Fall rye cover crop was seeded on Sept. 19; however, the fall was extremely dry & there was very little emergence prior to freeze-up
- Some of rye emerged in the early spring, but densities were undoubtedly below the target of ~200 plants/m² & individual plants were small (~1-3 leaves); rye was terminated with glyphosate the evening before seeding canola on May 14
- 80 mm of precipitation fell over a five-day period within less than a week of seeding – this resulted in excellent canola emergence & any viable fall rye seeds that were stranded in dry soil also germinated at this time

Fall Rye Cover Crop Preceding Canola Effects on Establishment: Spring vs Post-Harvest

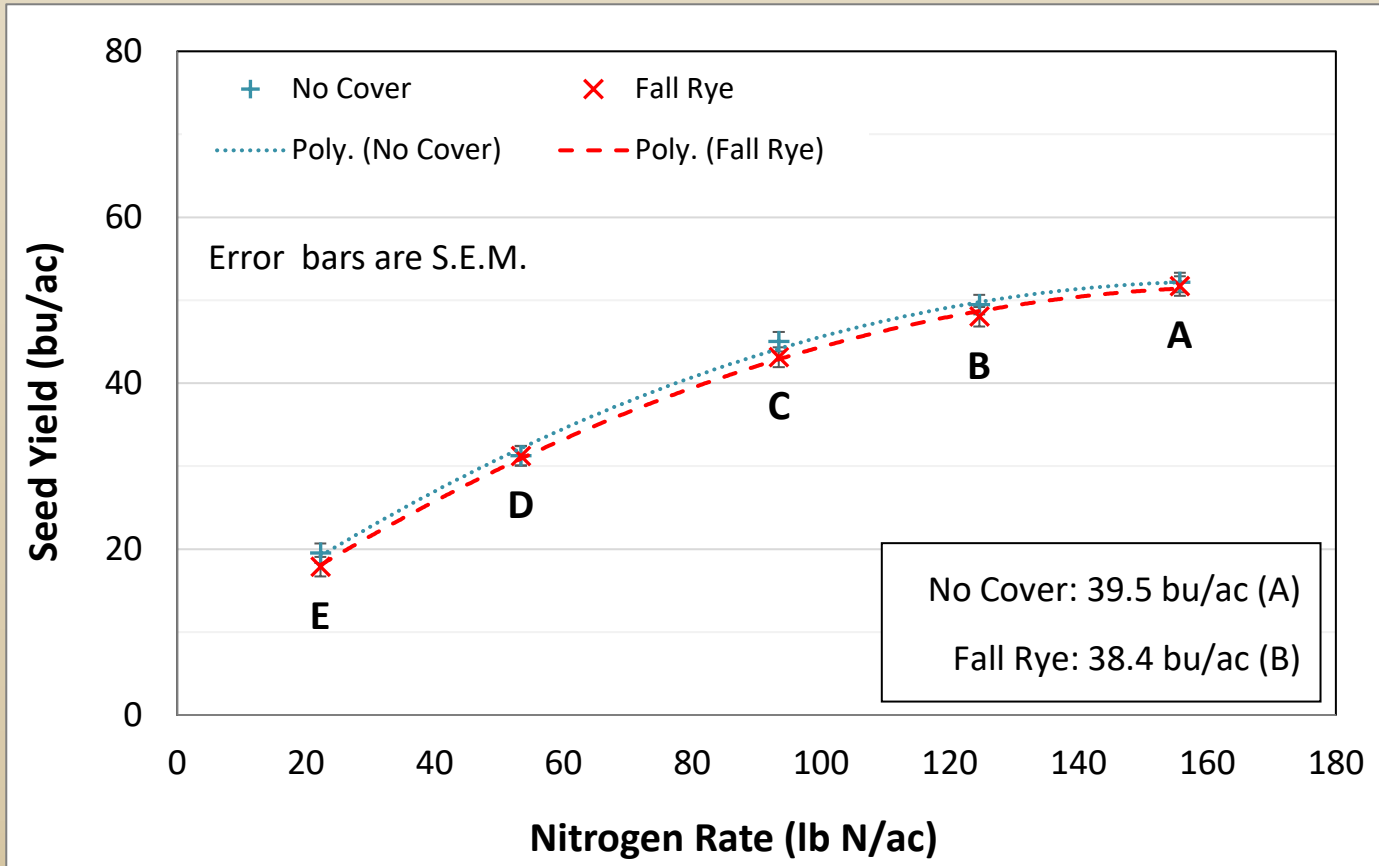


Fall Rye Cover Crop Preceding Canola Effects on In-Crop Weed Densities



Fall Rye Cover Crop Preceding Canola Effects on Canola Yield & Response to Nitrogen

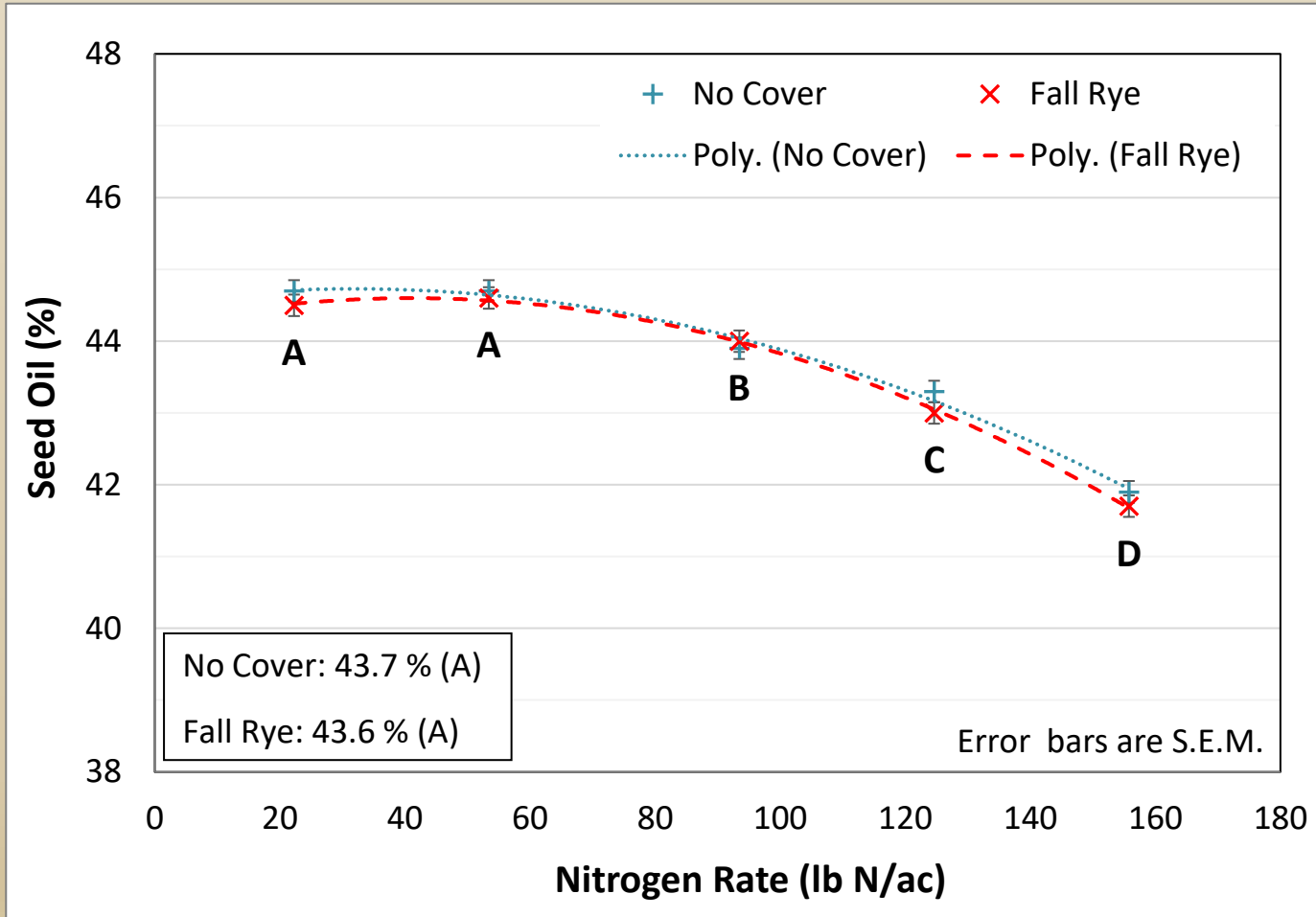
Source	Pr > F
CC	0.008
NR	<0.001
CC x NR	0.477



- Residual NO₃-N (0-24"): 25 lb N/ac with no cover & 18 lb/ac with cover crop (conventional composites)
- PRS probe analyses showed opposite trends so observed differences may have been due more to random variation than actual treatment effects

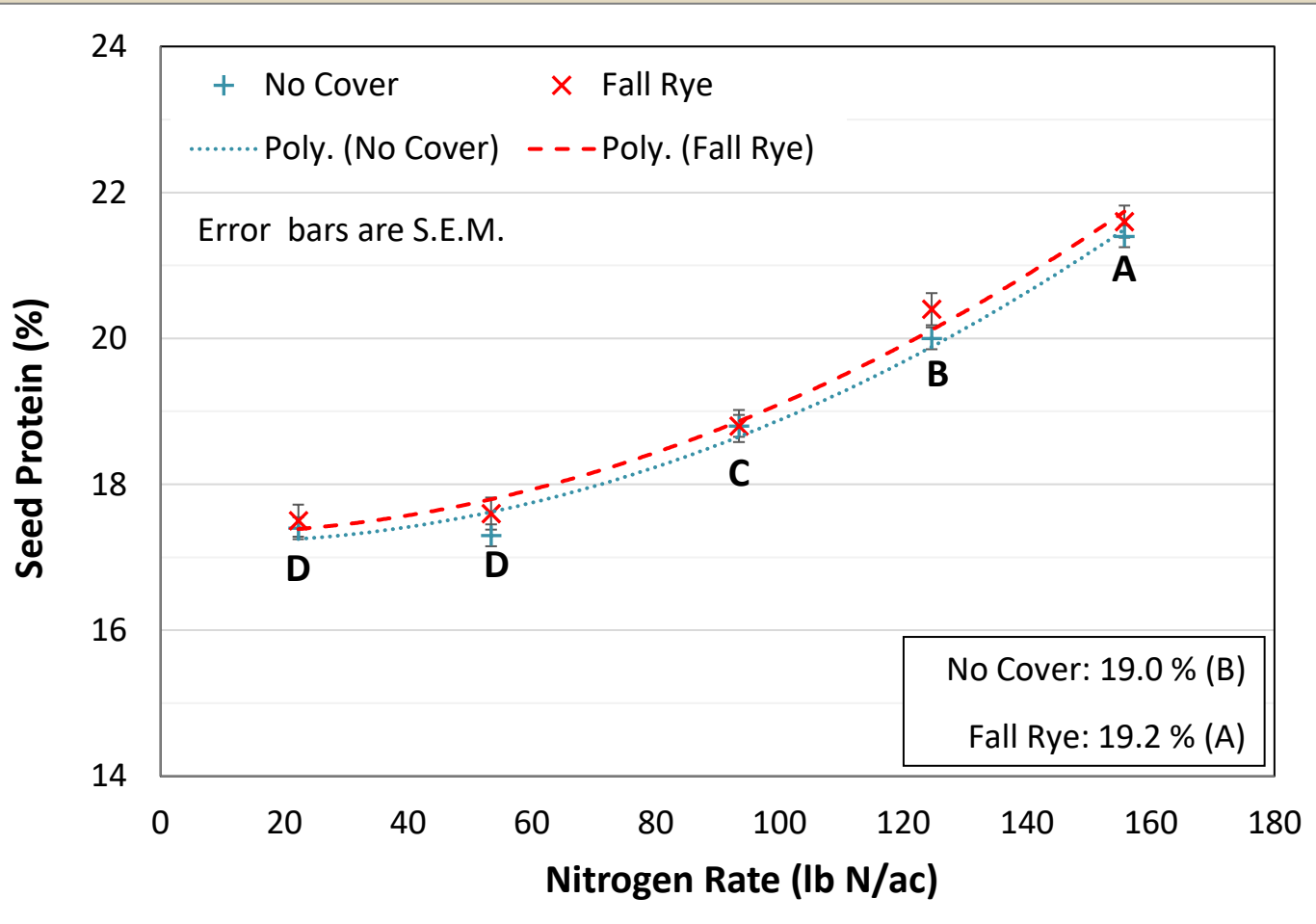
Fall Rye Cover Crop & Nitrogen Rate Effects on Canola Seed Oil Content

Source	Pr > F
CC	0.118
NR	<0.001
CC x NR	0.511



Fall Rye Cover Crop & Nitrogen Rate Effects on Canola Seed Protein

Source	Pr > F
CC	0.043
NR	<0.001
CC x NR	0.896





THANK YOU

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