

Trials and Tribulations in N management



Mike Hall – Research Coordinator

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Enhanced Efficiency Nitrogen Fertilizers

- eNtrench (treated Urea)
 - Nitrification inhibitor slows the conversion of NH_4 to NO_3
 - Reduces losses of NO_3 to leaching and Denitrification (N_2 ↑ and N_2O ↑)
- SuperU (treated Urea)
 - Nitrification inhibitor
 - Urease inhibitor slows the conversion of urea to NH_4 which convert to NH_3 ↑, particularly if pH is high.
- Tribune (treated UAN)
 - Nitrification and Urease inhibitor



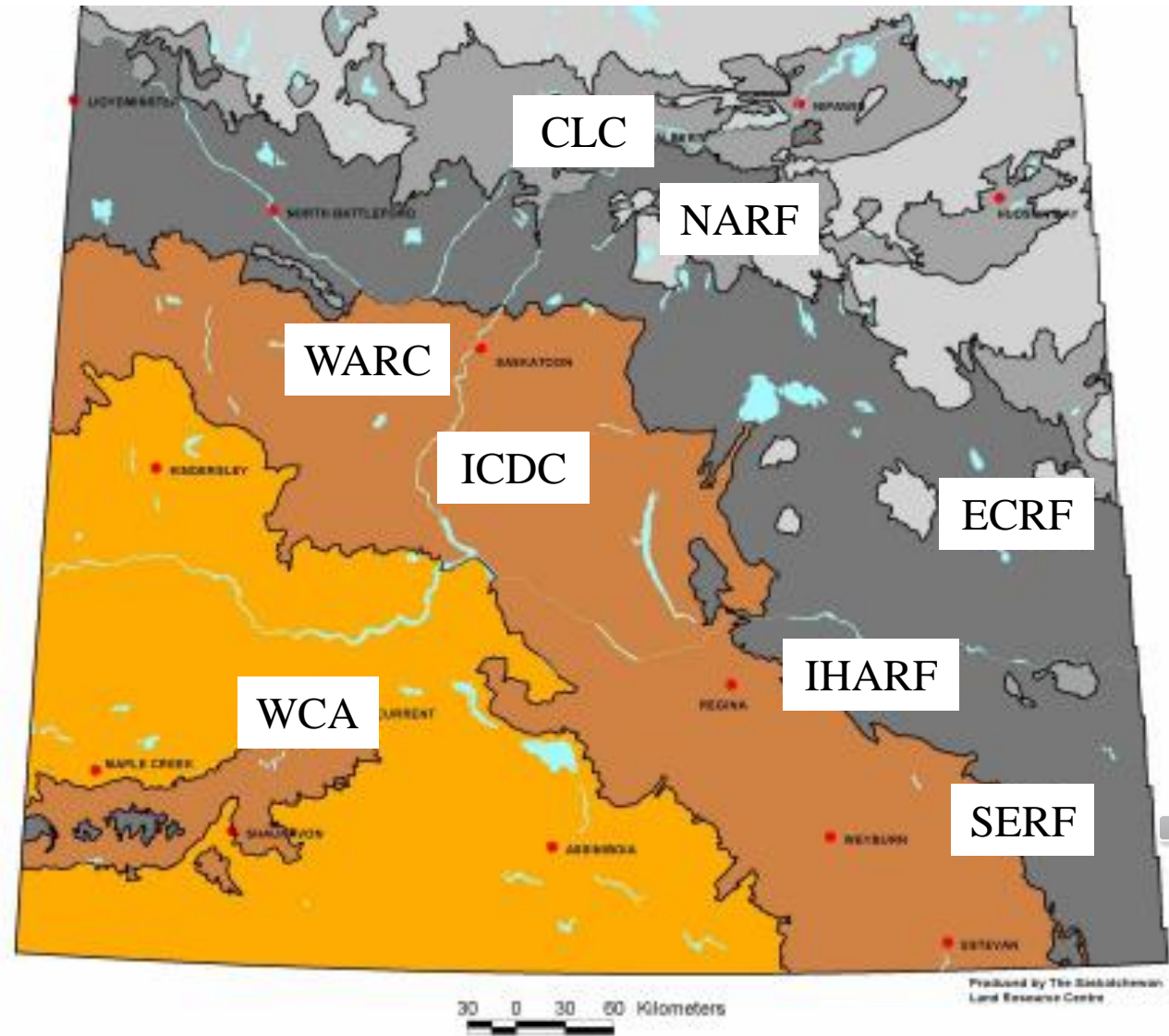
Enhanced Efficiency Nitrogen Fertilizers

- How well do EEF work
 - in the side-band?
 - when shallow banding
 - when fall broadcasting
 - when applied post-emergence



Agriarm Network of Sites

- Indian Head** – Indian Head Agricultural Research Foundation (IHARF)
- Melfort** – Northeast Agriculture Research Foundation (NARF)
- Redvers** – South East Research Farm (SERF)
- Outlook** – Irrigation Crop Diversification Corporation (ICDC)
- Prince Albert** – Conservation Learning Center (CLC)
- Scott** – Western Applied Research Corporation (WARC)
- Swift Current** – Wheatland Conservation Area Inc. (WCA)
- Yorkton** – East Central Research Foundation (ECRF)



Project Supported by:



**Sustainable Canadian
Agricultural Partnership**

Saskatchewan! 

The logo for the province of Saskatchewan. The word "Saskatchewan" is written in a green, italicized serif font. To the right of the word is a graphic element consisting of three overlapping, upward-pointing shapes in yellow, white, and green, resembling a stylized sun or a field.

Canada  

The logo for the Government of Canada. The word "Canada" is written in a black, serif font. To the right of the word is a small Canadian flag (red and white with a red maple leaf). Below the flag is a small, stylized logo of a hand holding a tool, representing the Government of Canada's commitment to agriculture and rural development.

Is it Worth Using Enhanced Efficiency N Fertilizers in the Side-band?



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Is it Worth Using Enhanced Efficiency N Fertilizers in the Side-band?

Yorkton
East Central Research
Foundation/Suncrest College



Prince Albert
Conservation learning Centre



Scott
Western Applied Research Corporation



Indian Head
Indian Head Agricultural Research
Foundation



Melfort
Northeast Agriculture Research
Foundation



Table 1. Treatment list

Trt #	Side-banded Product	N Rate (lb/ac soil + fert N) ¹	
1	Urea	80	
2	Urea	120	
3	Urea	160	
4	eNtrench	80	
5	eNtrench	120	
6	eNtrench	160	
7	SUPERU©	80	
8	SUPERU©	120	
9	SUPERU©	160	
10	Check: No side banded N	0	

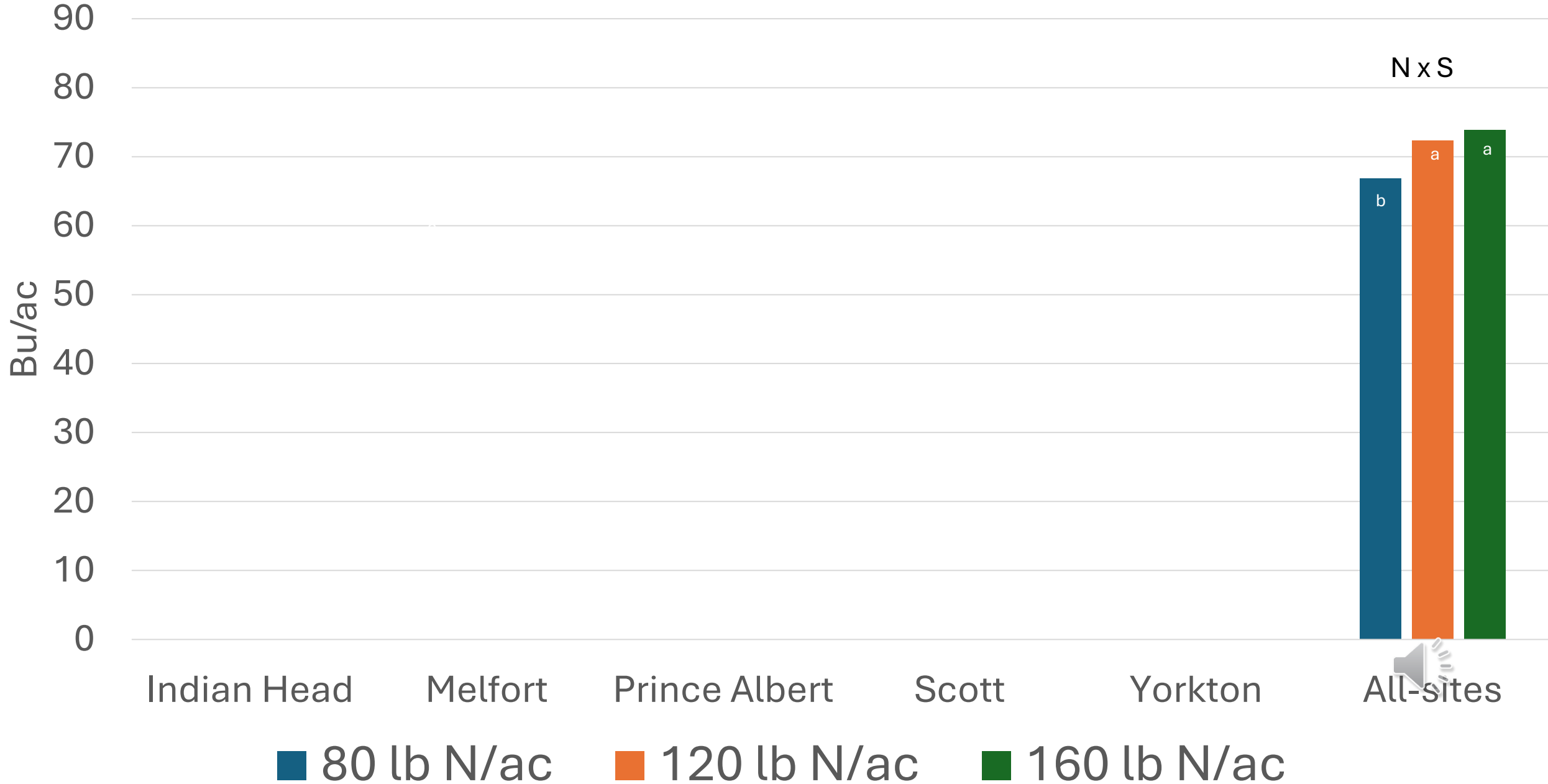
¹Soil N will be based on (0-24" soil depth). Values from a 0-12" soil depth will be multiplied by 1.5 to approximate a 0-24" depth.

Why are we doing this?

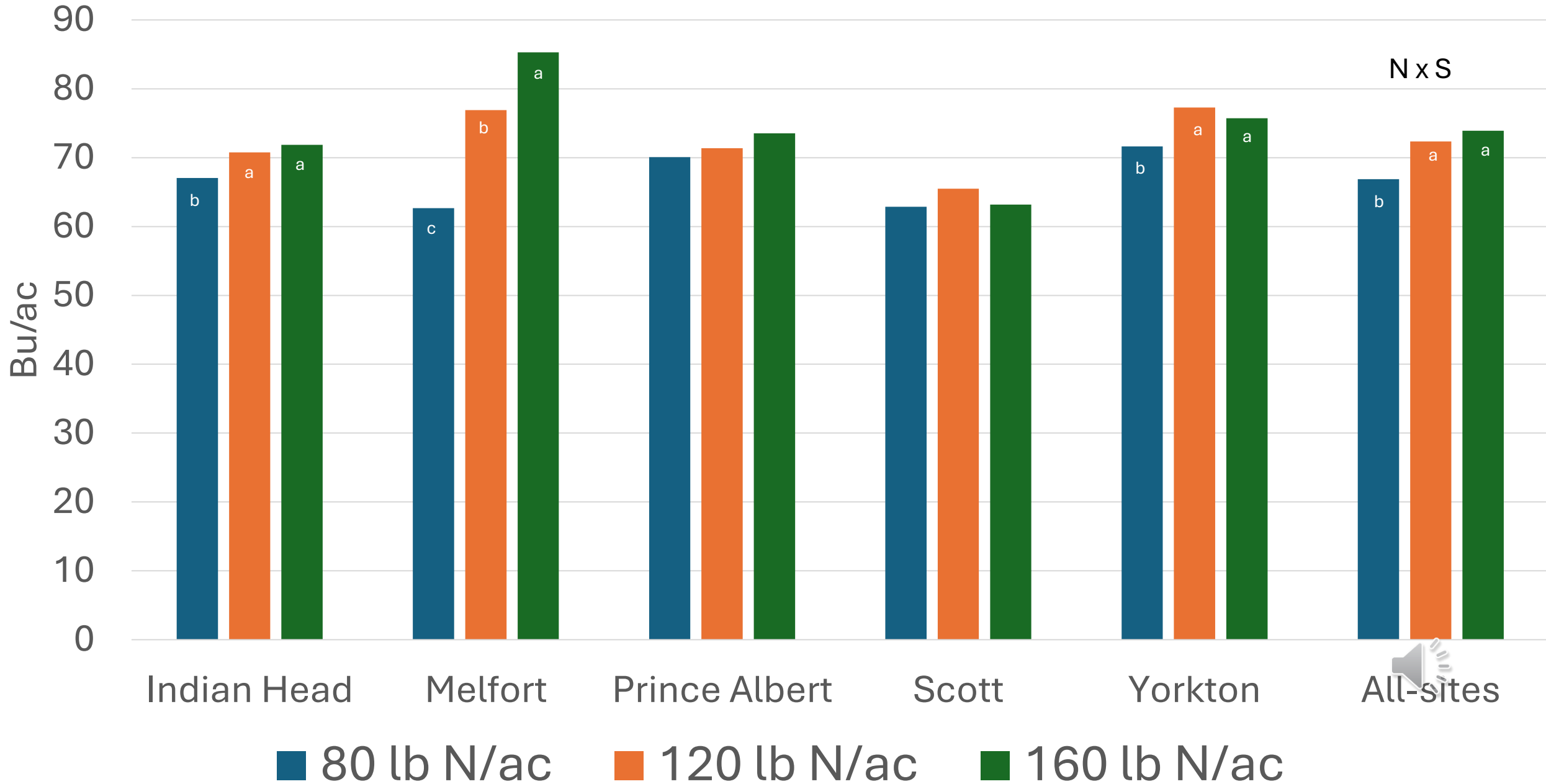
- eNtrench and SuperU have been reported to reduce N₂O emissions from side banded applications in spring.
- However, yield or grain protein increases are rarely reported.
 - More likely to be a benefit when side-banding winter wheat (denitrification)
- Our study is simply using wheat yield and grain protein to infer N use efficiency. We are NOT measuring any gas emissions.



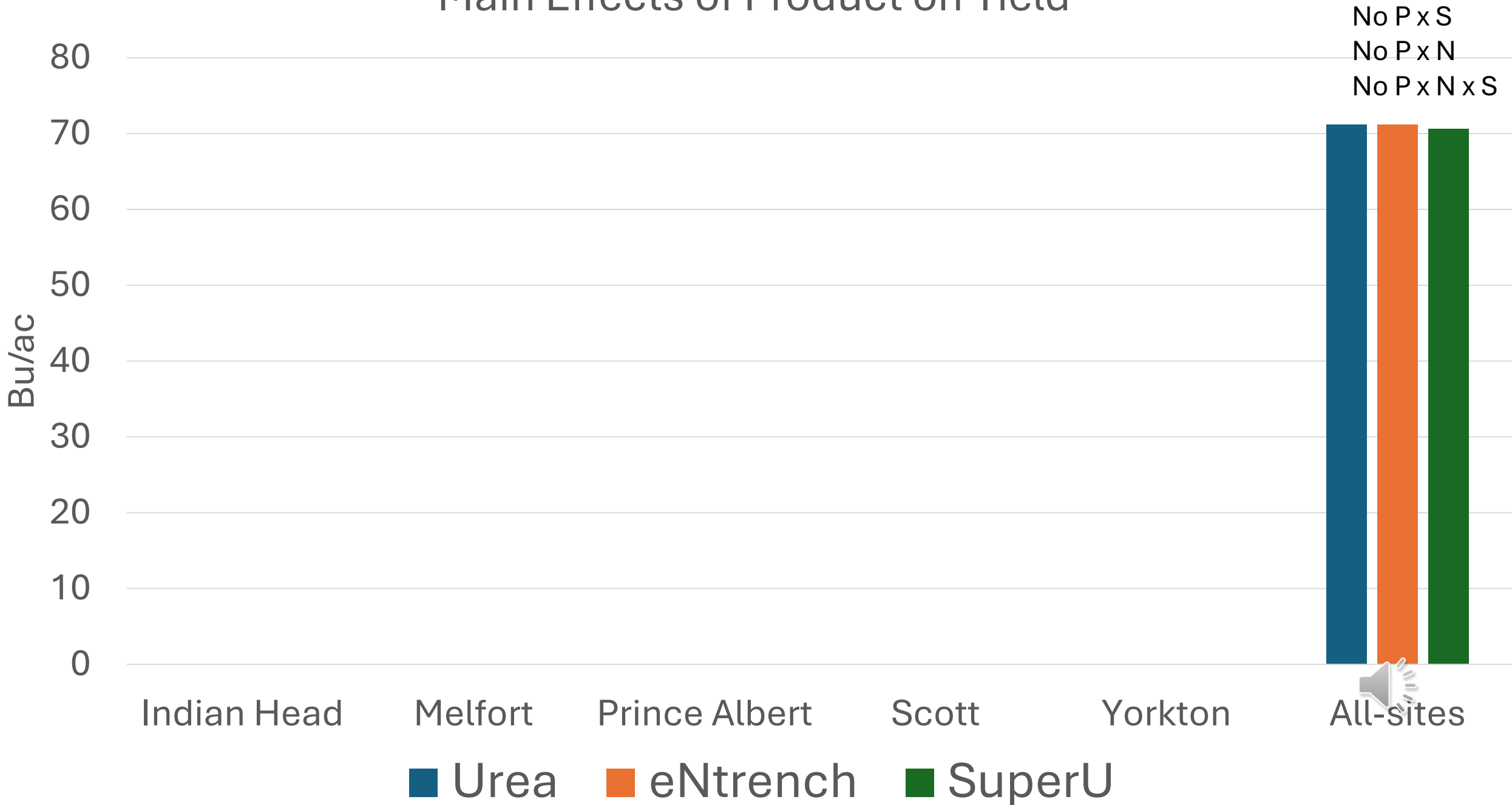
Main Effects of Increasing N (soil + fertilizer) on Yield



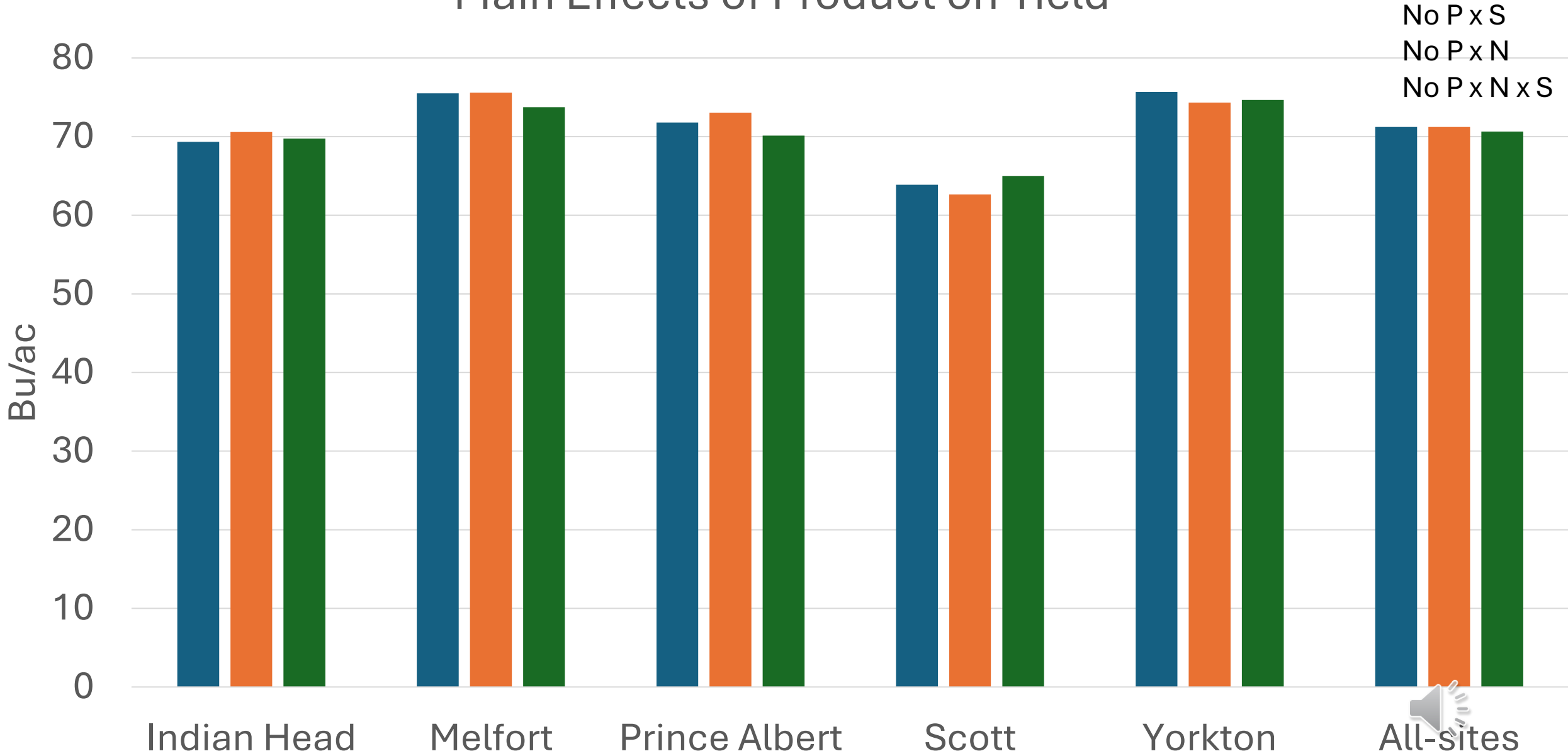
Main Effects of Increasing N (soil + fertilizer) on Yield



Main Effects of Product on Yield



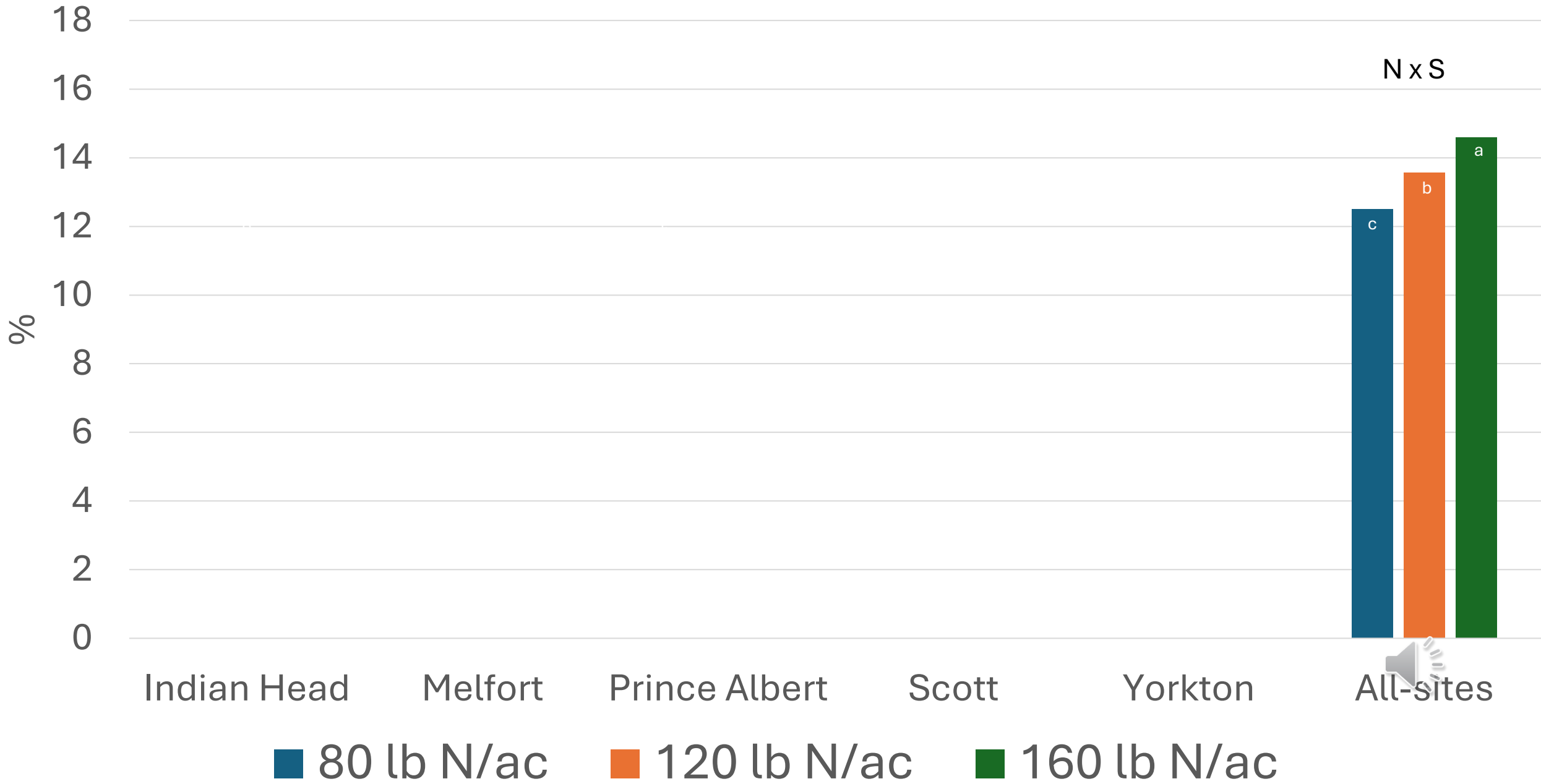
Main Effects of Product on Yield



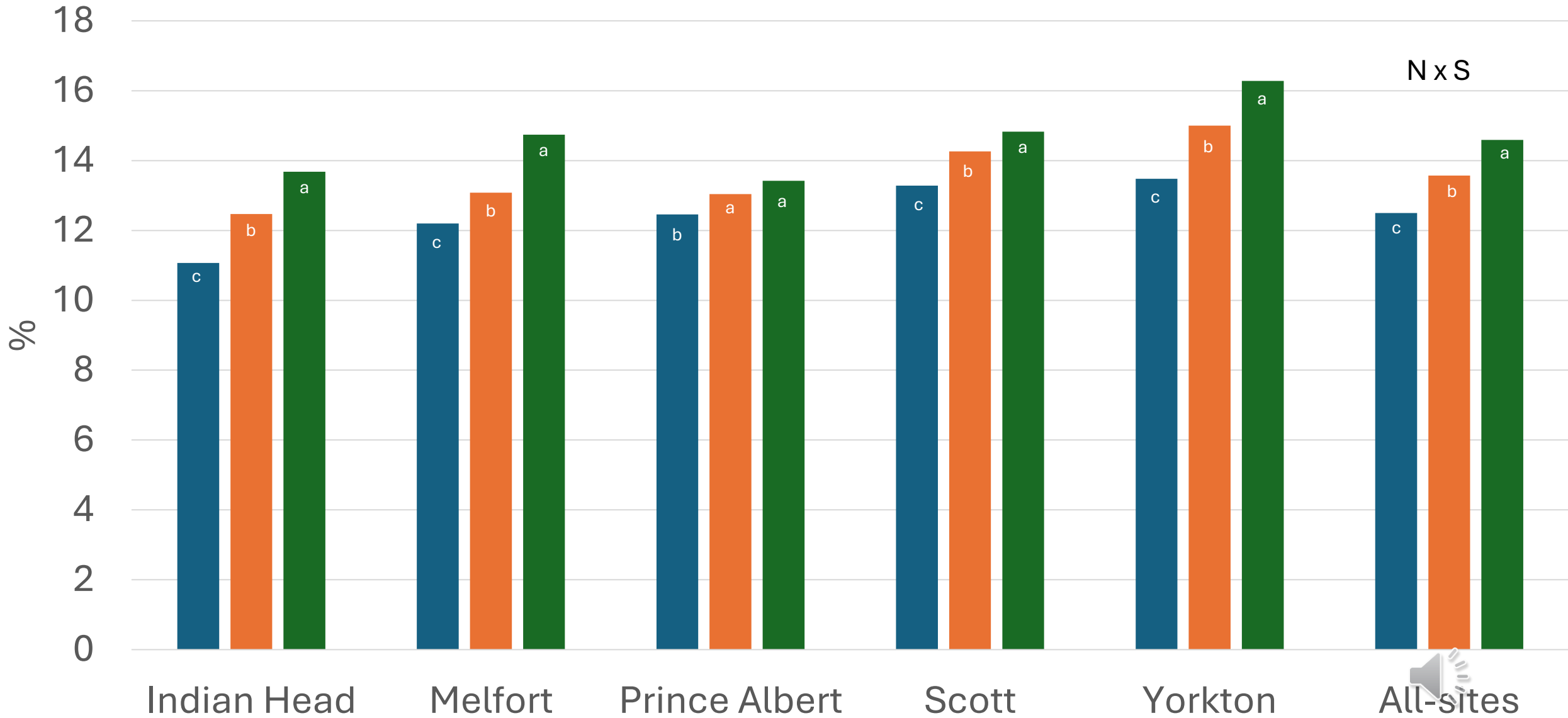
No yield benefit from side-banding either eNtrench or SuperU over straight Urea at any site

■ Urea ■ eNtrench ■ SuperU

Main Effects of Increasing N (soil + fertiler) on Grain Protein



Main Effects of Increasing N (soil + fertiler) on Grain Protein



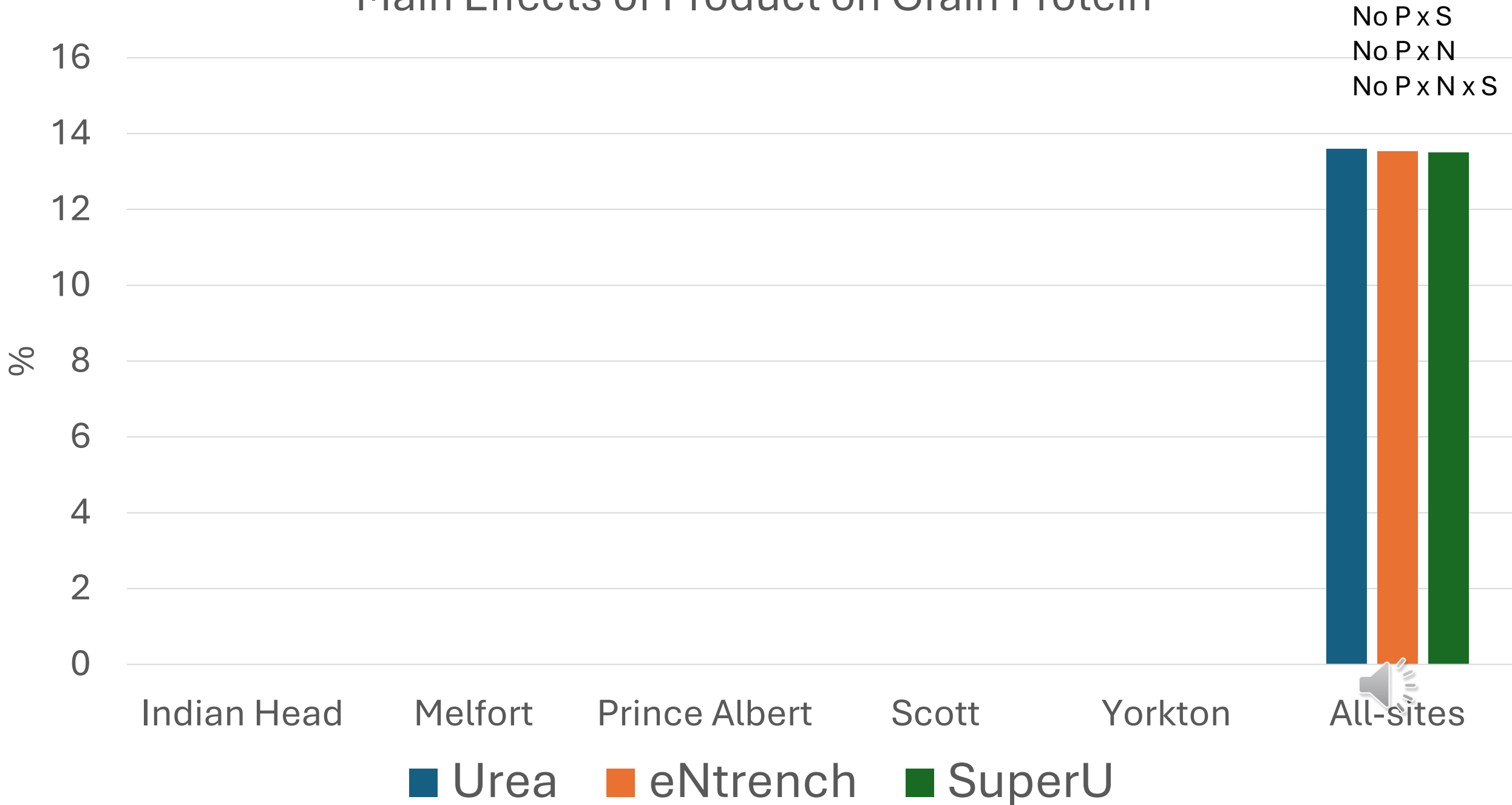
Grain Protein should be a good indicator of NUE between products

80 lb N/ac

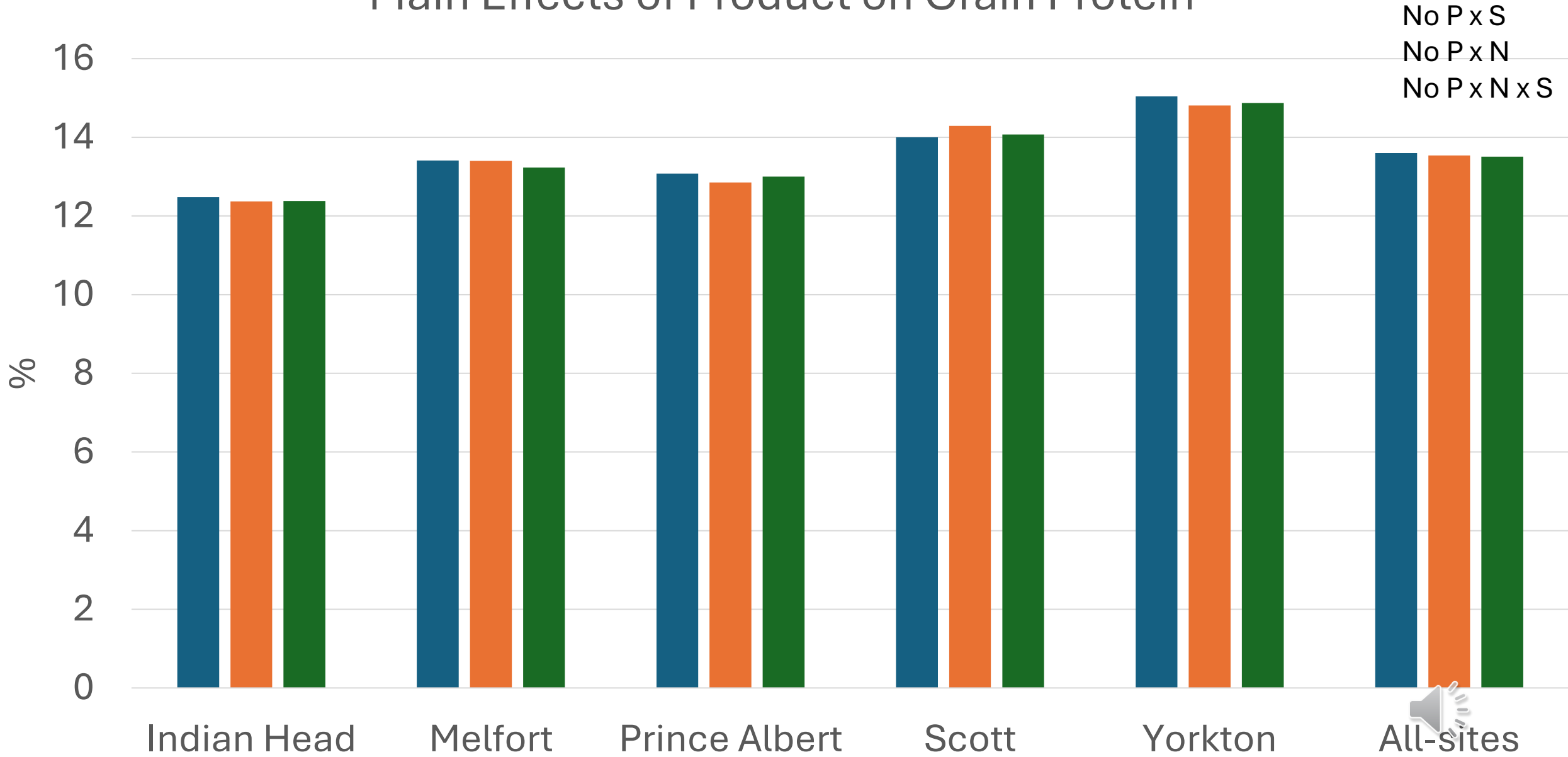
120 lb N/ac

160 lb N/ac

Main Effects of Product on Grain Protein



Main Effects of Product on Grain Protein



No yield benefit from side-banding either eNtrench or SuperU over straight Urea at any site

■ Urea ■ eNtrench ■ SuperU

Conclusions

- Neither eNtrench or SuperU improved the nitrogen use efficiency of side banded urea in wheat, when using yield and grain protein as proxies.



What if the urea is shallow banded?

- Producers might band shallow to reduce the draft on machinery or when seeding canola shallow.
- Some studies have found volatilization loss of N can actually be worse when shallow banding urea compared to broadcast applications! Counter Intuitive.
 - Why? High pH in concentrated band with little moist soil above.



Banding Shallow May Actually Increase N Loss!



Banding Shallow May Actually Increase N Loss!

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Prince Albert
Conservation learning Centre



Scott
Western Applied Research
Corporation



Melfort
Northeast Agriculture R
Foundation



Treatment list.

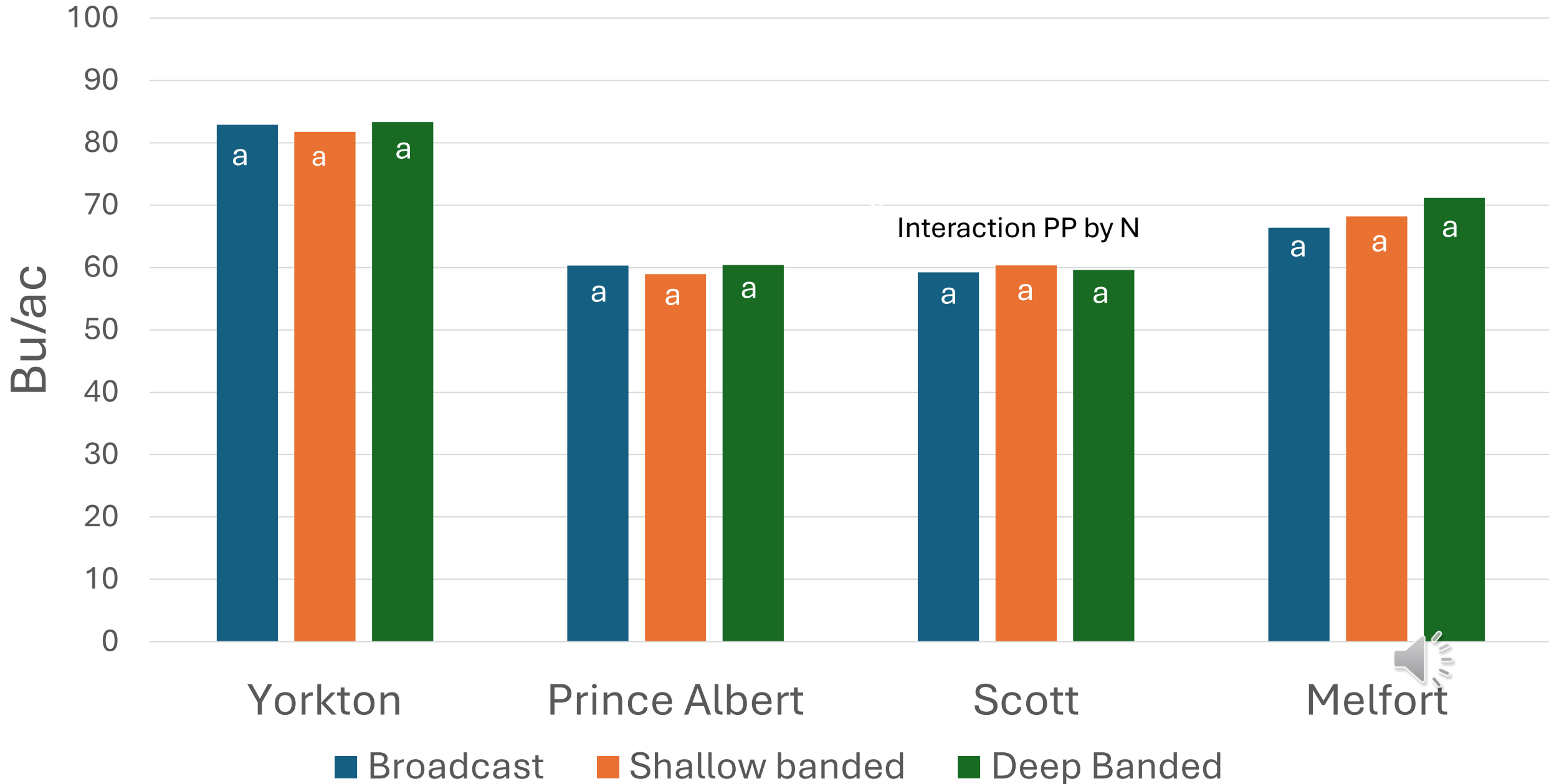
Trt #	Product Placement	Product	N Rate (lb/ac soil +fert N) ¹
1	Broadcast	Urea	80
2	Broadcast	Urea	160
3	Broadcast	SuperU	80
4	Broadcast	SuperU	160
5	Shallow Banded (1.5 inches)	Urea	80
6	Shallow Banded (1.5 inches)	Urea	160
7	Shallow Banded (1.5 inches)	SuperU	80
8	Shallow Banded (1.5 inches)	SuperU	160
9	Deep Banded (4 inches)	Urea	80
10	Deep Banded (4 inches)	Urea	160
11	Deep Banded (4 inches)	SuperU	80
12	Deep Banded (4 inches)	SuperU	160
13	Check: No Urea applied		



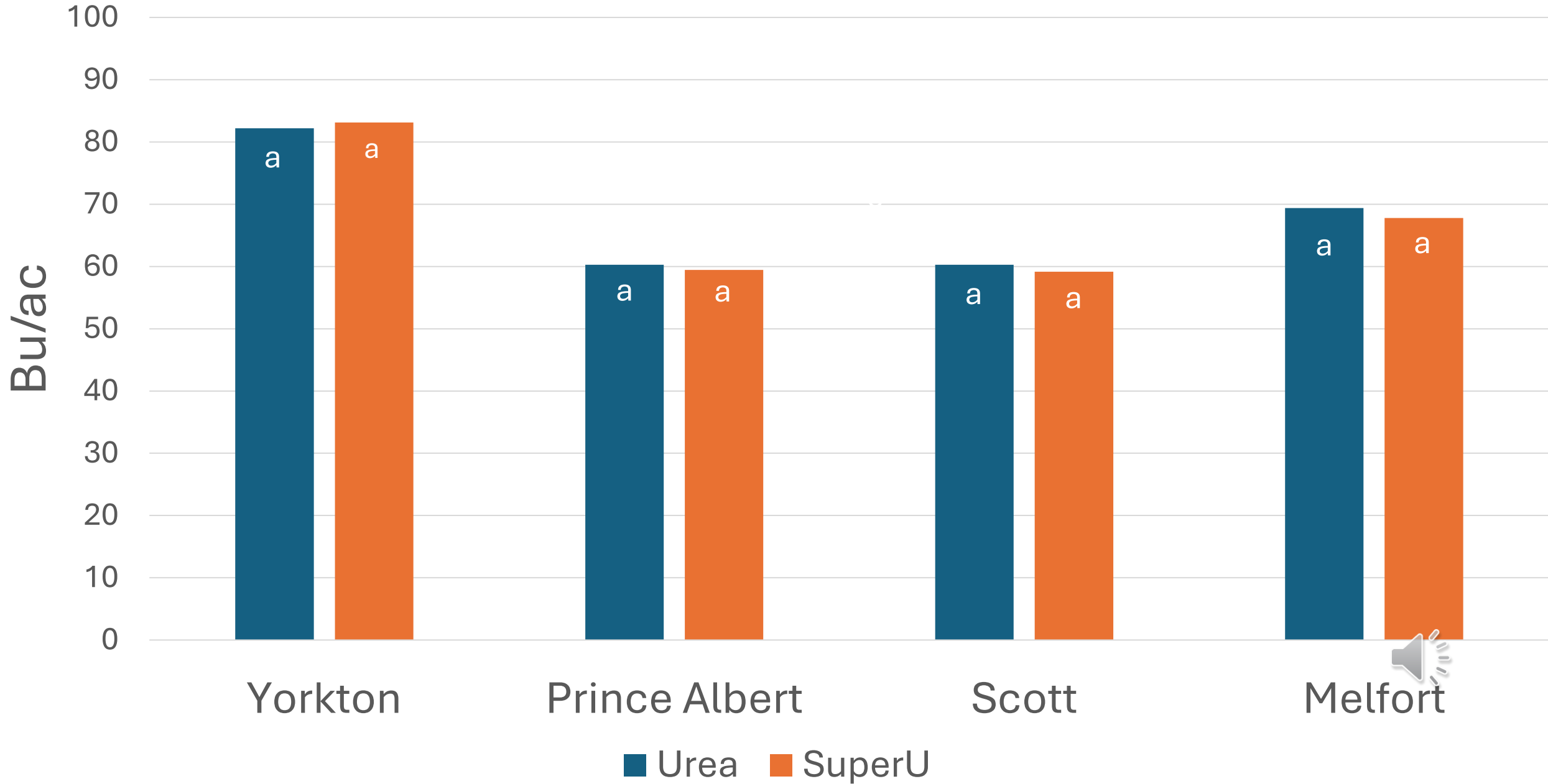
¹Soil N will be based on (0-24" soil depth). Values from a 0-12" soil depth will be multiplied by 1.5 to approximate a 0-24" depth.

Wish we could have included Anvol

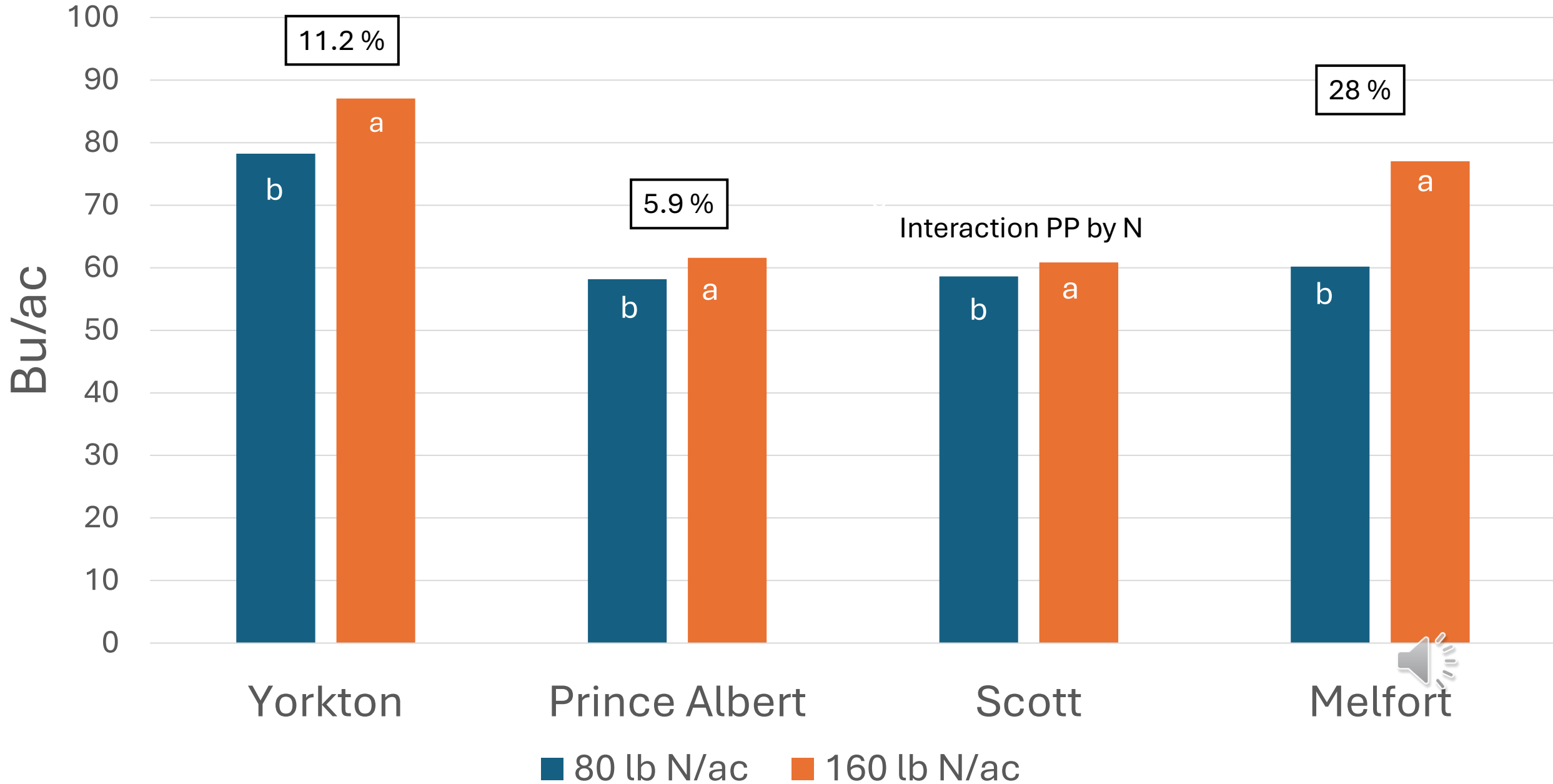
Effect Product Placement on Wheat Yield



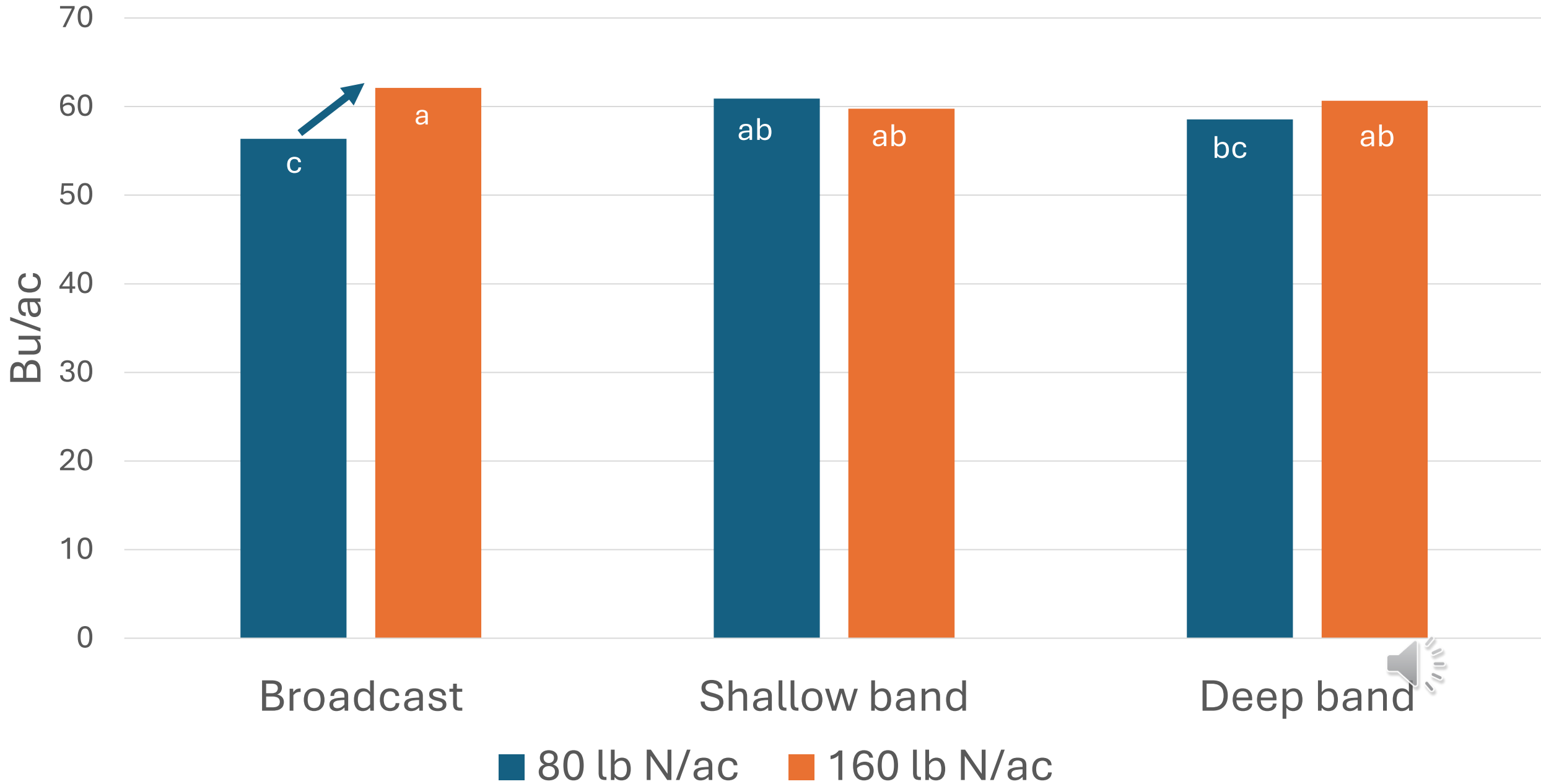
Effect Product on Wheat Yield



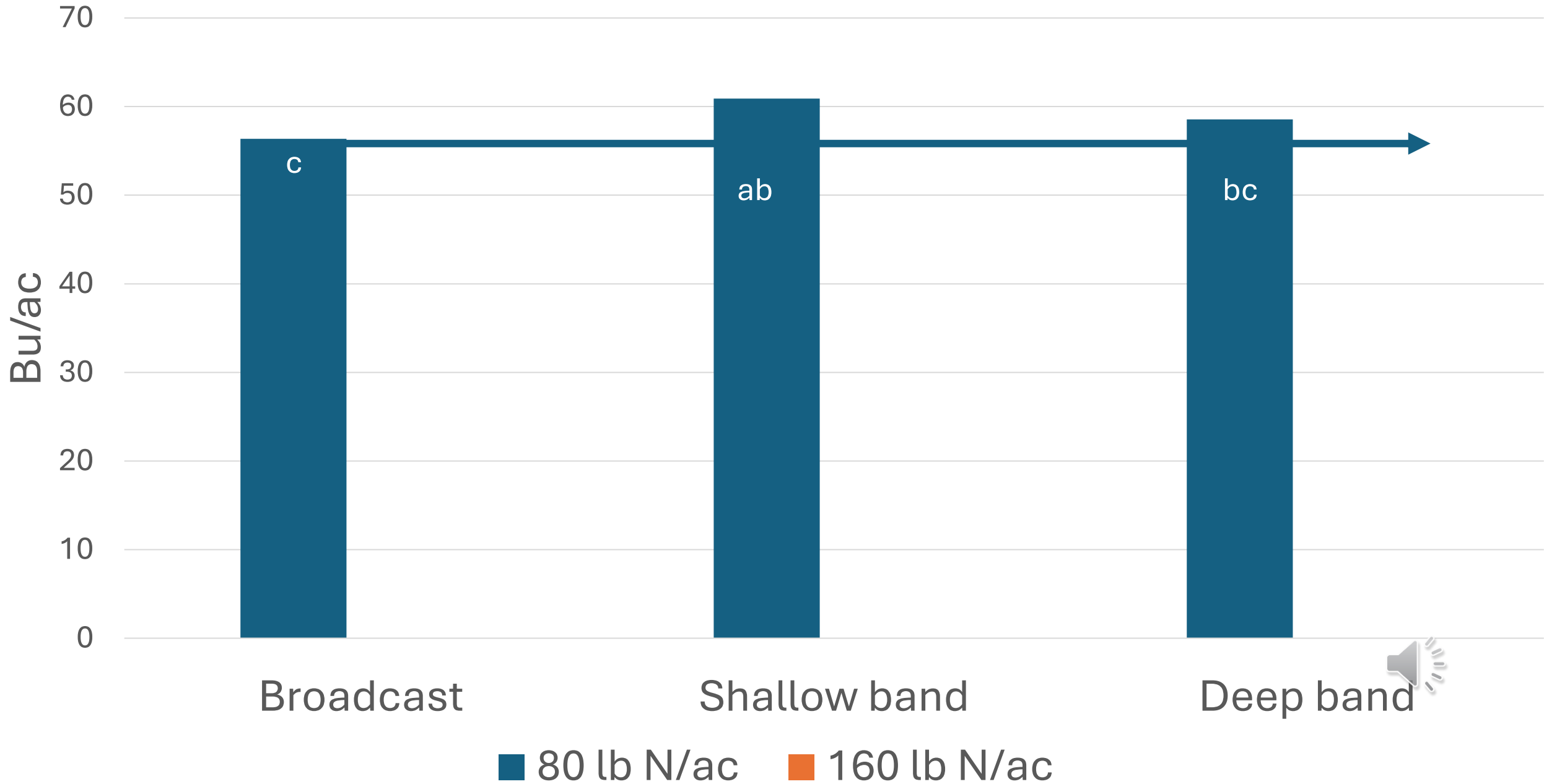
Effect N rate on Wheat Yield



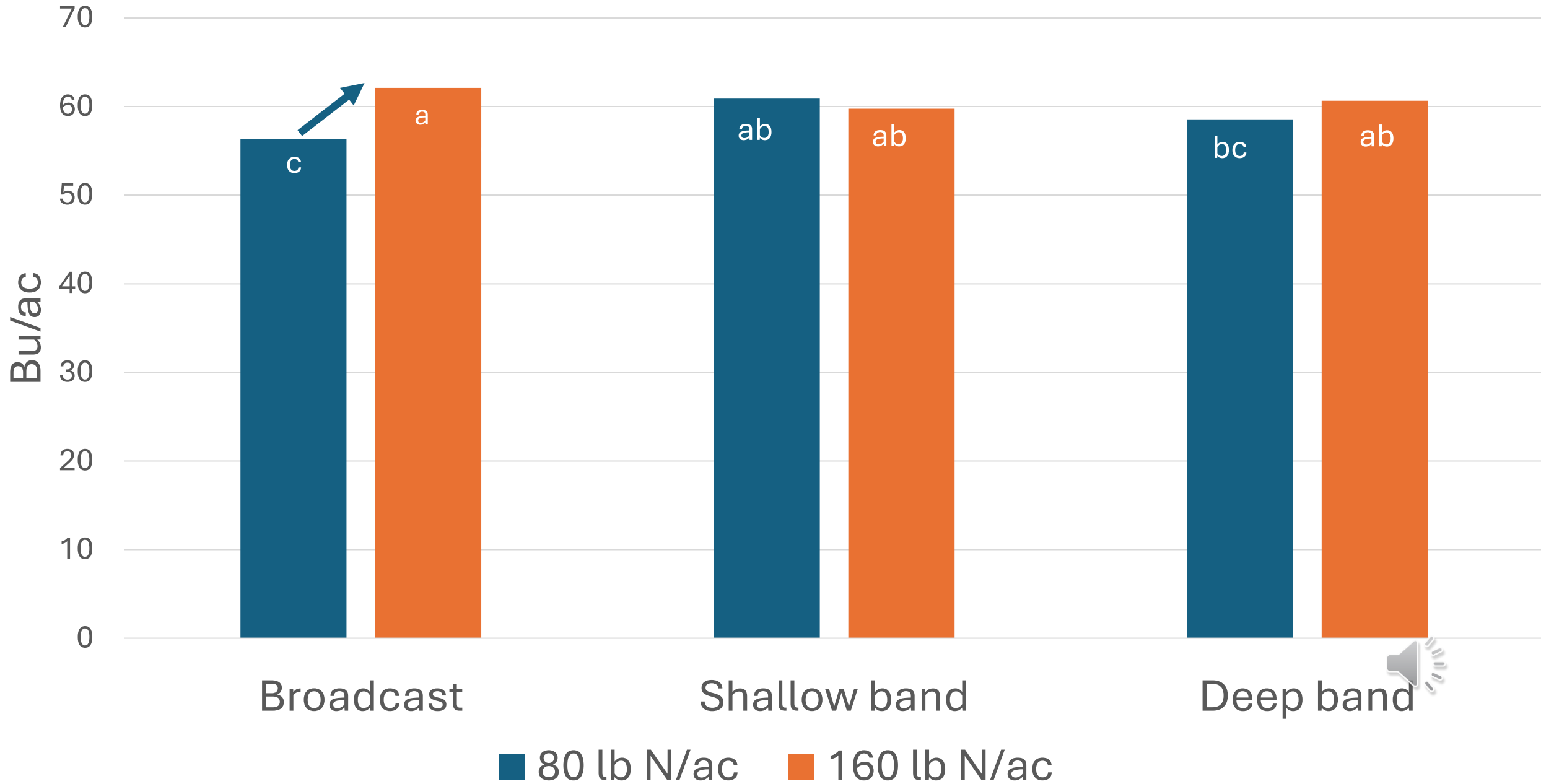
Effect of Product Placement, and N rate on Wheat Yield (Scott)



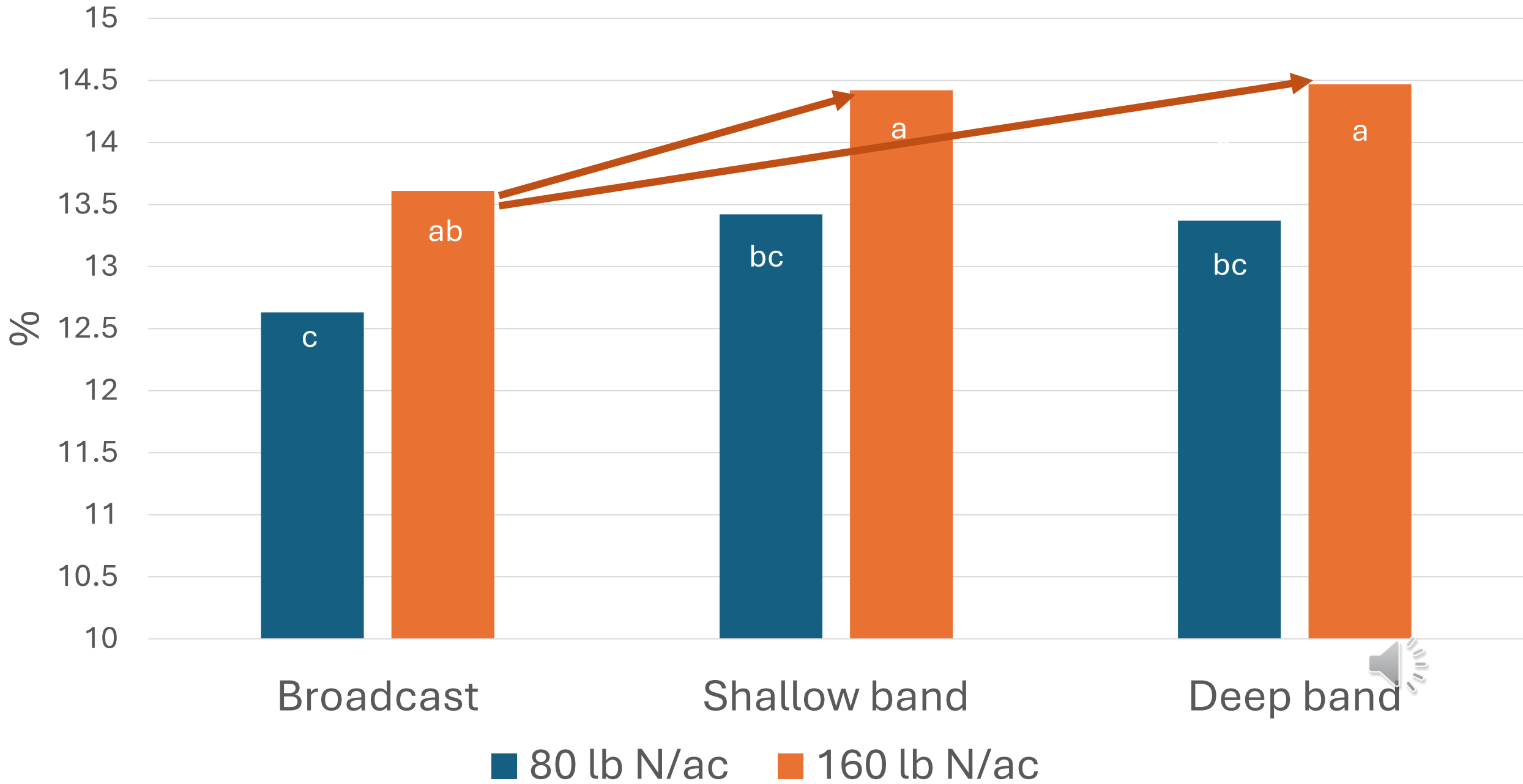
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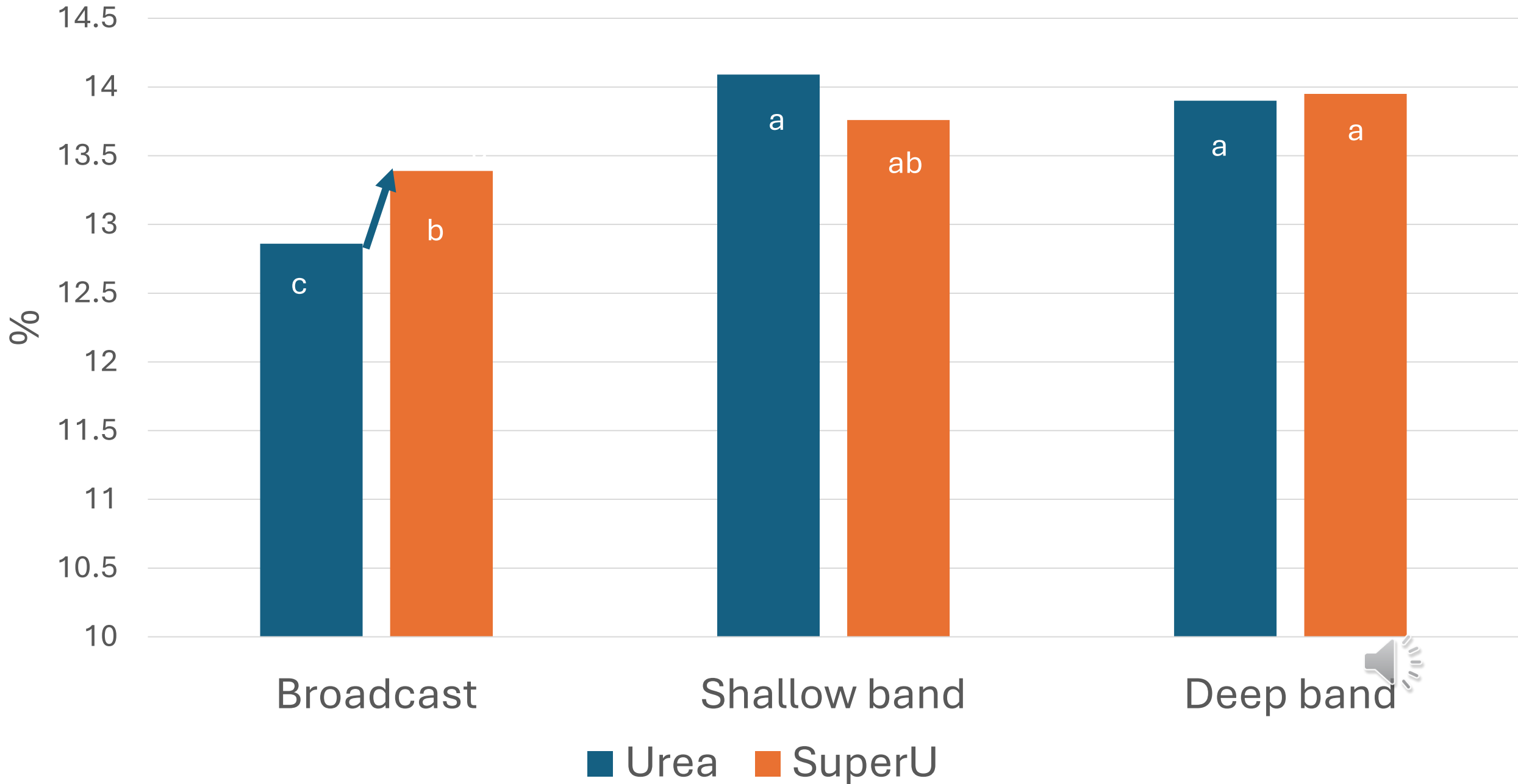
Effect of Product Placement, and N rate on Wheat Yield (Scott)



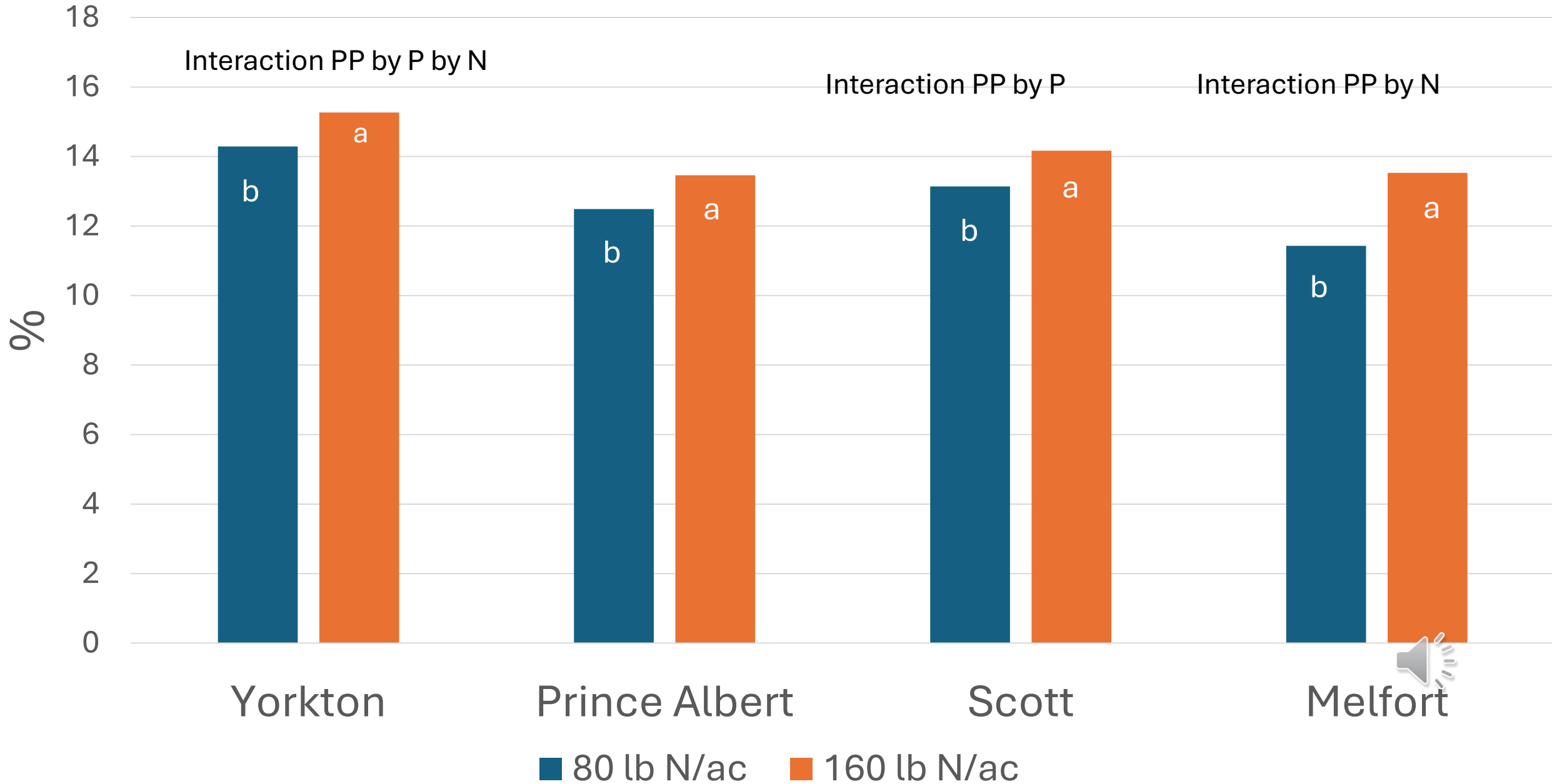
Effect of Product Placement, and N rate on Wheat Grain Protein (Scott)



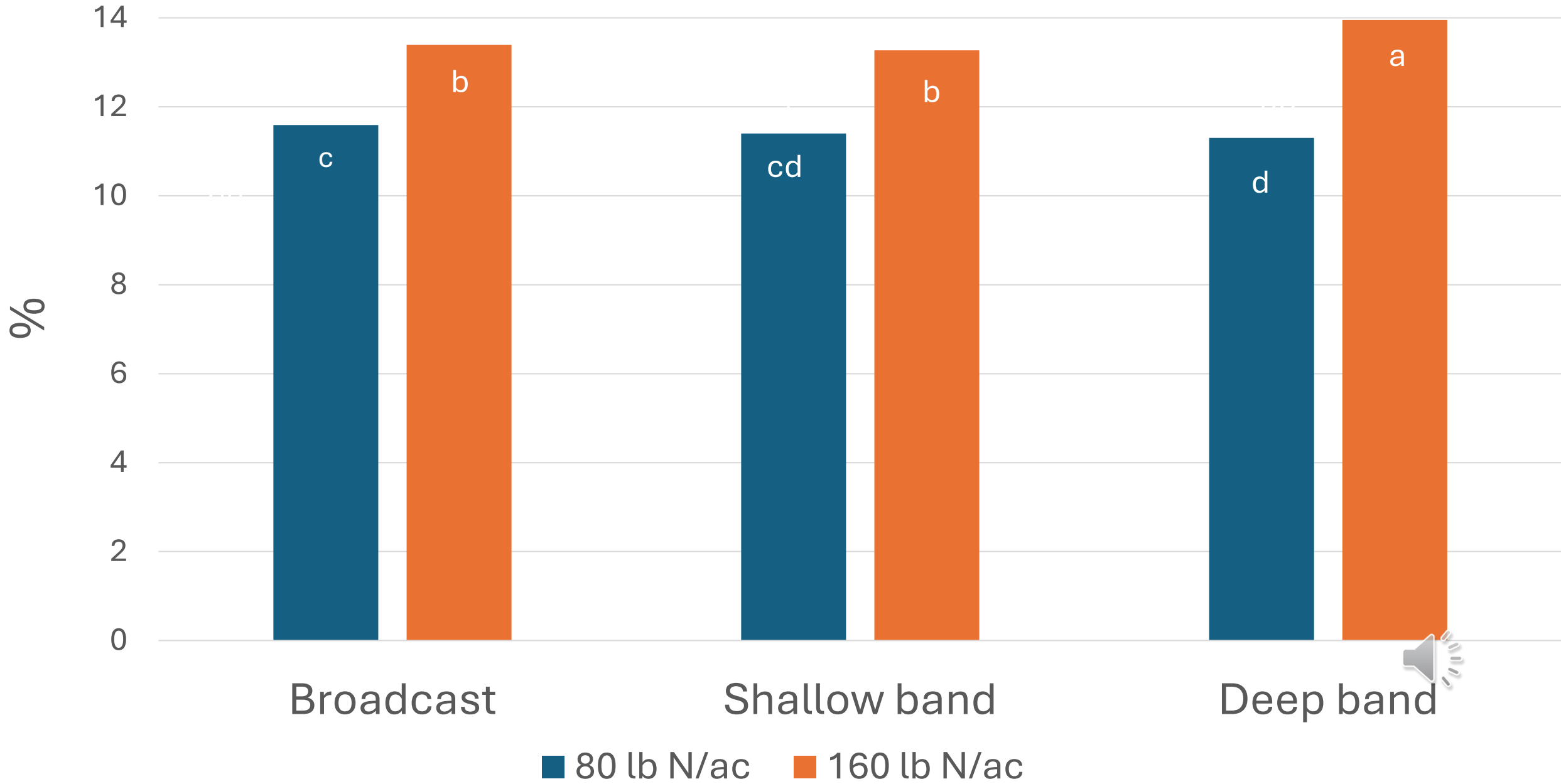
Effect of Product Placement, and Product on Wheat Grain Protein (Scott)



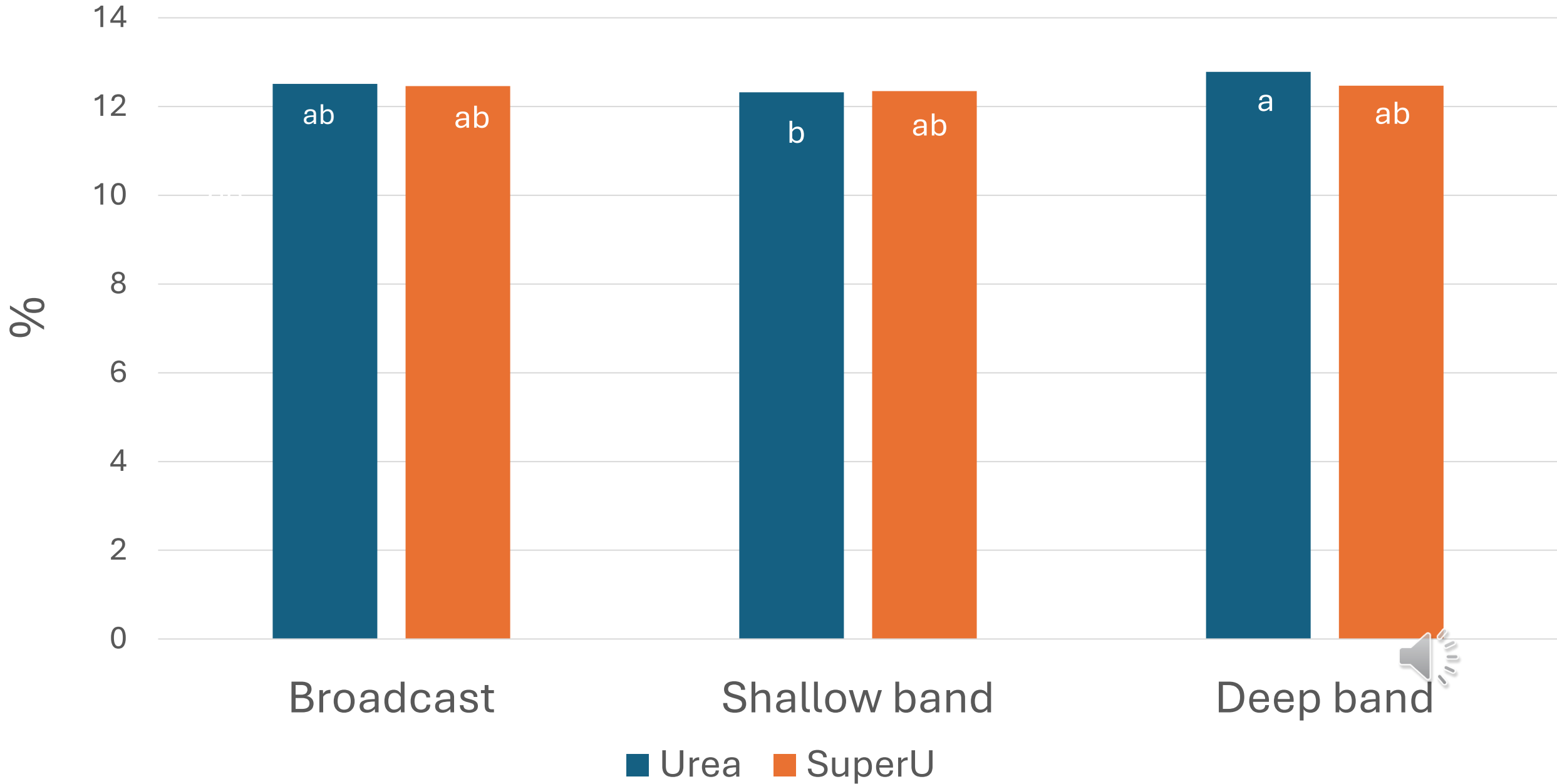
Effect N rate on Wheat Grain Protein



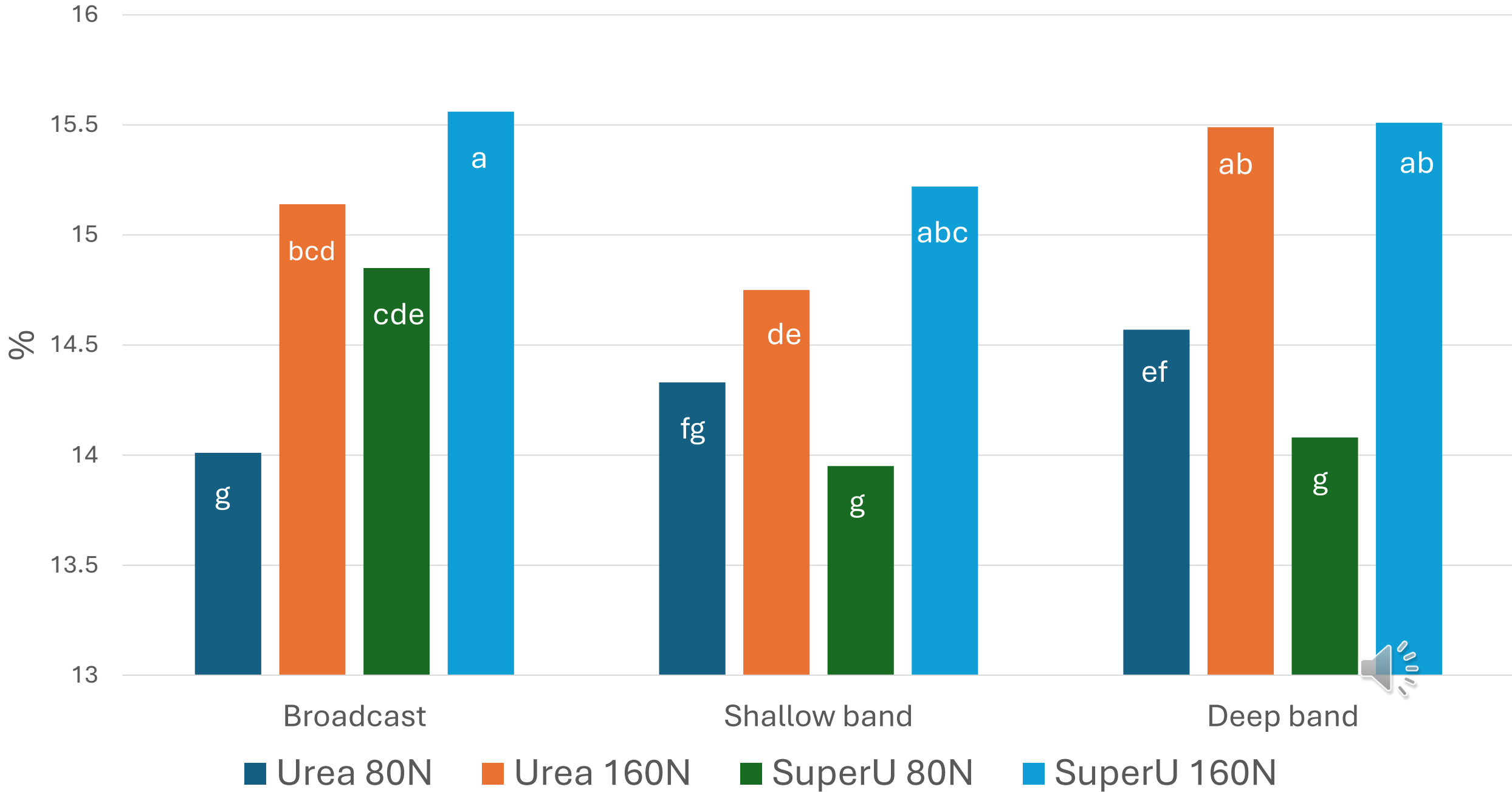
Effect of Product Placement, and N rate on Wheat Grain Protein (Melfort)



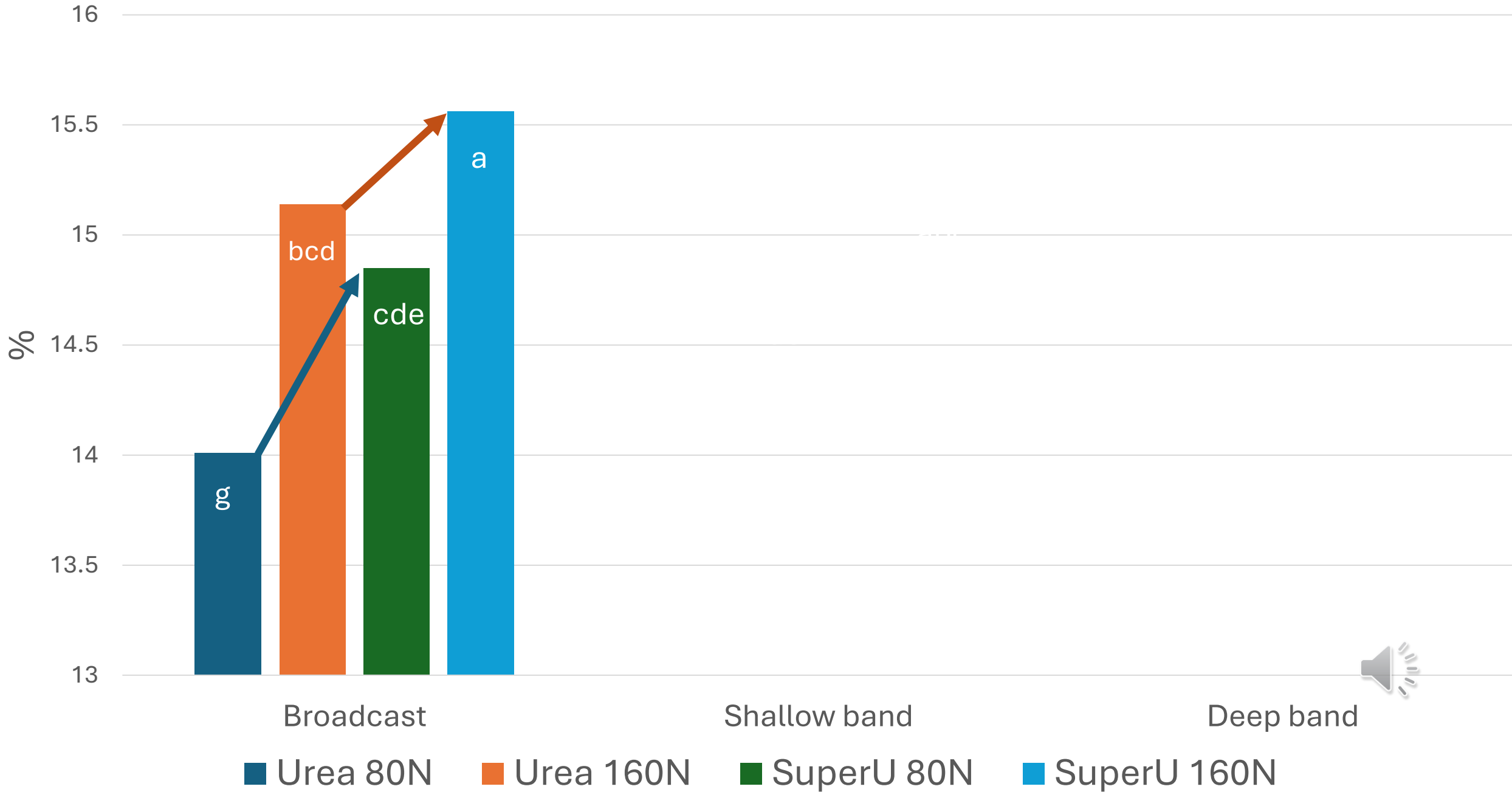
Effect of Product Placement, and N rate on Wheat Grain Protein (Melfort)



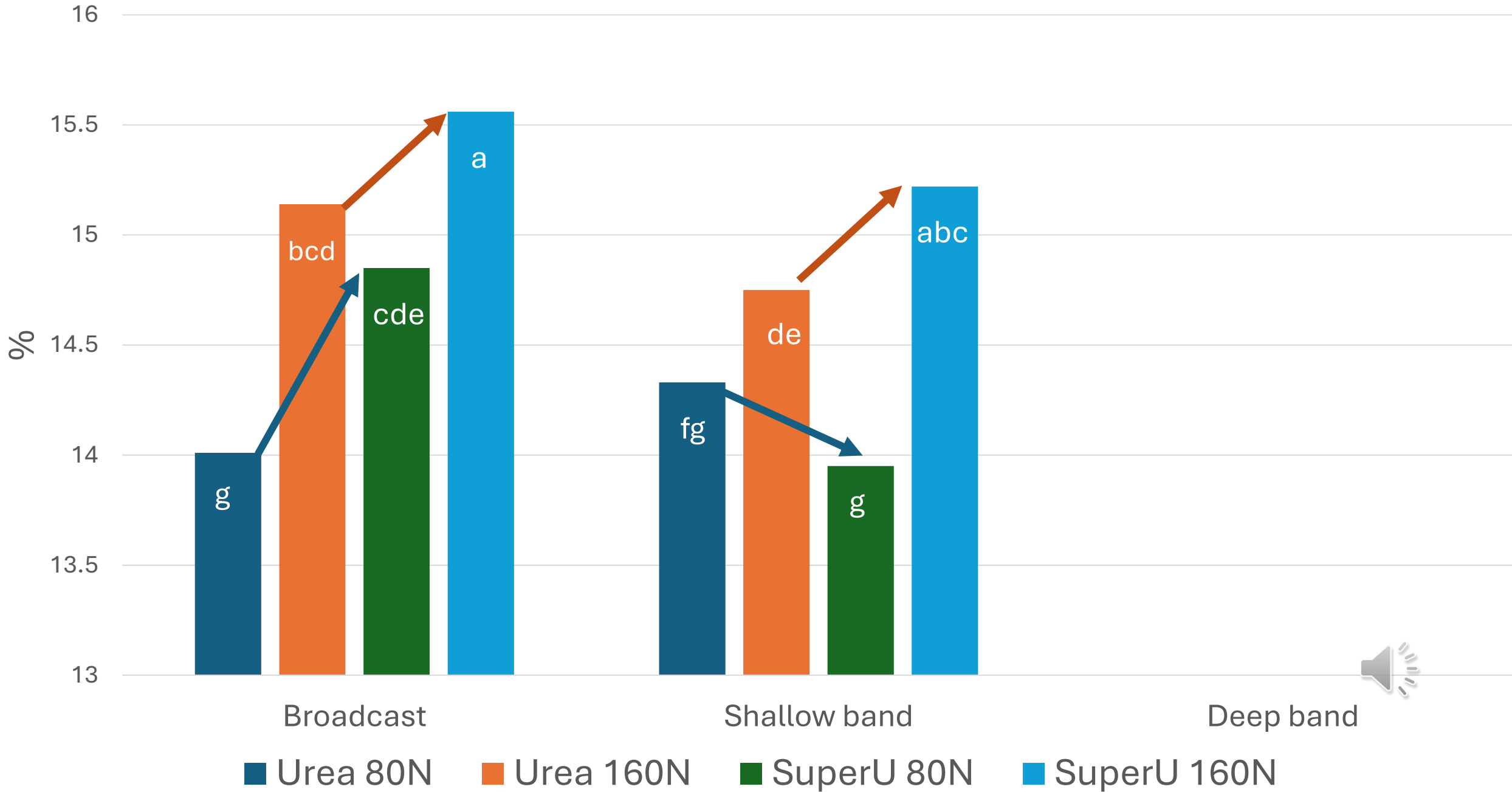
Effect of Product Placement, Product and N rate on Wheat Grain Protein (Yorkton)



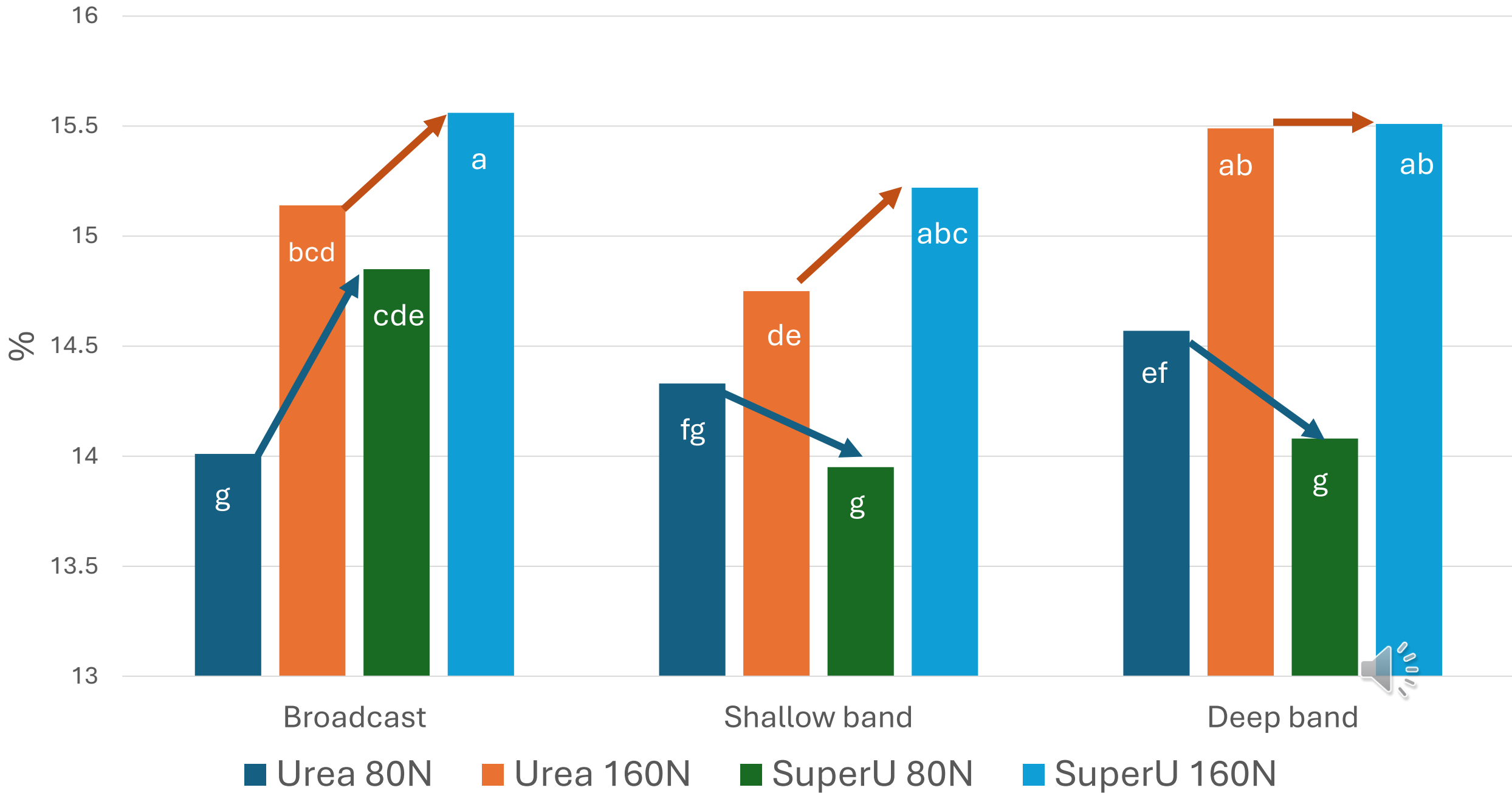
Effect of Product Placement, Product and N rate on Wheat Grain Protein (Yorkton)



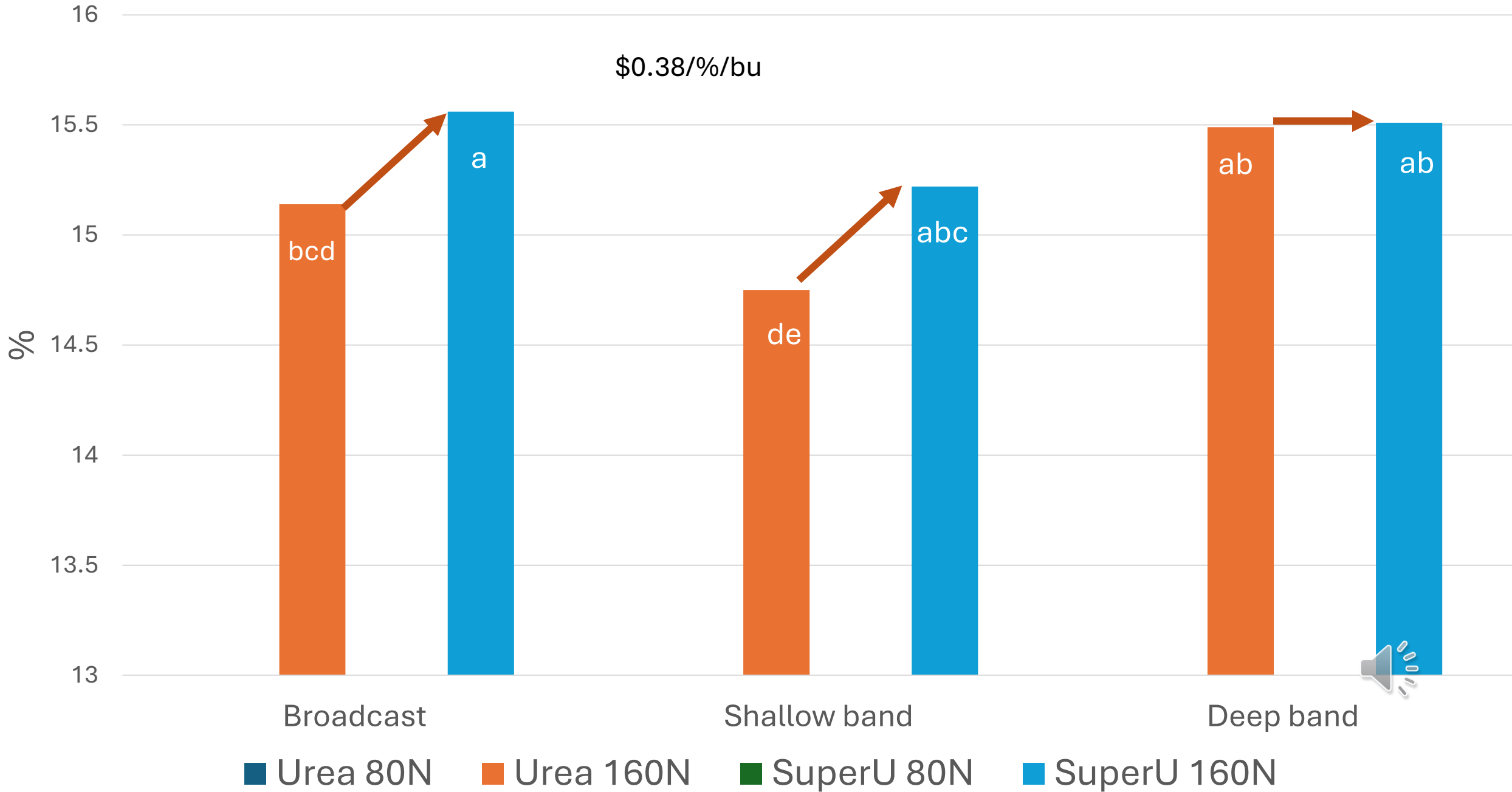
Effect of Product Placement, Product and N rate on Wheat Grain Protein (Yorkton)



Effect of Product Placement, Product and N rate on Wheat Grain Protein (Yorkton)



Effect of Product Placement, Product and N rate on Wheat Grain Protein (Yorkton)



Conclusions

\$0.38/%/bu

- There was some evidence to suggest volatilization losses were higher when broadcasting and shallow banding and that these losses could be reduced by either deep banding or using SuperU
- However, using SuperU over straight urea would have only been economical at a protein premium beyond \$0.38/%/bu.



So where do these products have an excellent fit?

- Broadcasting in fall, particularly if done early. But not on snow.



Should N be applied to snow to speed up seeding operations the following spring?



Mike Hall – Research Coordinator



2018



Broadcast Urea and SUPERU

- Early Fall (Oct. 2)
- Late Fall (Oct. 27)
- Early Winter on 10 cm of snow (Nov. 5)

VERSUS

Banded Urea Checks

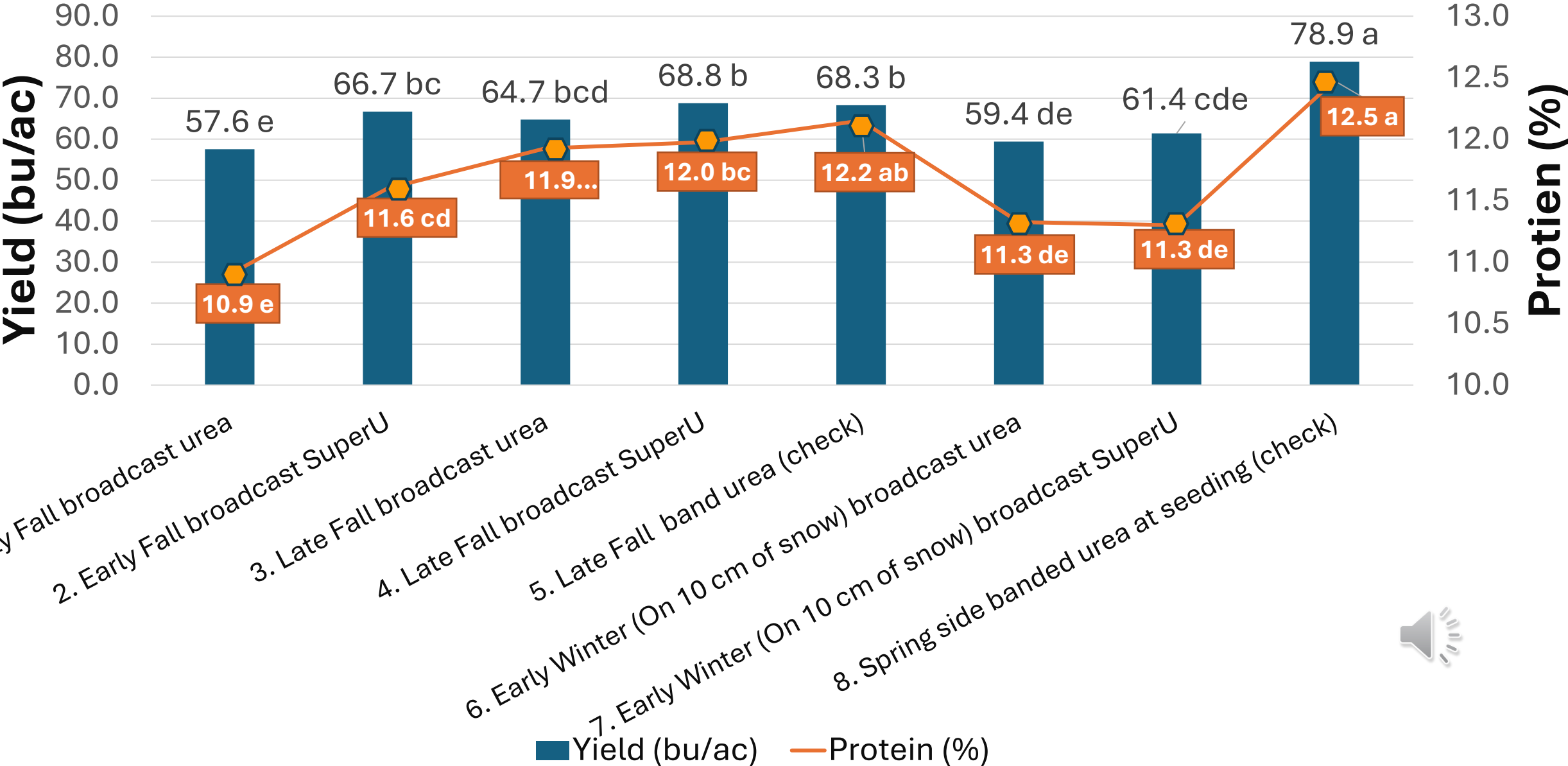
- Late Fall (Oct. 27)
- Side banded at seeding

Every treatment has received 80 lb N/ac

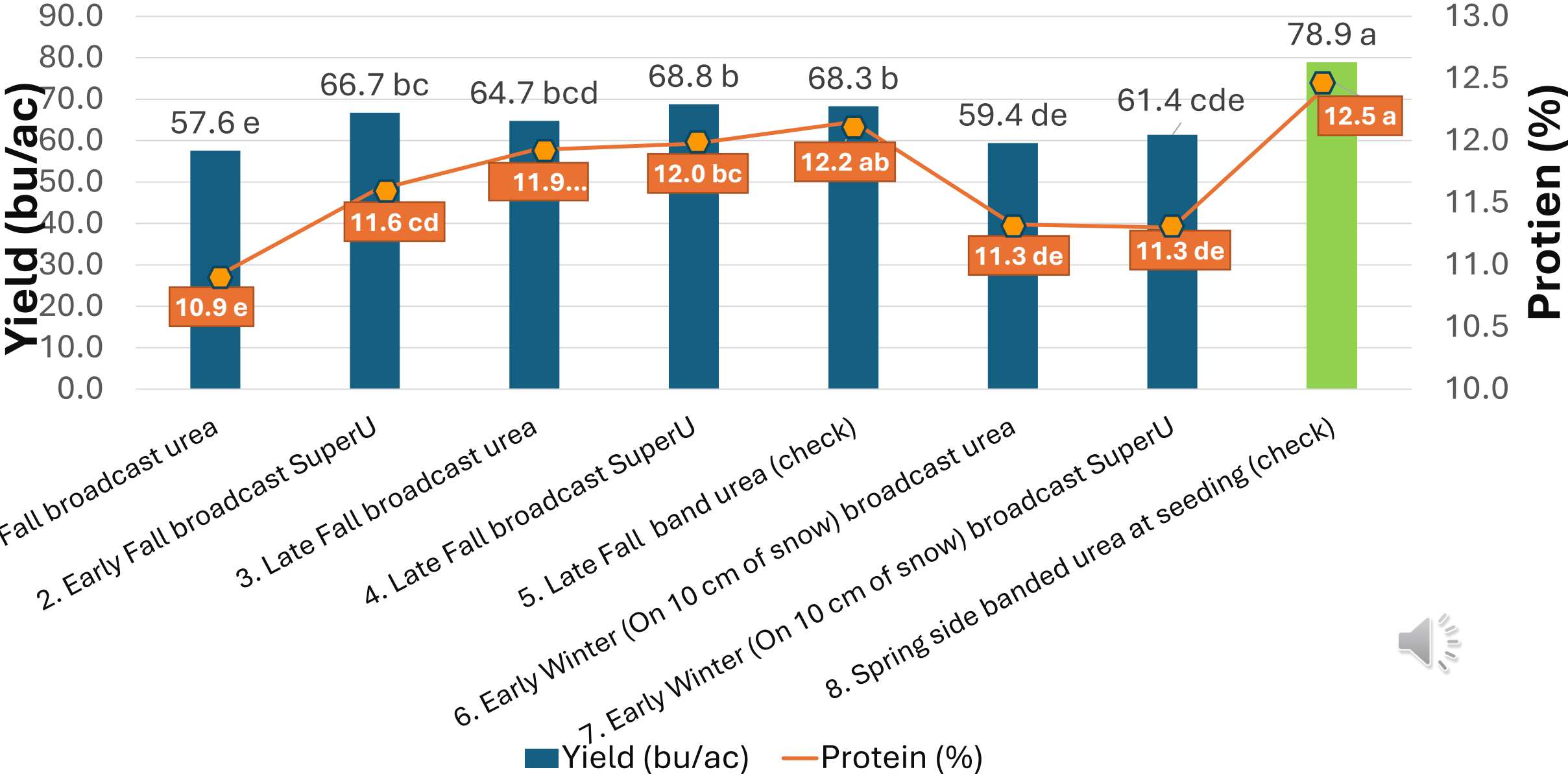




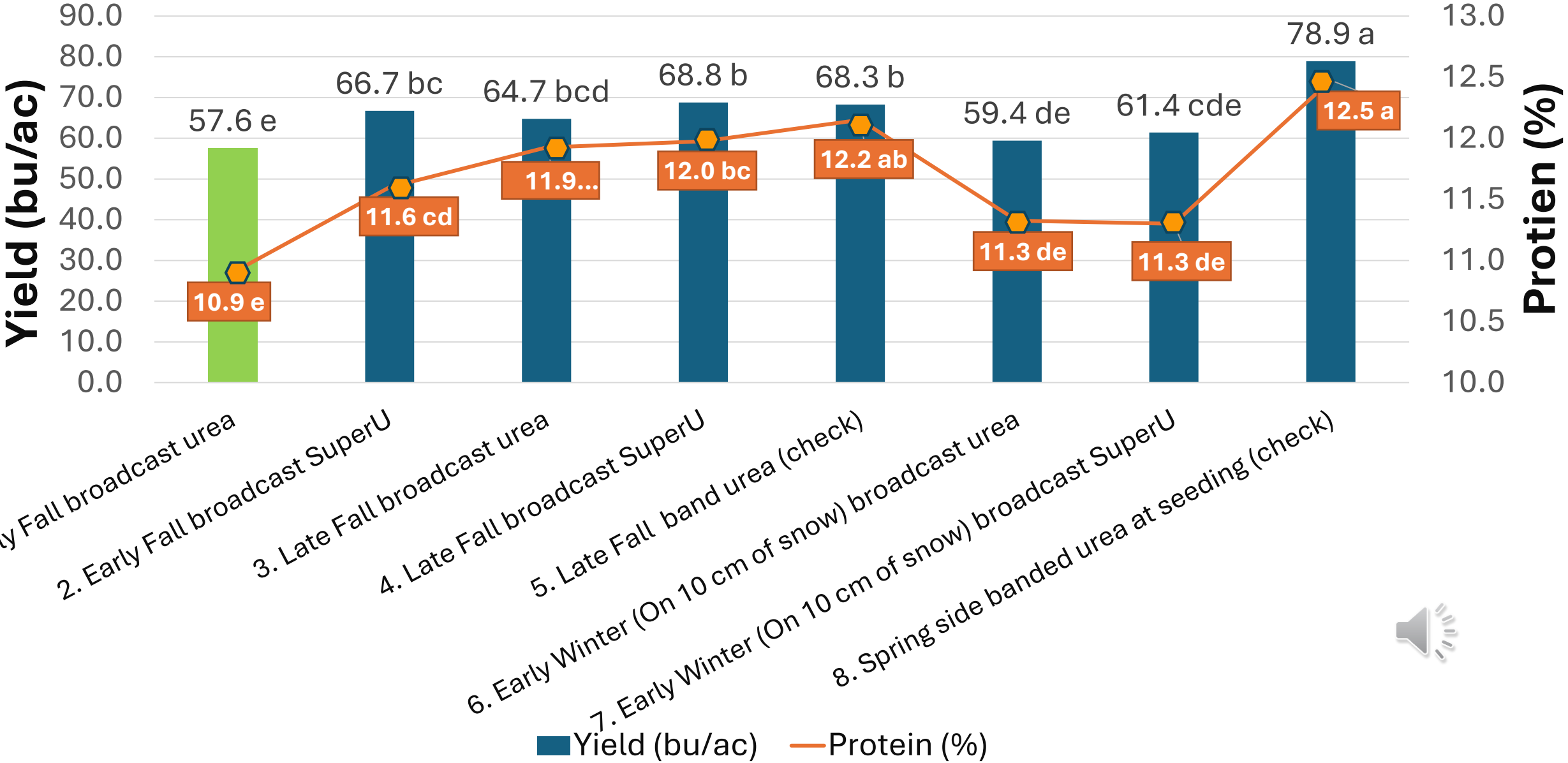
Effect of Urea (80 lbs N/ac) Source and Timing on Yield and Protein of Wheat¹



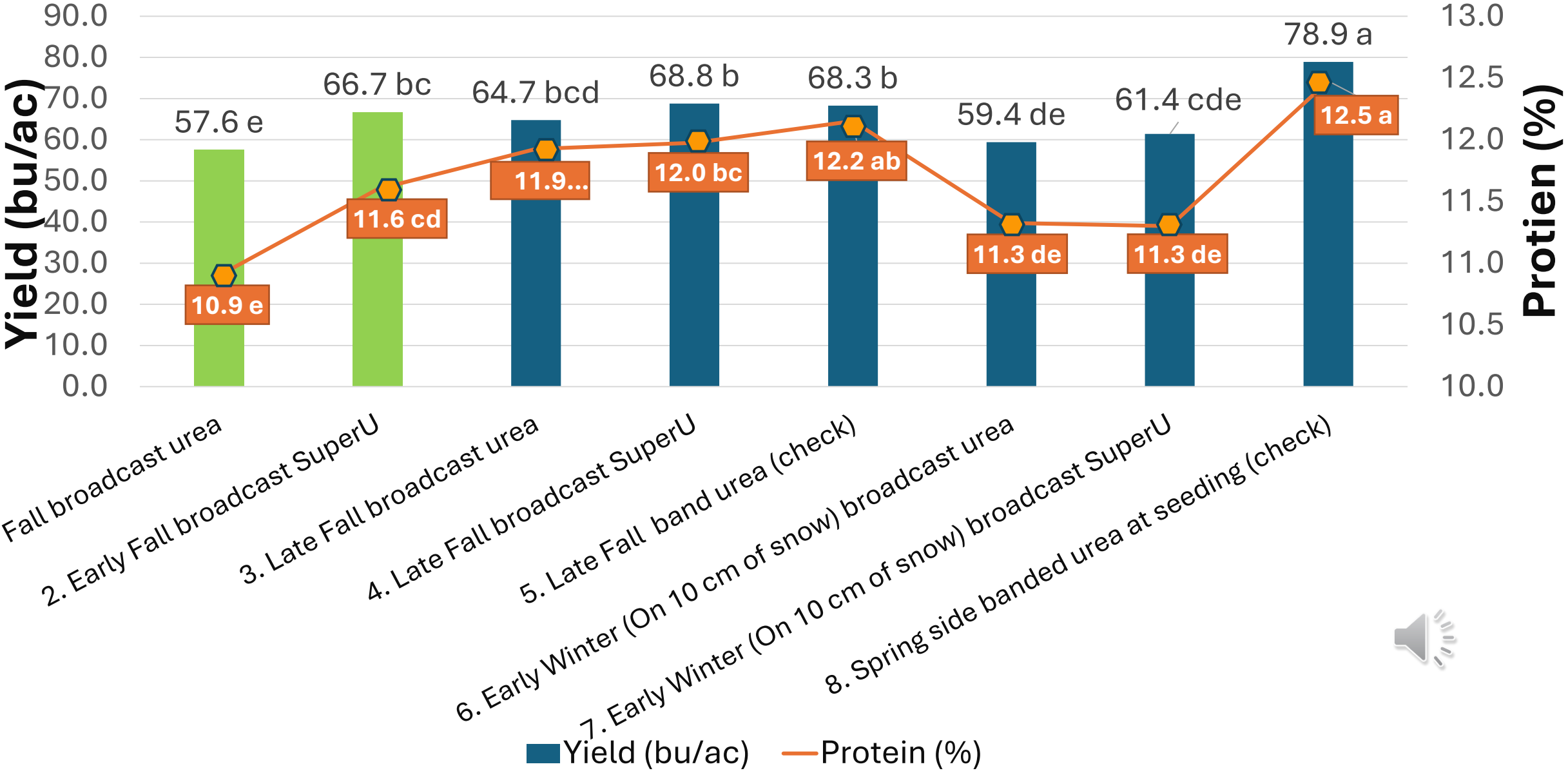
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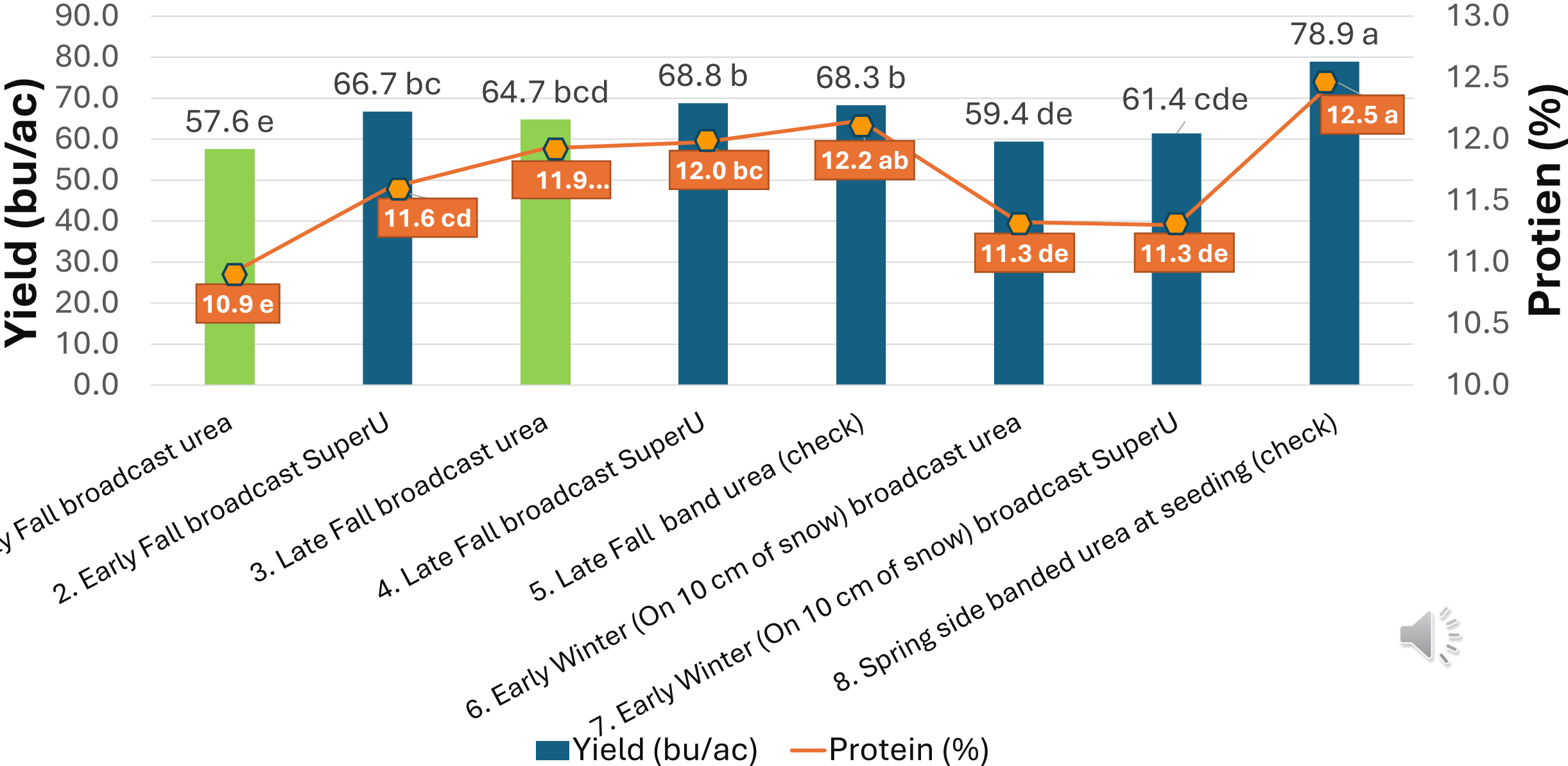
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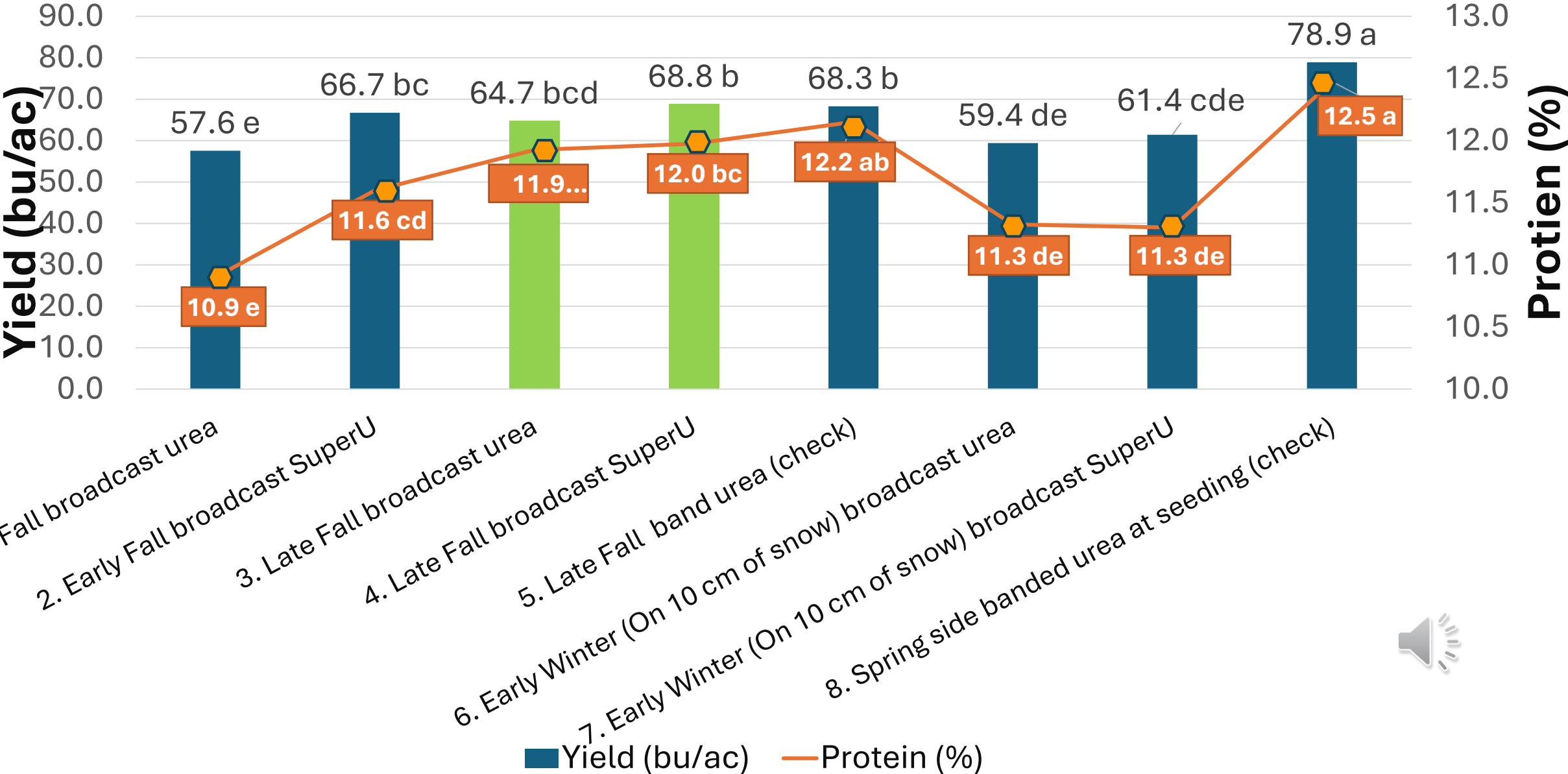
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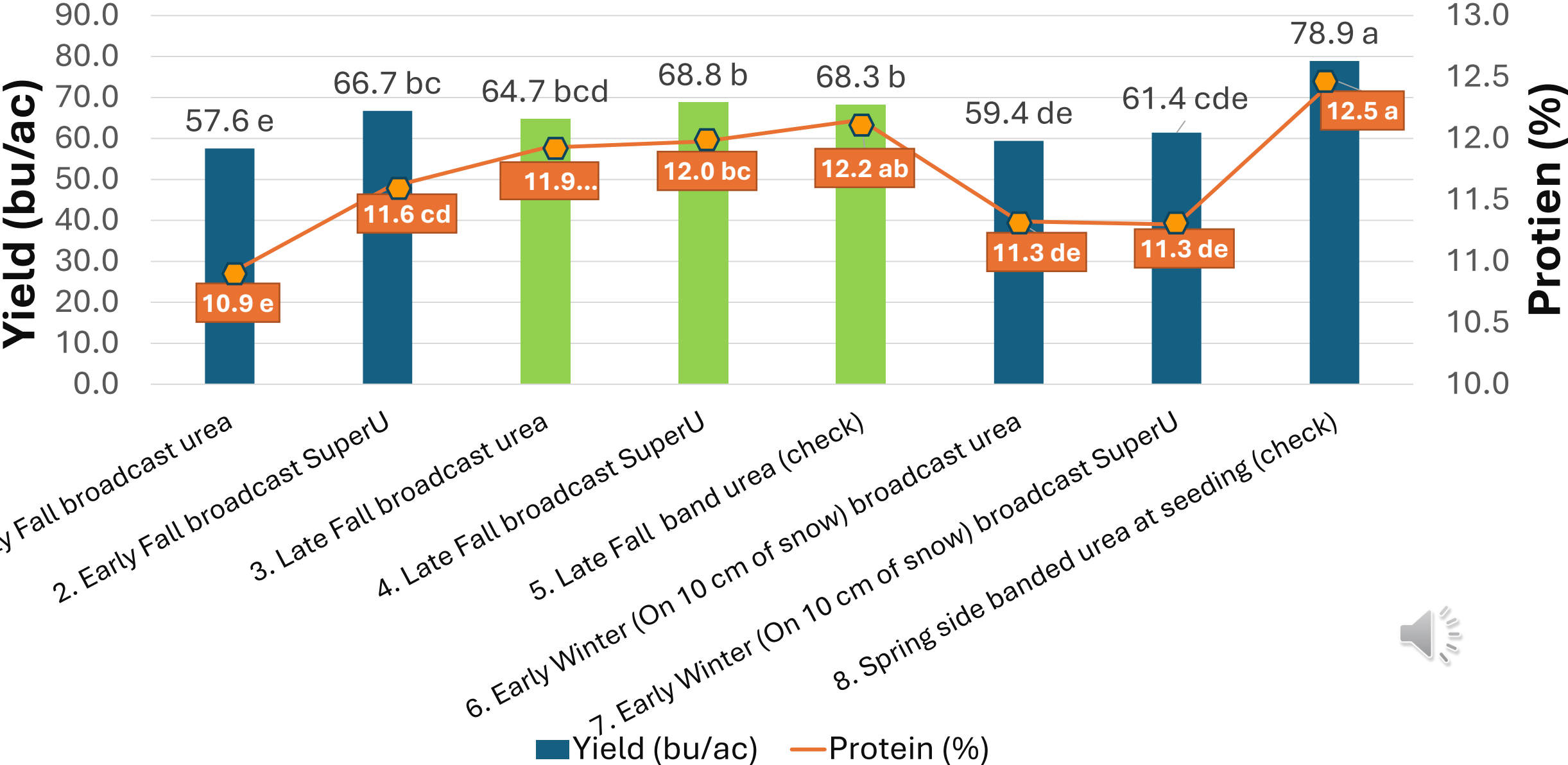
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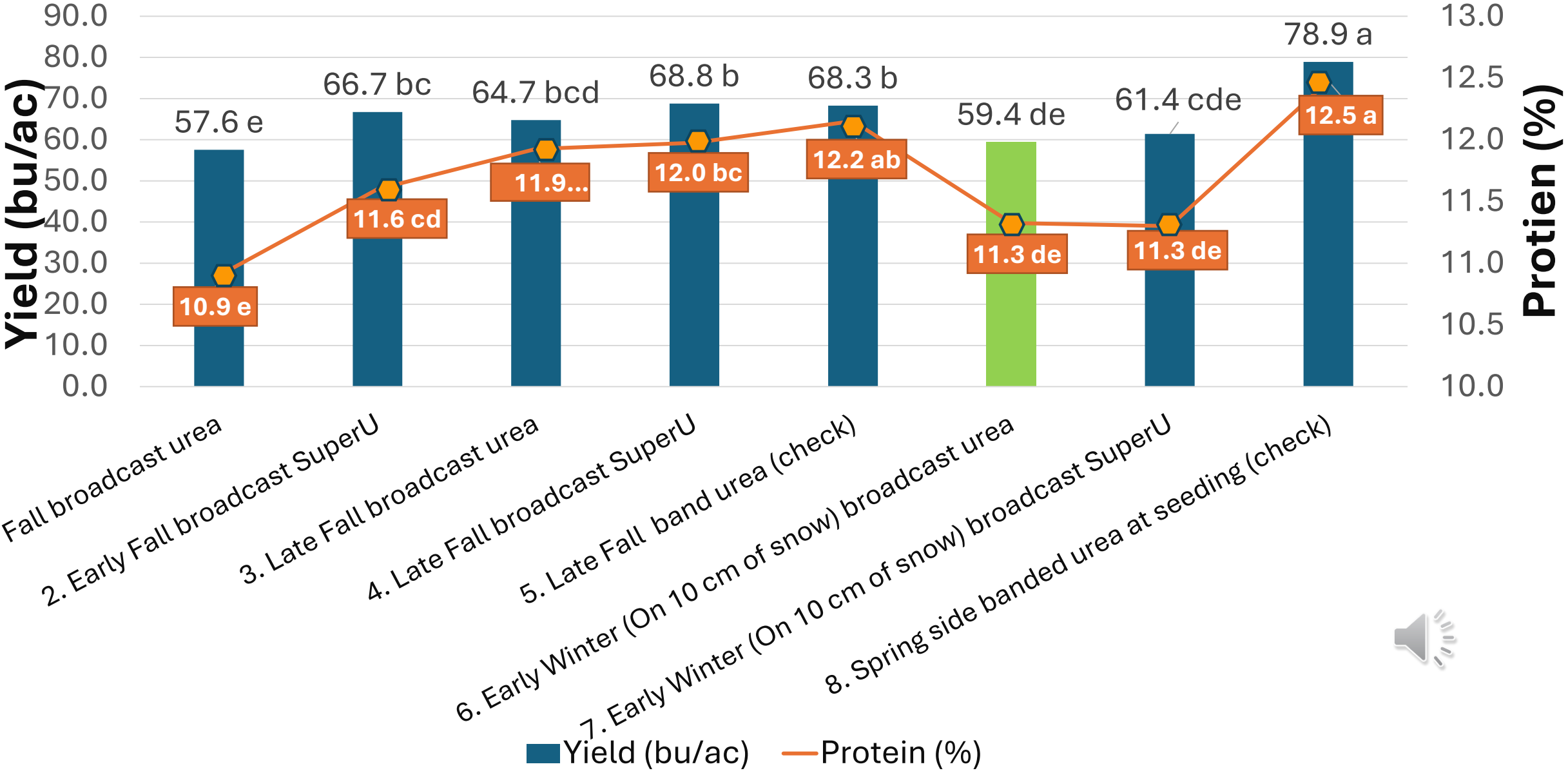
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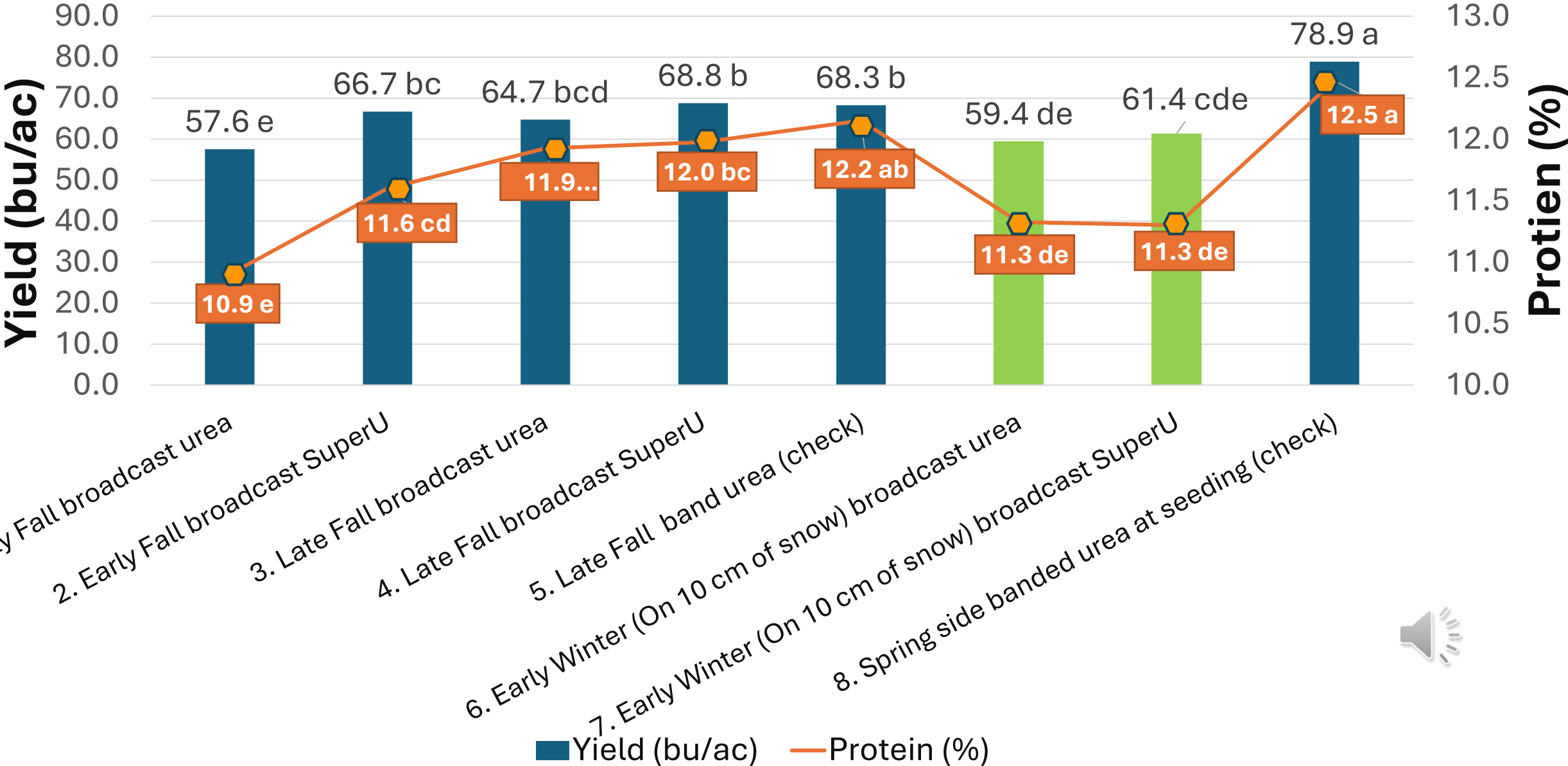
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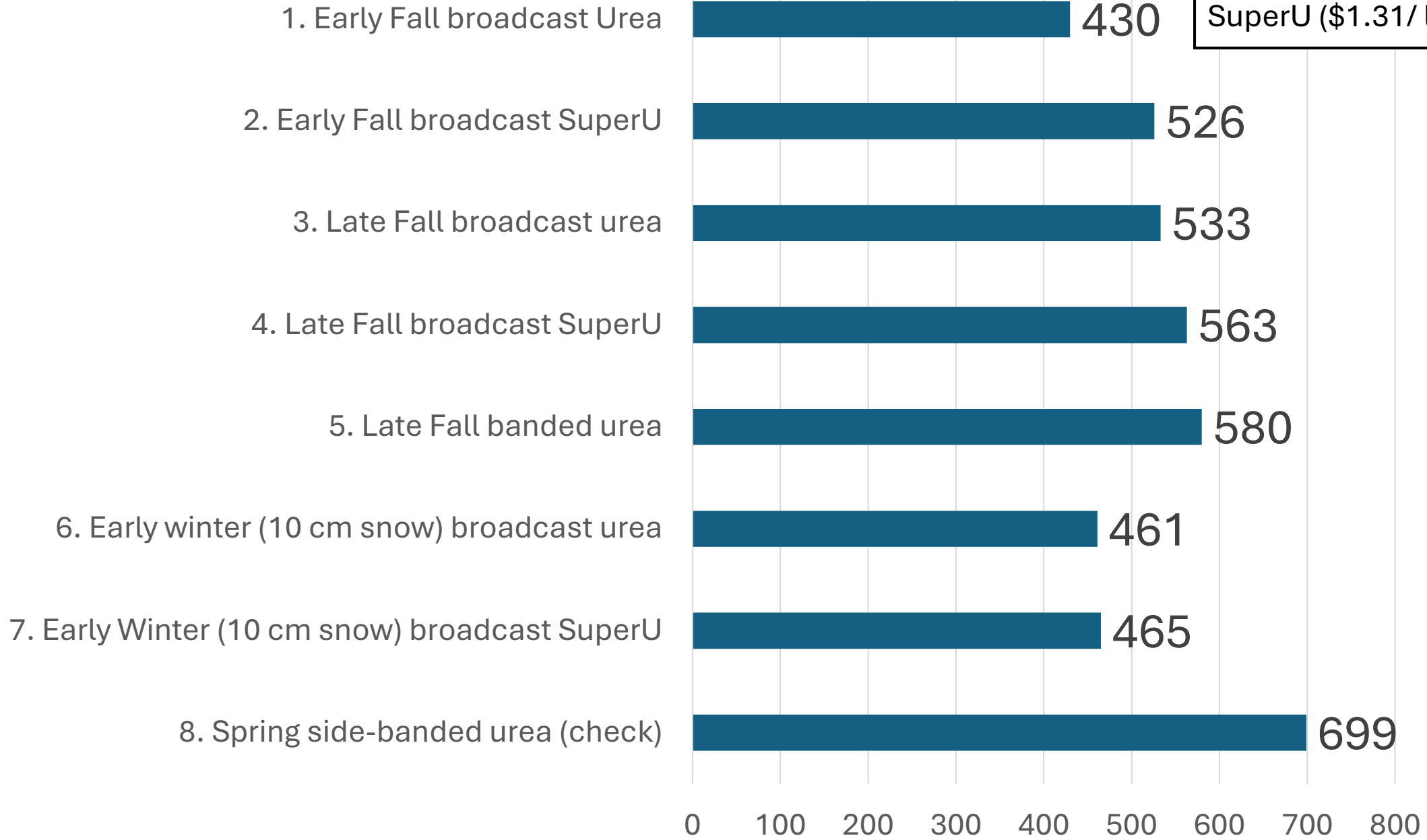
Effect of Urea (80 lbs N/ac) Source and Timing on Yield and Protein of Wheat¹



Yorkton 2018 Gross Return-N cost (\$/ac)

80 lb N/ac

Wheat @12.5 protein (\$10/bu)
Protein premium (\$0.6/%/bu)
Urea (\$1.13/ lb N; \$1146/tonne)
SuperU (\$1.31/ lb N; \$1328/tonne)



What about Post-emergent applications?

- How efficient are they relative to side-banding N?
- By when should the N be applied?
- Can using EEF help?



Post-emergent N in Spring Wheat



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Enhanced
Efficiency
Products
&
Staging



Table 1. Treatment list

Trt #	Seeding Date ¹	N Management	
		Side-Banded N (lb N/ac)	Post-emergent N Product ²
1	Early	0-Check	None
2	Early	70 - urea	None
3	Early	70 - SuperU©	None
4	Early	0	70 lb N/ac -UAN
5	Early	0	70 lb N/ac -UAN + Tribune
6	Early	0	70 lb N/ac - Urea
7	Early	0	70 lb N/ac -SuperU©
8	Late	0-Check	None
9	Late	70 - urea	None
10	Late	70 – SuperU©	None
11	Late	0	70 lb N/ac -UAN
12	Late	0	70 lb N/ac -UAN + Tribune
13	Late	0	70 lb N/ac - Urea
14	Late	0	70 lb N/ac -SuperU©



¹Early seeding date will target early May. Late seeding date will be 10 days later than early seeding date.

²All post-emergent products will be sprayed on the same day. The intent is to be applying product at tillering for the early seeded plots and between the 1-3 leaf stage for the late seeded plots.

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May 6



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May 27



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3 leaf stage



Tillering

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5	Early	0	70 lb N/ac -UAN + Tribune
6	Early	0	70 lb N/ac - Urea
7	Early	0	70 lb N/ac -SuperU©
8	Late	0-Check	None
9	Late	70 - urea	None
10	Late	70 – SuperU©	None
11	Late	0	70 lb N/ac -UAN
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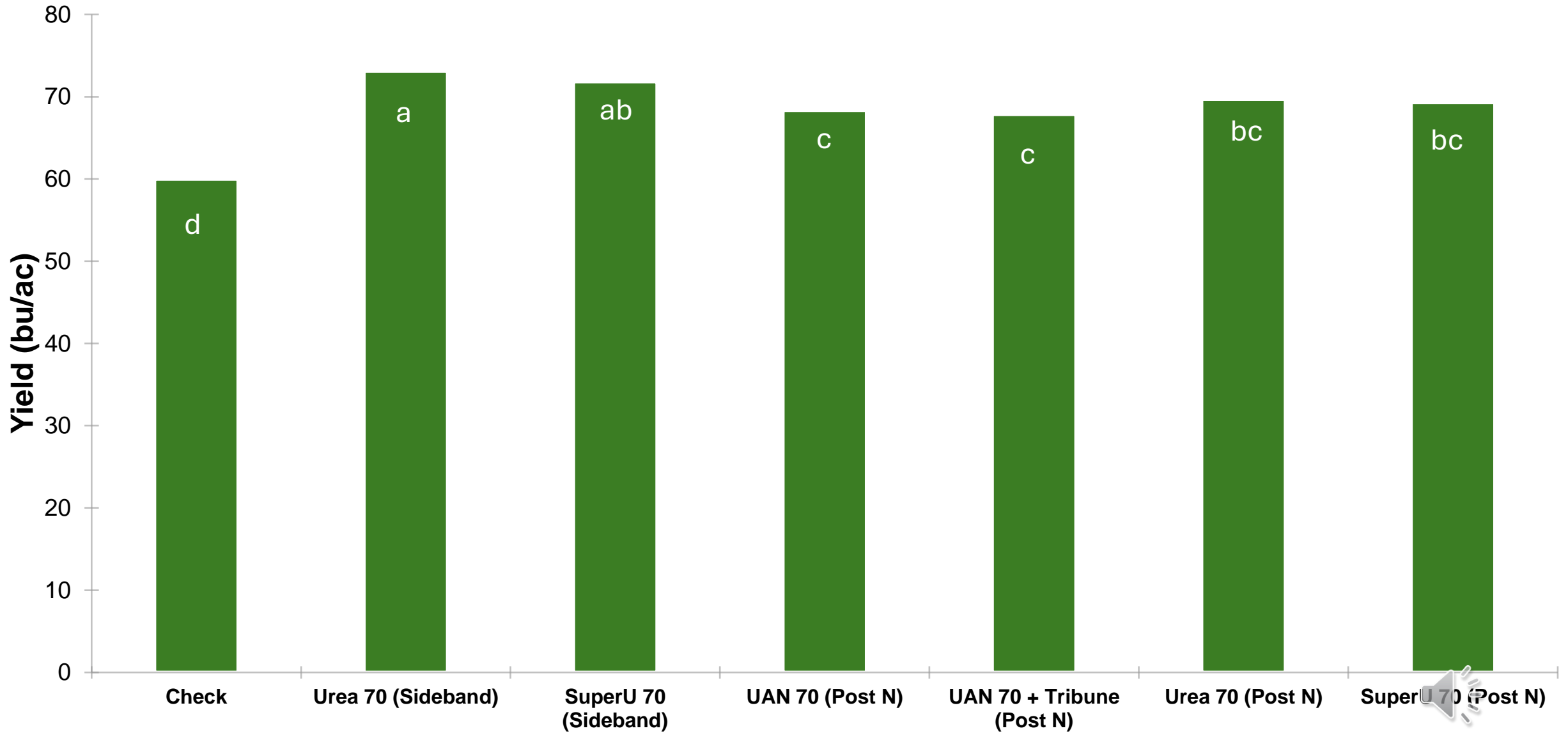
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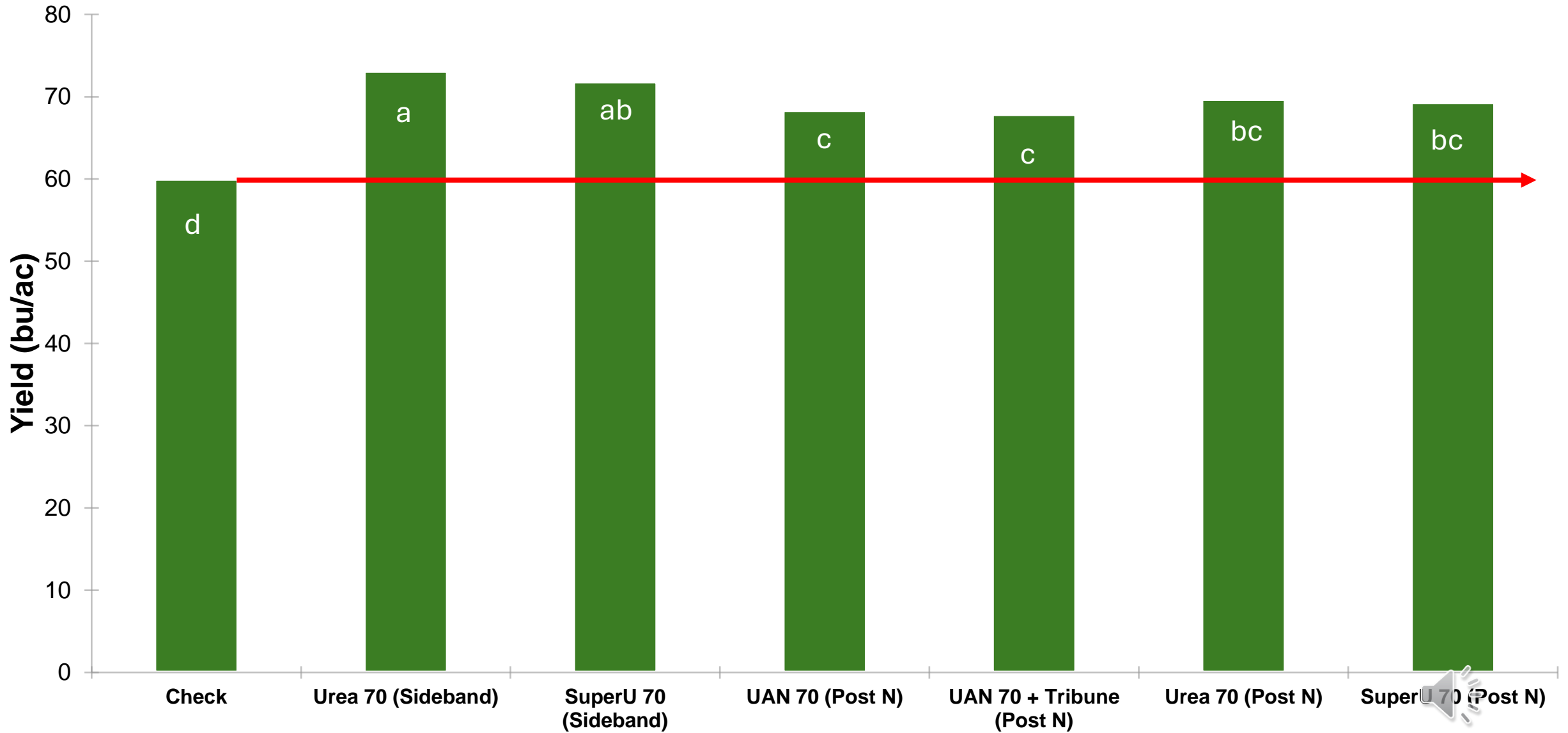
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■ Averaged over early and late seeding dates



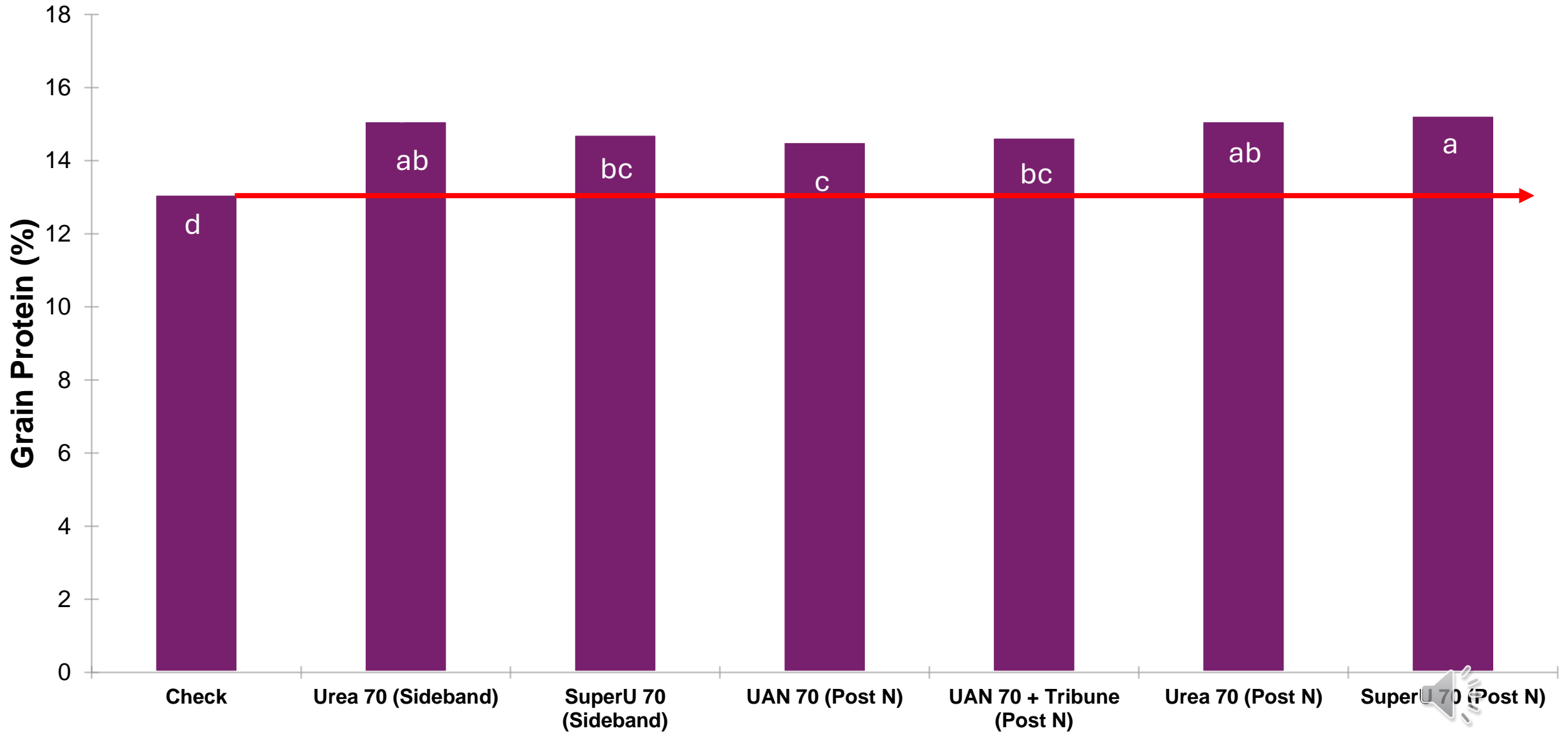
Effect of N Management on Yield

■ Averaged over early and late seeding dates



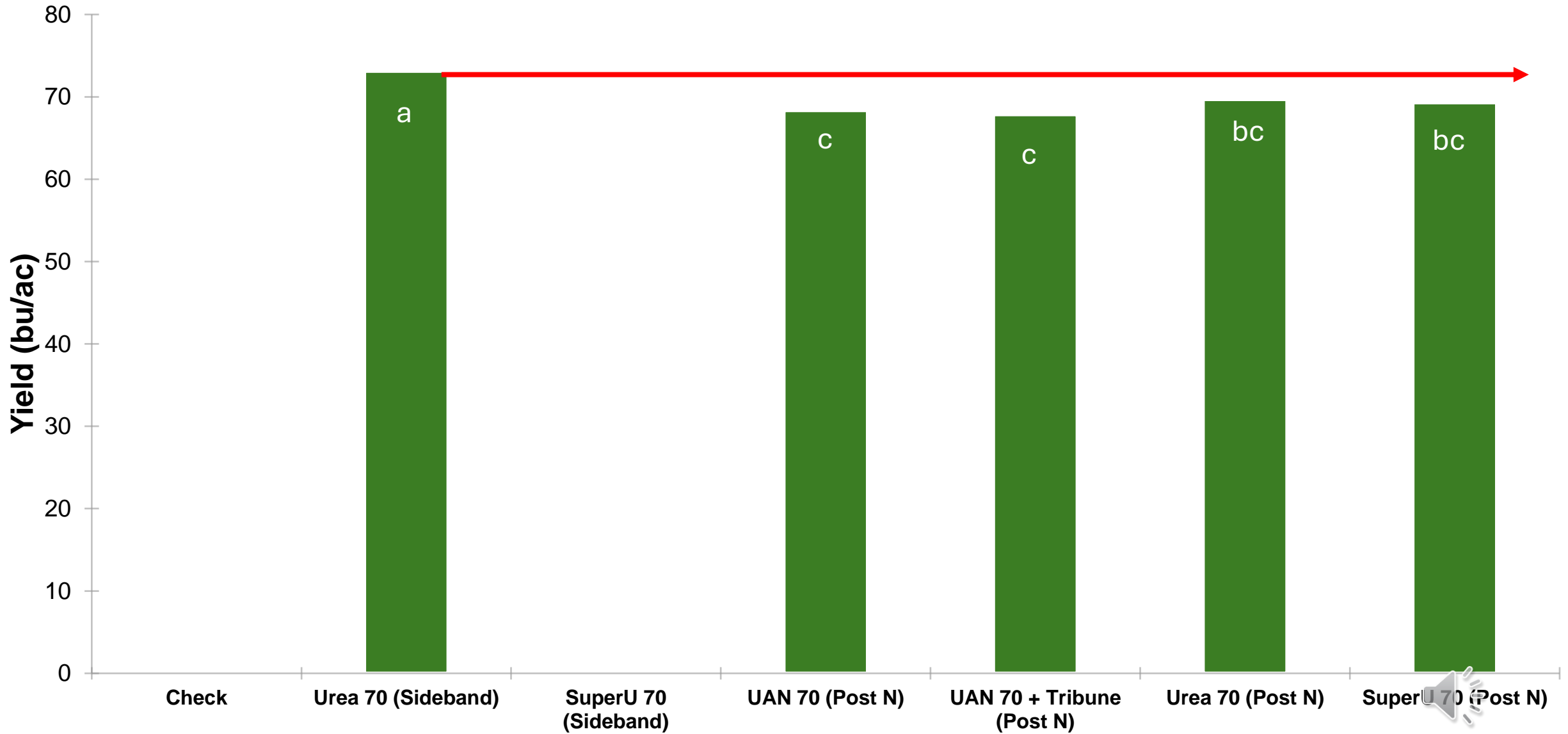
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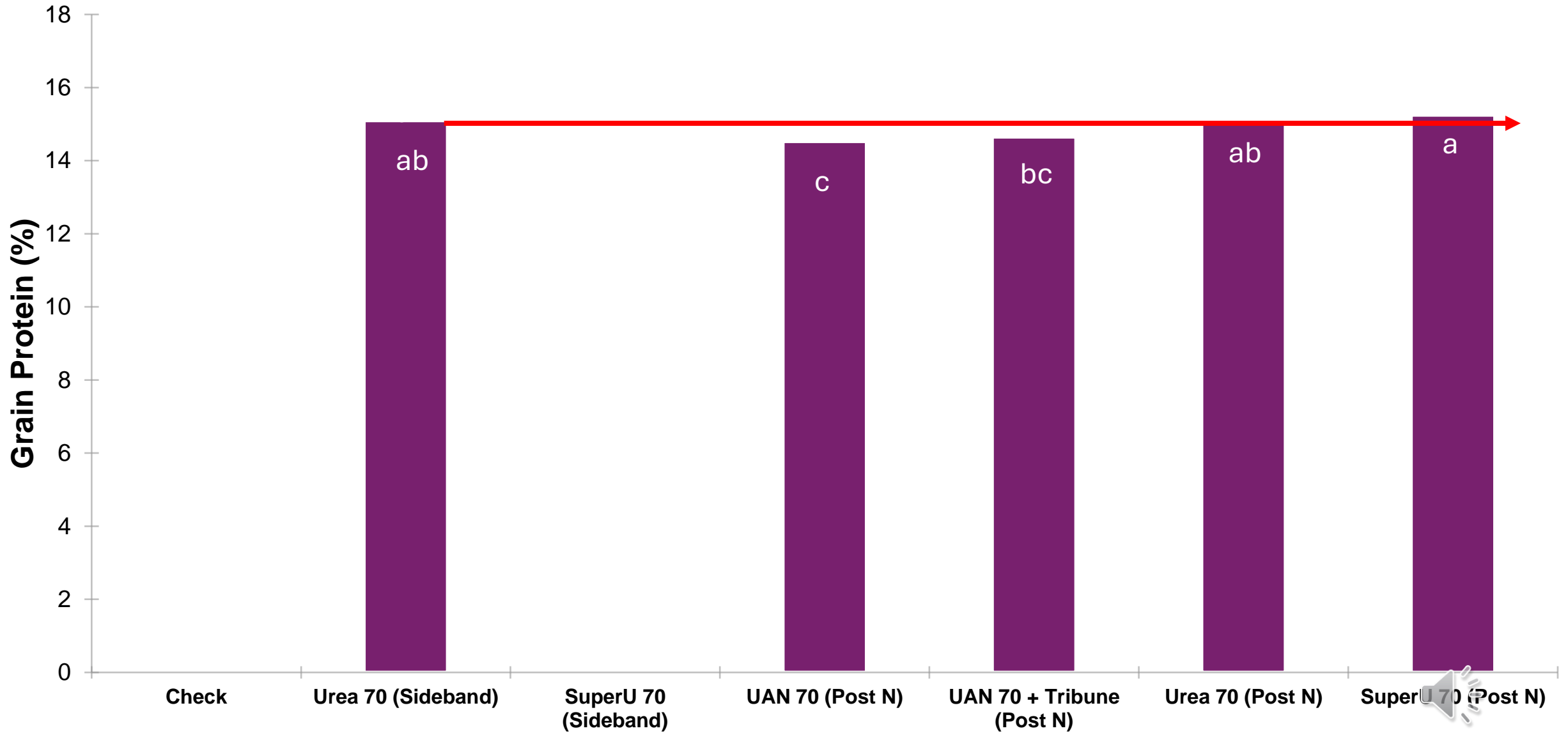
Effect of N Management on Grain Protein

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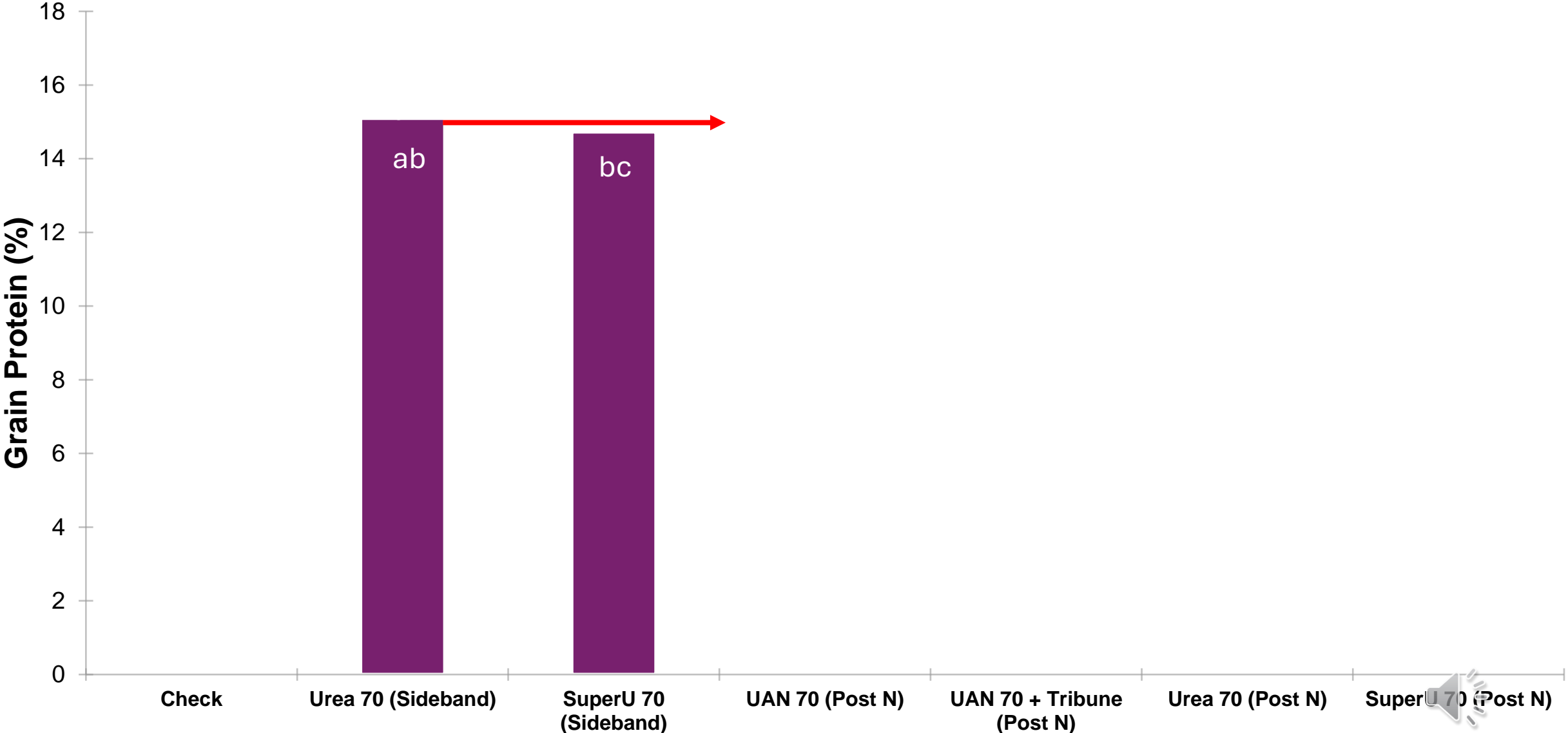
Effect of N Management on Yield

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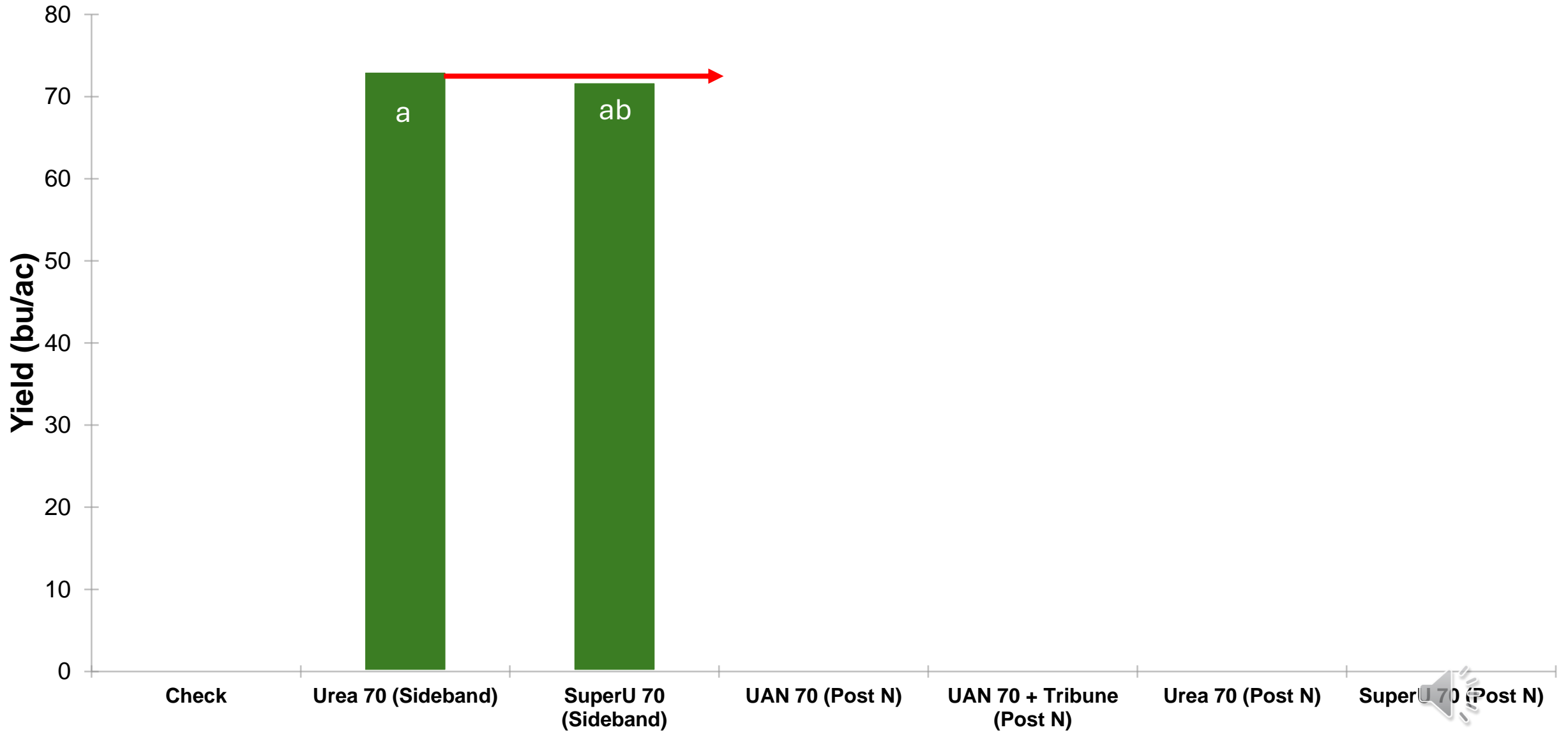
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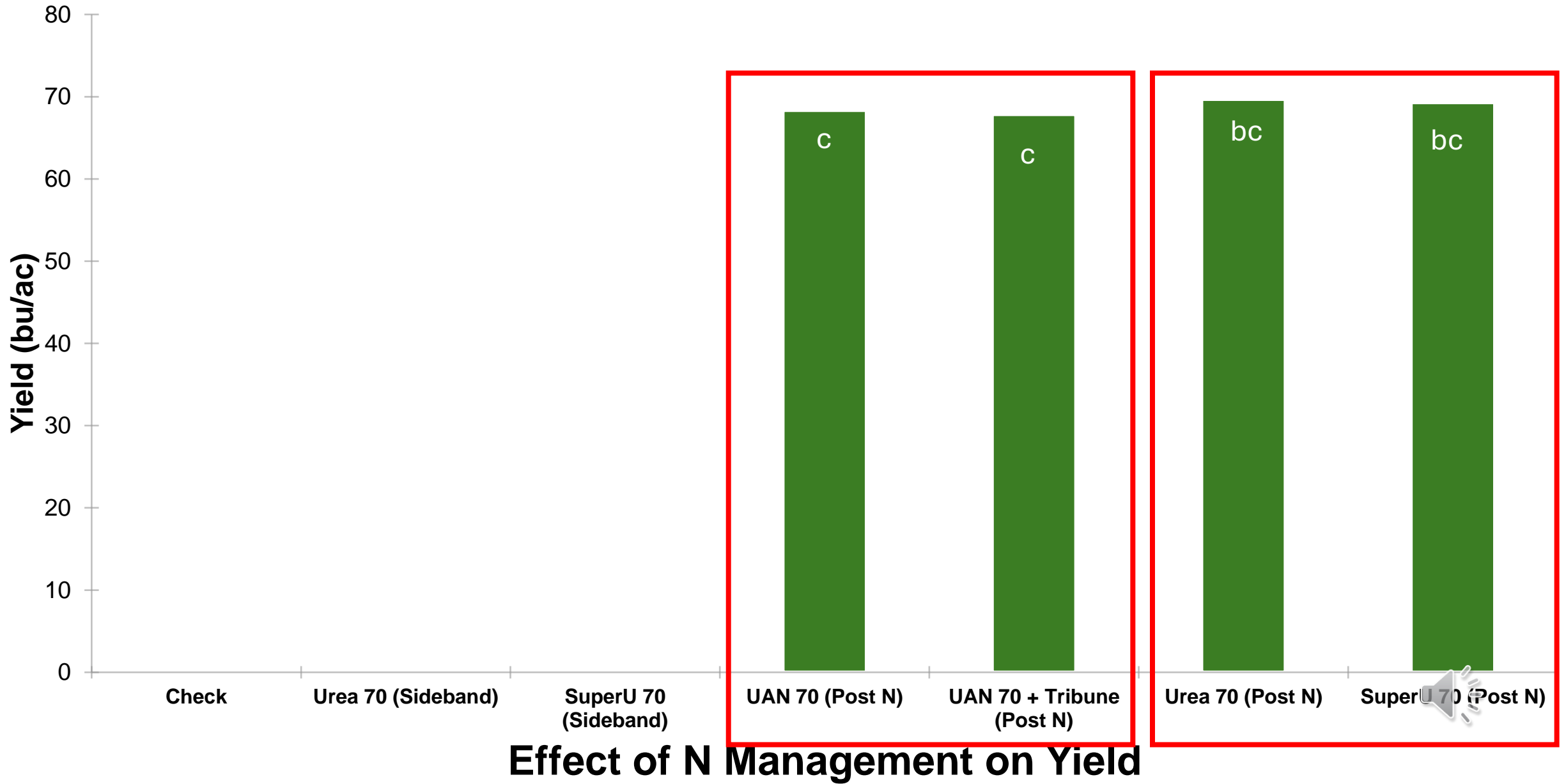
Effect of N Management on Grain Protein

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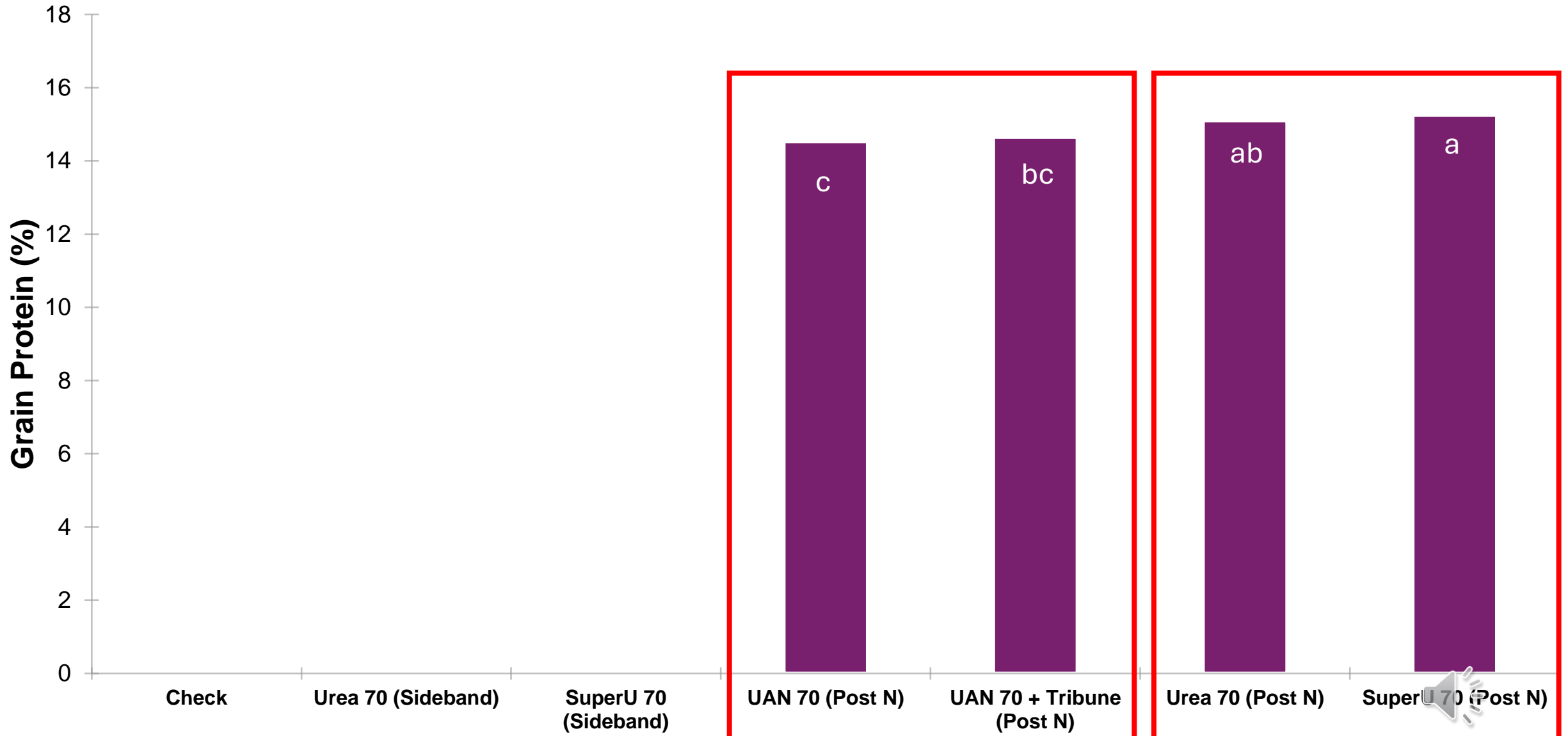


Effect of N Management on Yield

■ Averaged over early and late seeding dates



■ Averaged over early and late seeding dates



Effect of N Management on Grain Protein

Conclusions

- Side banded urea provided the highest yield potential (ie better NUE than post-emergent applications)
- SuperU didn't increase yield or grain protein over straight urea for side-banded or broadcast applications
 - We received 8 mm of rain shortly after application
 - Side-banding protects the urea from volatilization
- Adding Tribune to UAN didn't increase yield or grain protein
- UAN tended not to perform as well as broadcast urea. Why?
- We did not observed comparatively higher yields when post-emergent N was applied at the 3-leaf stage vs tillering.
 - Background N relatively high (42 lb N/ac in top 12 inches)
 - Rainfall ensured the N got to crop shortly after application



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Mike Hall
m.hall@suncrestcollege.ca



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