



4R N Management for High Yielding Spring Wheat

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Challenges to our traditional N fertilization management

- Current provincial guidelines do not address the high yield potential of current varieties that may exceed 90 bu/ac
- The existing recommendation of 2-3 lbs. N/bu spring wheat target yield creates large financial, agronomic and environmental risks
- When high yields are achieved, risk of inadequate protein content for milling market is substantial
- Midseason fertilization may mitigate these risks but there is very little research for Manitoba growing conditions



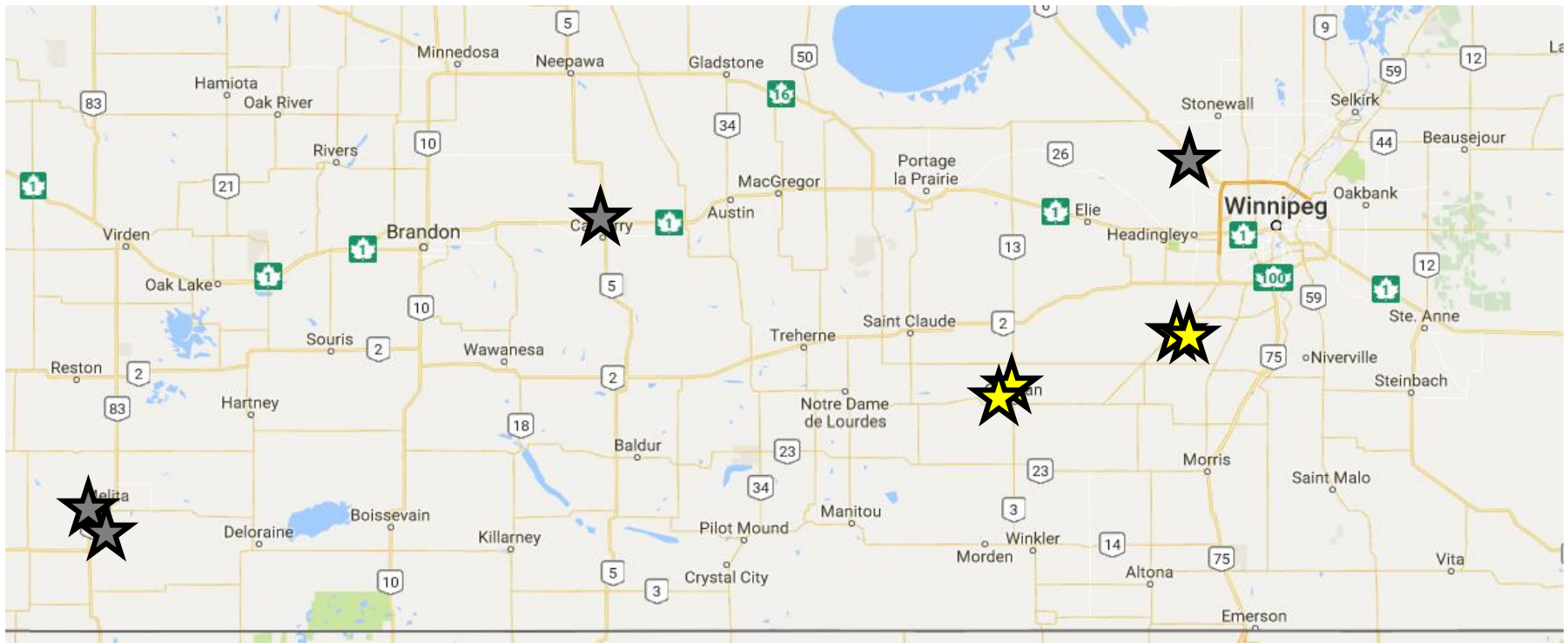
Project Objectives

1. **Determine appropriate N rates, based on realistic yield and protein goals for new high-yielding varieties**
2. **Determine the most effective and efficient combination of N timing, rate, and source to meet yield and protein potential**
3. Evaluate innovative soil tests for predicting mineralizable nitrogen during the growing season
4. Develop decision tools for midseason and post-harvest evaluation of N sufficiency for yield and protein potential



Methods

- Field trials conducted across MB over the 2016-2017 field seasons (8 site-years)
- Intensive agronomic management to maximize yields
- Factorial Design (Variety X N Treatment) arranged as a RCBD
- Two levels of research intensity – Gold & Silver



Treatments

Variety	N Rate (lbs N/ac)		Source		Timing/Placement	
	Spring	In Season	Spring	In Season	Spring	In Season
RATE	0		Conventional Urea			
	50					
	80					
	110					
	140					
	170					
	200					
Brandon (CWRS) and Prosper (CNHR)	80		ESN:Urea (40:40)		Midrow band at seeding	
	140		ESN:Urea (100:40)			
TIMING	80	30	Conventional Urea	Agrotain treated urea		Stem elongation, broadcast
	80	60				Flag leaf, broadcast
	80	30				
	80	60				
SOURCE	80	30		UAN		Post anthesis, foliar
	80	30		Urea Sol'n		



Carman 2017



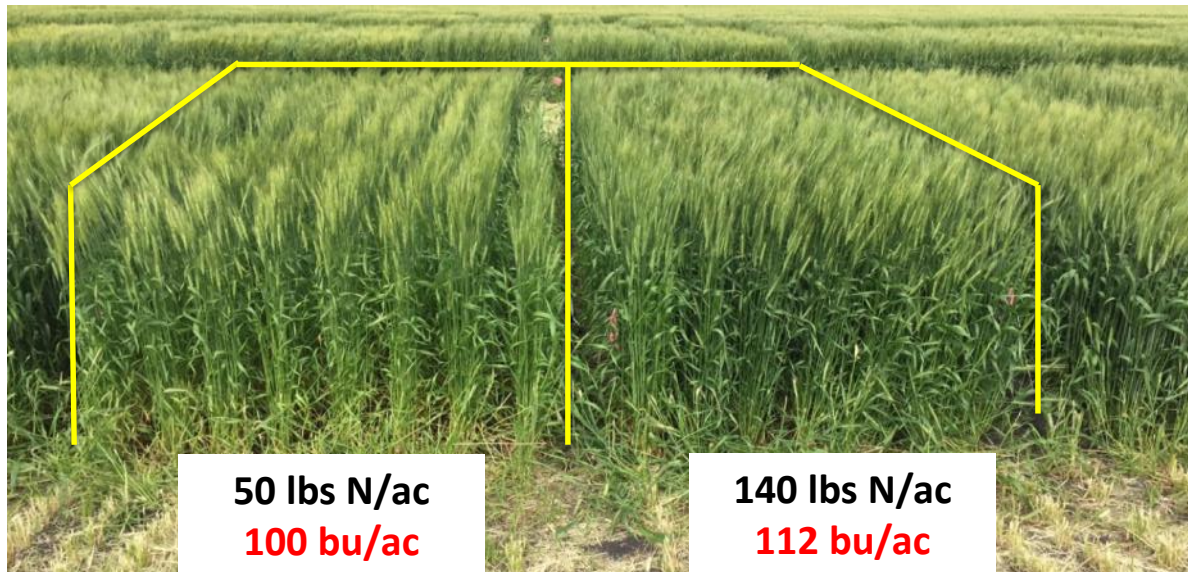
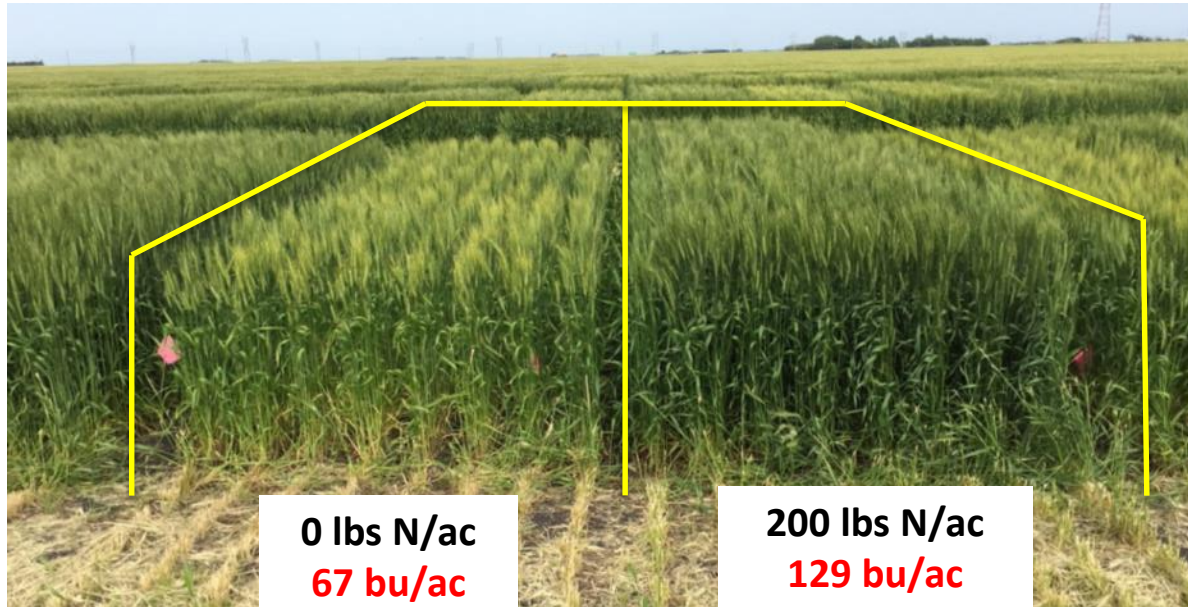
Brunkild 2016



Brunkild 2017

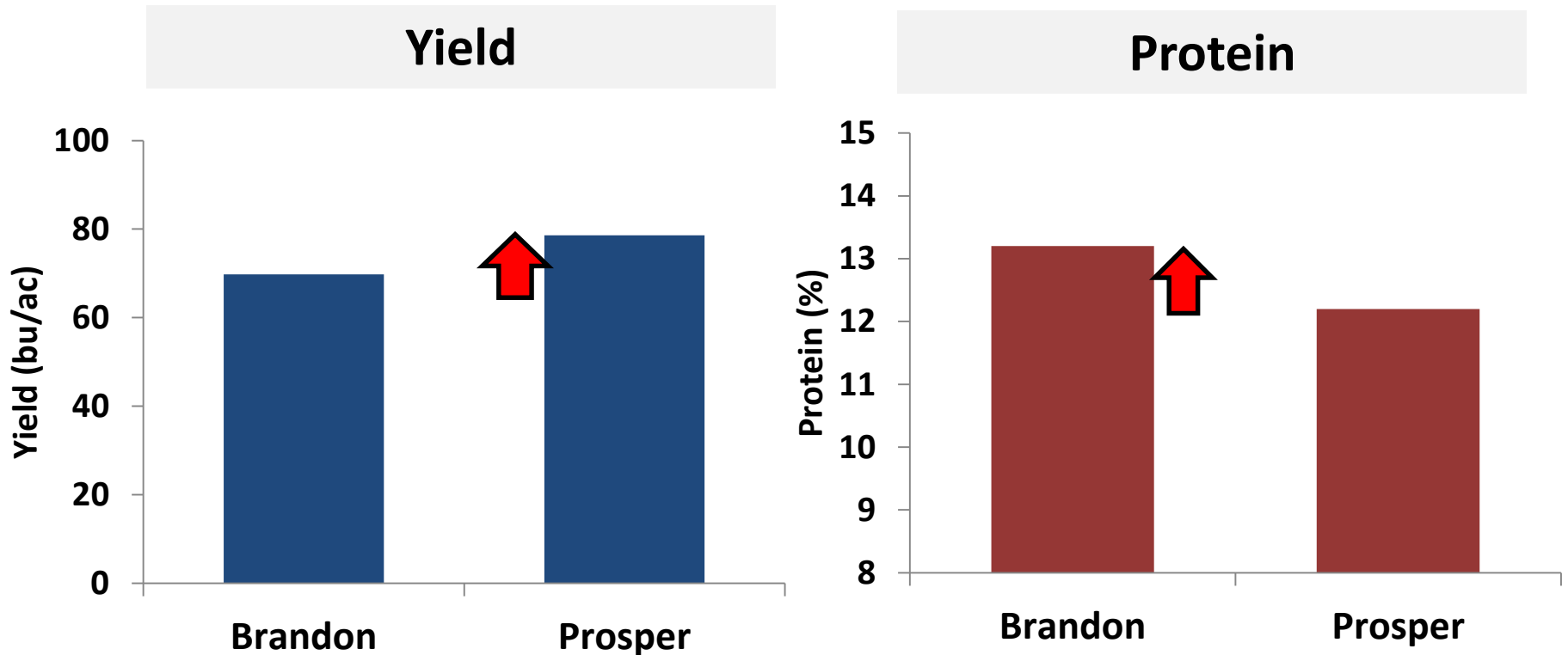
Prosper

Brunkild, MB
July 2017



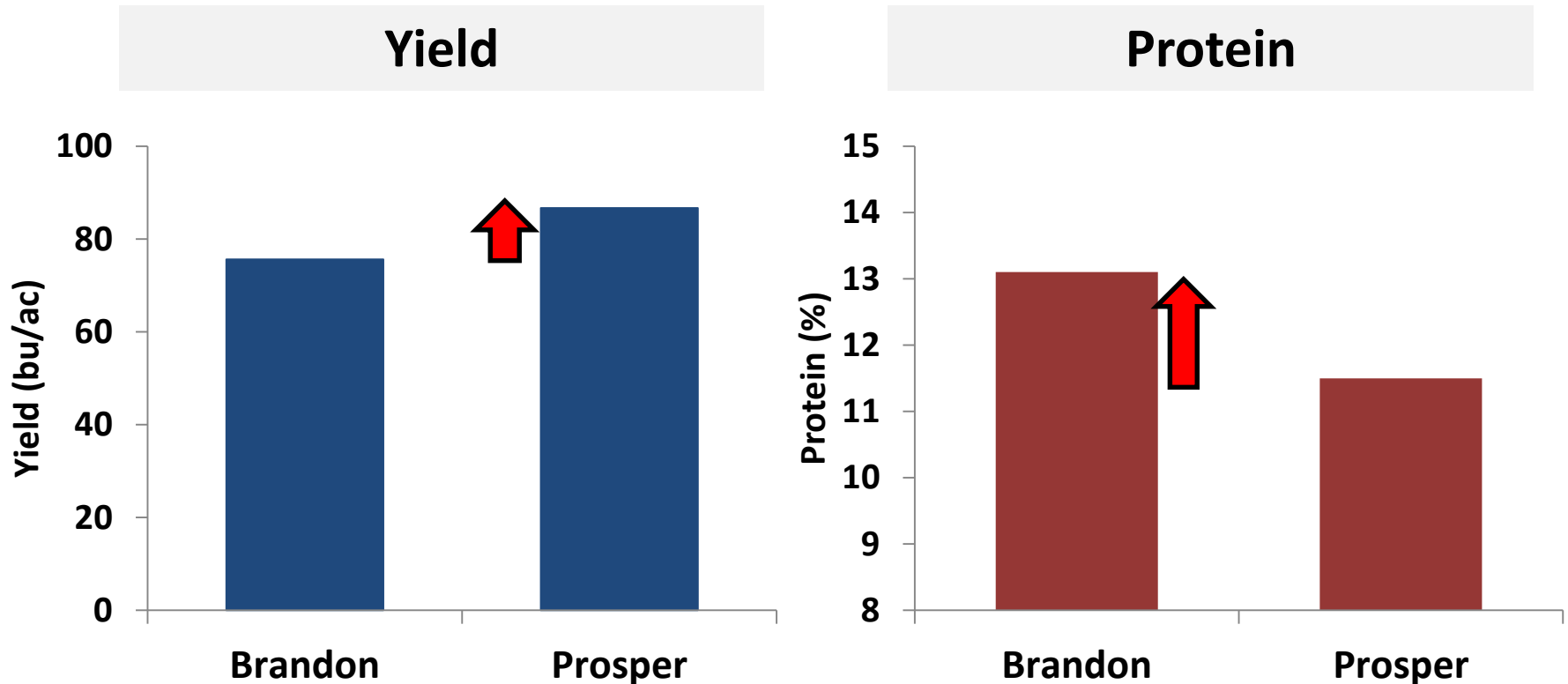
Variety

Variety: Silver Level Sites



- Prosper yield **4.2 – 16.3 bu/ac** more than Brandon across Site-years
- Brandon had **0.7 – 1.3 %** increased protein content than Prosper across Site-years

Variety: Gold Level Sites



- Prosper yield **7.8 – 15.4 bu/ac** more than Brandon across Site-years
- Brandon had **1.3 – 2.0 %** increased protein content than Prosper across Site-years

Nitrogen Rate

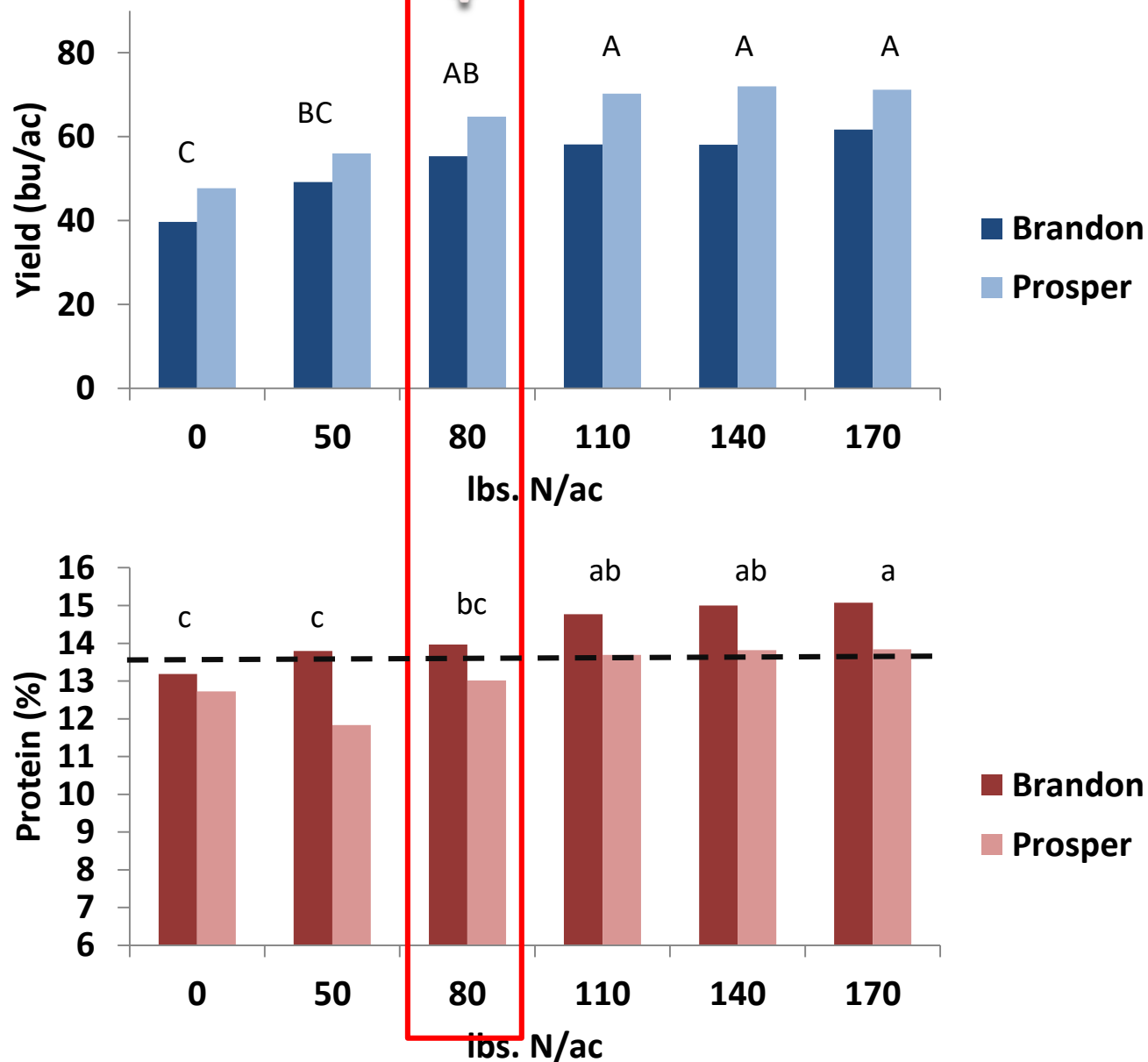
Melita 2016



*Profitability based on Jan 5,
2018 pricing

Residual NO₃-N:
43 lbs/ac

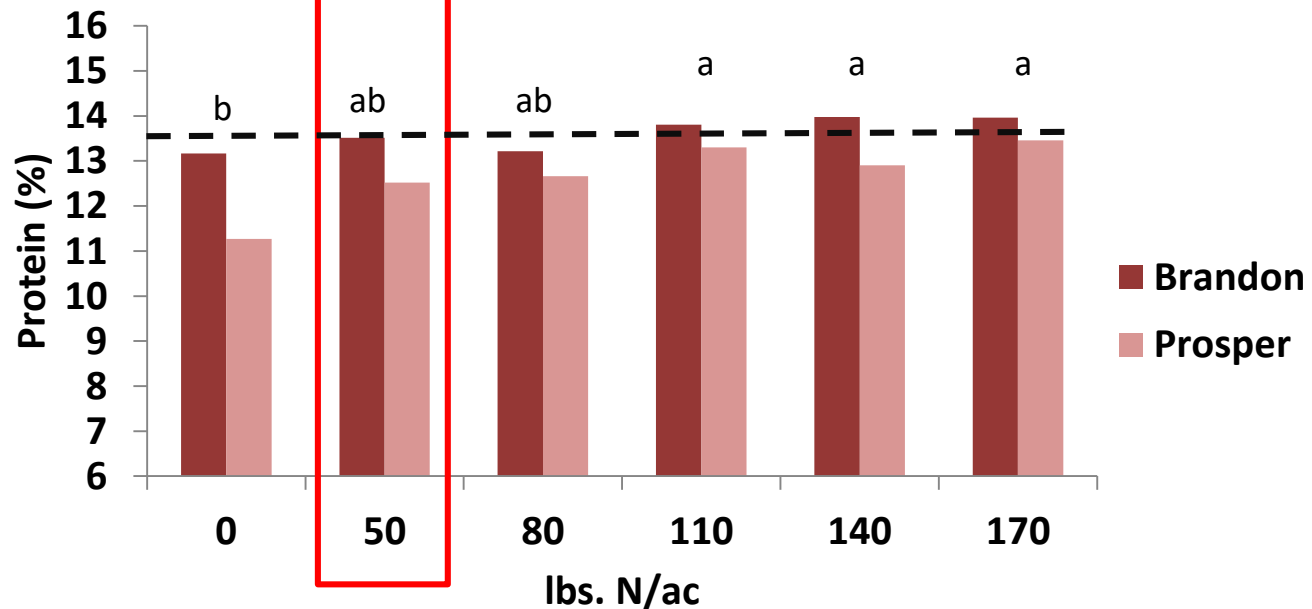
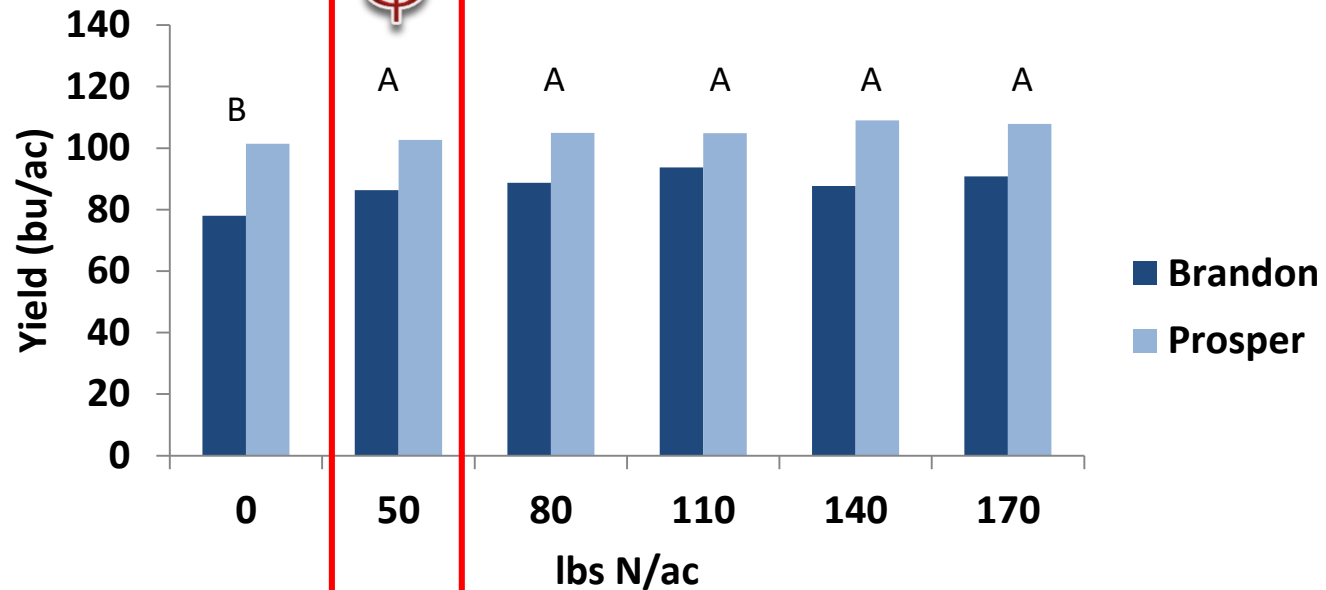
Yields adjusted to
13.5% moisture



Carberry 2016

*Residual NO3-N:
89 lbs/ac*

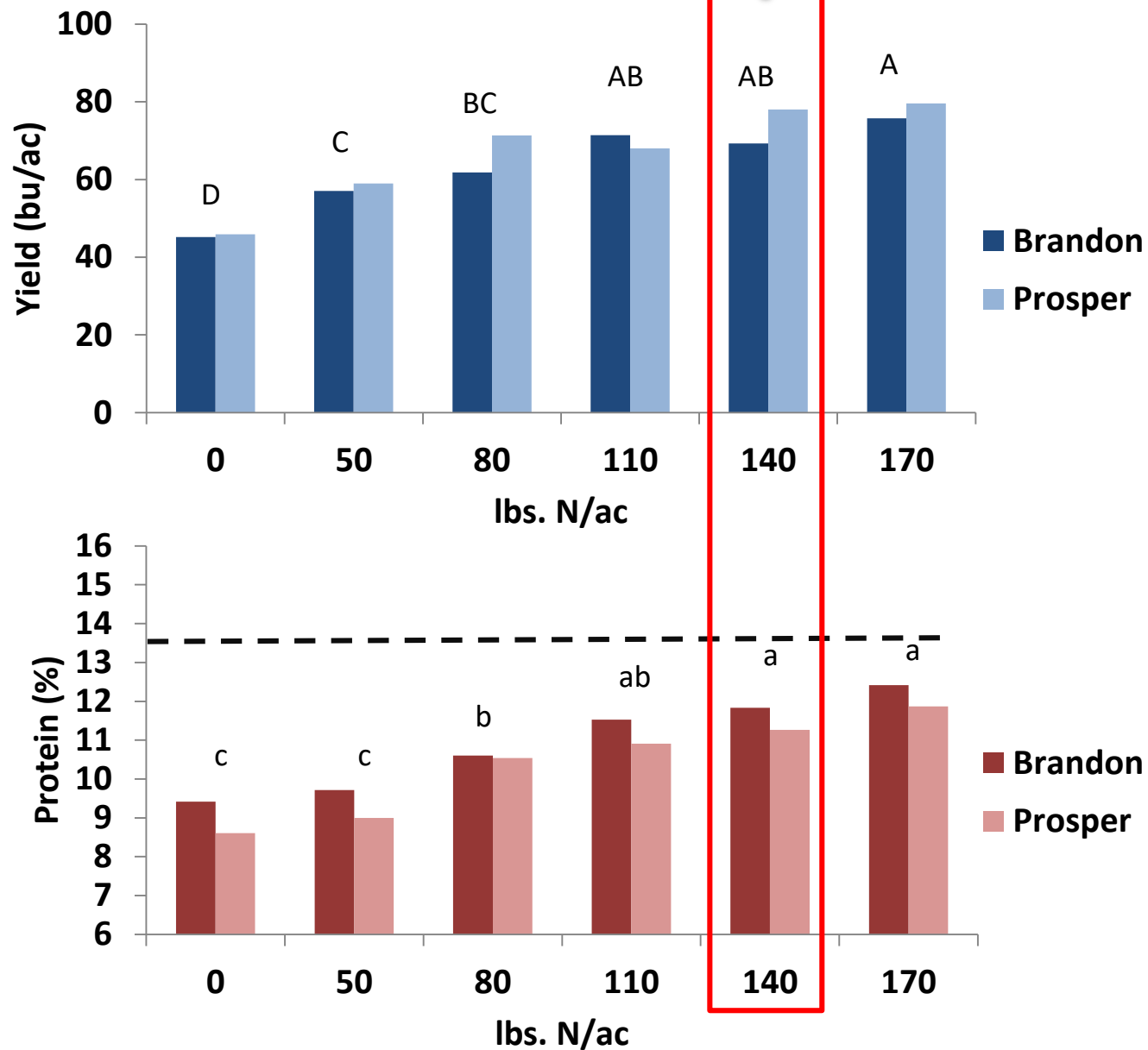
*Yields adjusted to
13.5% moisture*



Melita 2017

*Residual NO₃-N:
11 lbs/ac*

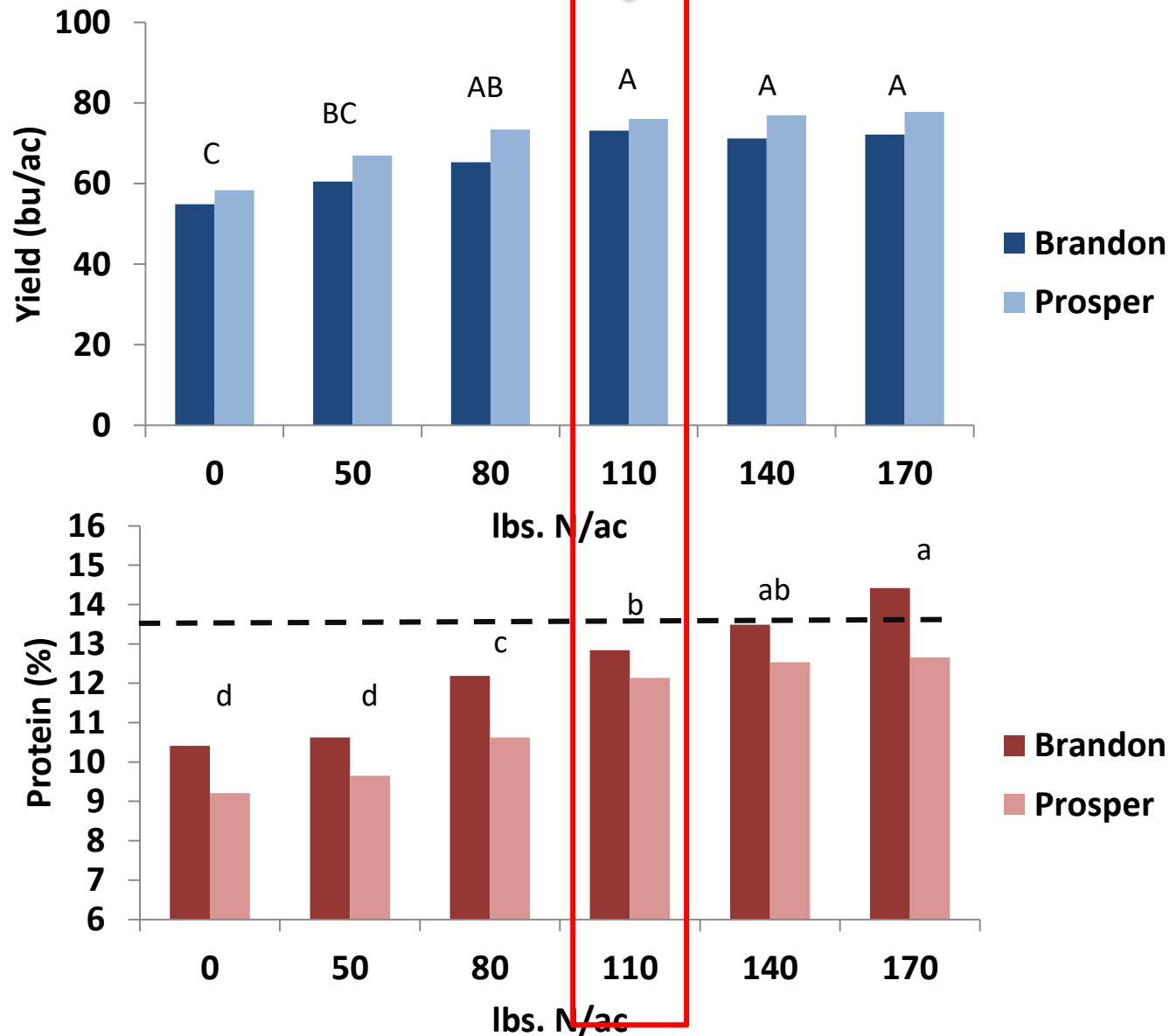
*Yields adjusted to
13.5% moisture*



Grosse Isle 2017

*Residual NO3-N:
65 lbs/ac*

*Yields adjusted to
13.5% moisture*



N Rate: Silver Level Sites

Site-year	Spring NO3-N	Fertilizer N @ Economic Optimum*	Total N @ Economic Optimum*	Yield at Economic Optimum*	Nitrogen Supply per bushel
	lbs N/ac	lbs N/ac	lbs N/ac	bu/ac	lbs N/bu
Melita 2016	43	80	123	60	2.1
Carberry 2016	89	50	139	95	1.5
Melita 2017	11	140	151	74	2.0
Grosse Isle 2017	65	110	175	75	2.3

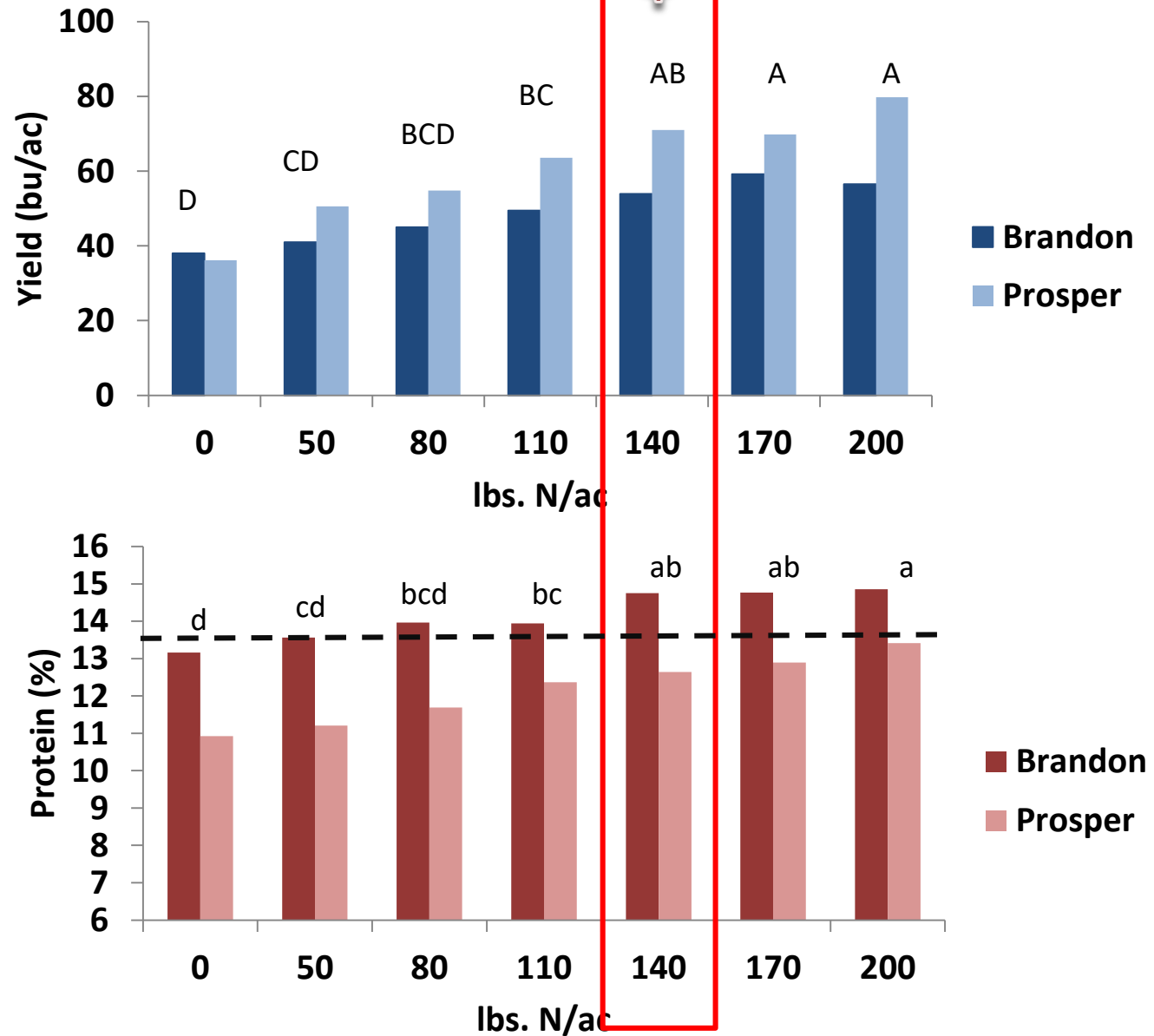
Range of soil test N + Fertilizer N per bushel:
1.5 – 2.3 lbs N/bu

*Wheat prices from Jan 5, 2018, Nitrogen prices based off 5-years AVG urea price (\$0.43/lbs N)

Carman 2016

*Residual NO3-N:
47 lbs/ac*

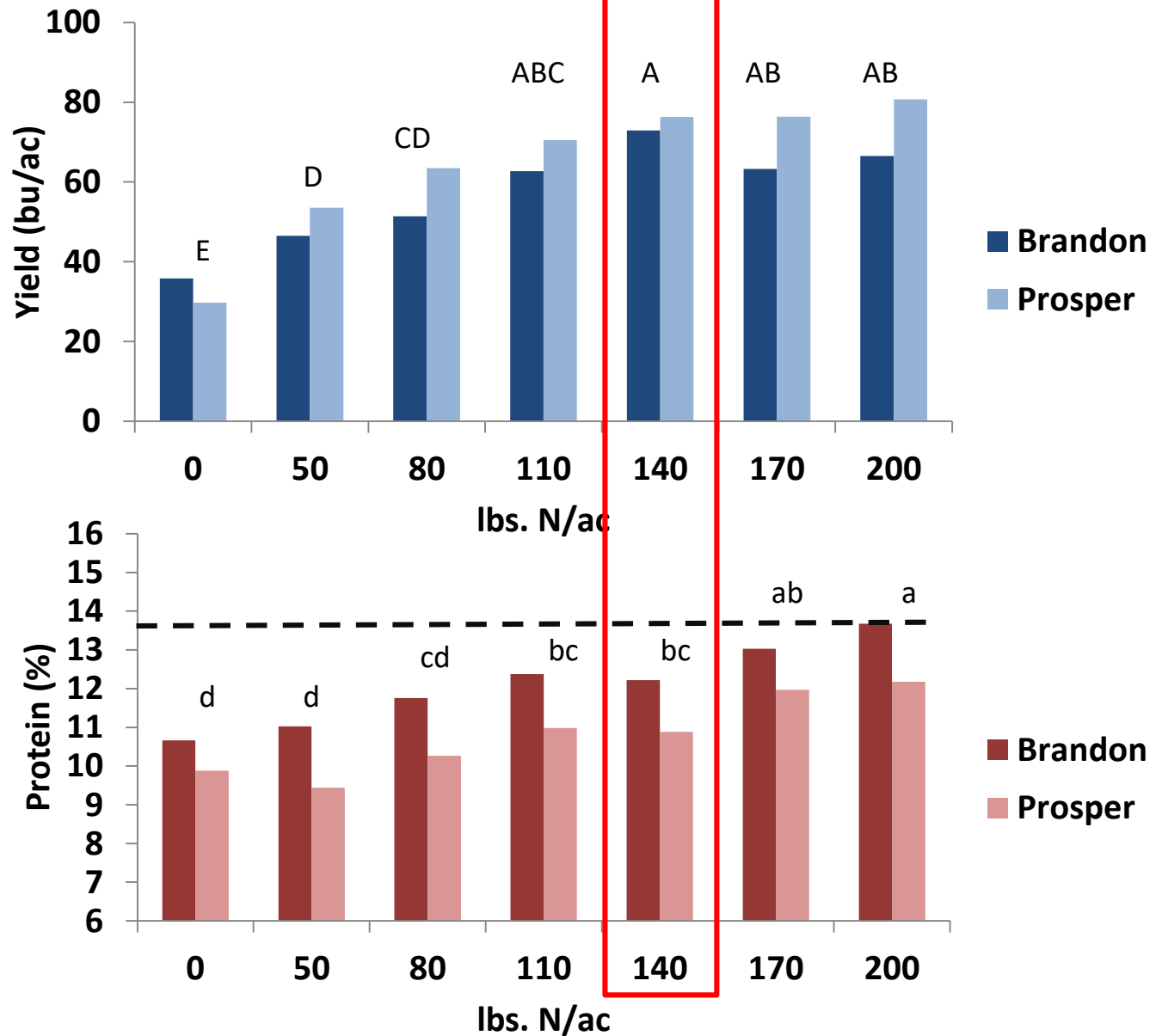
*Yields adjusted to
13.5% moisture*



Brunkild 2016

*Residual NO3-N:
40 lbs/ac*

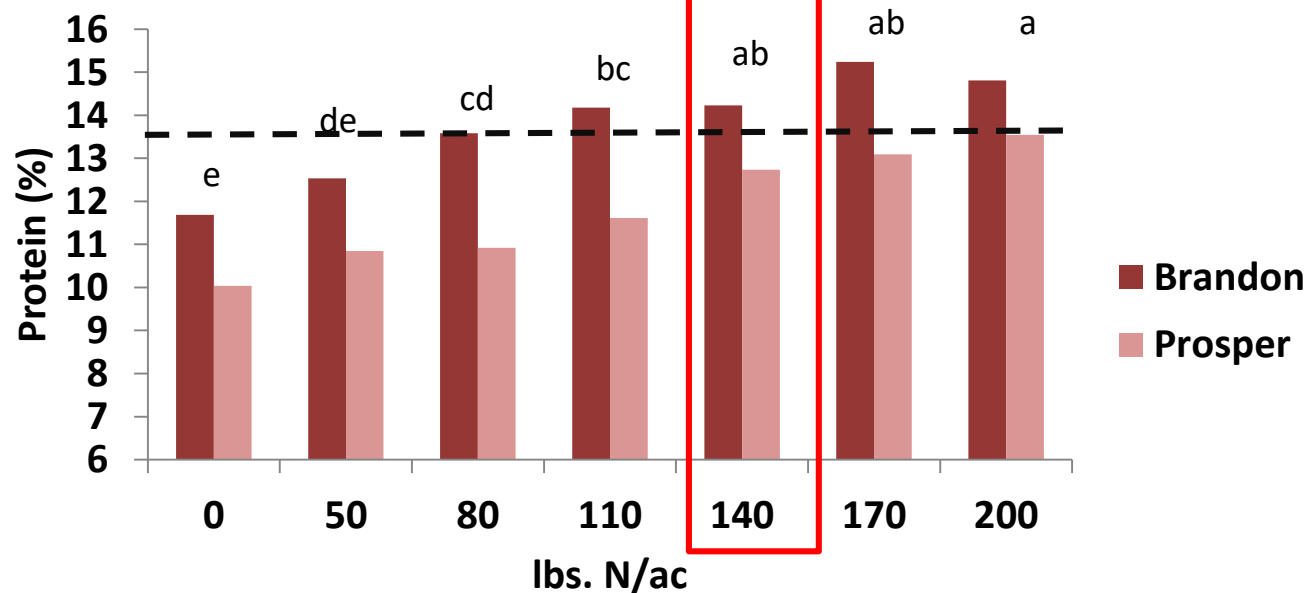
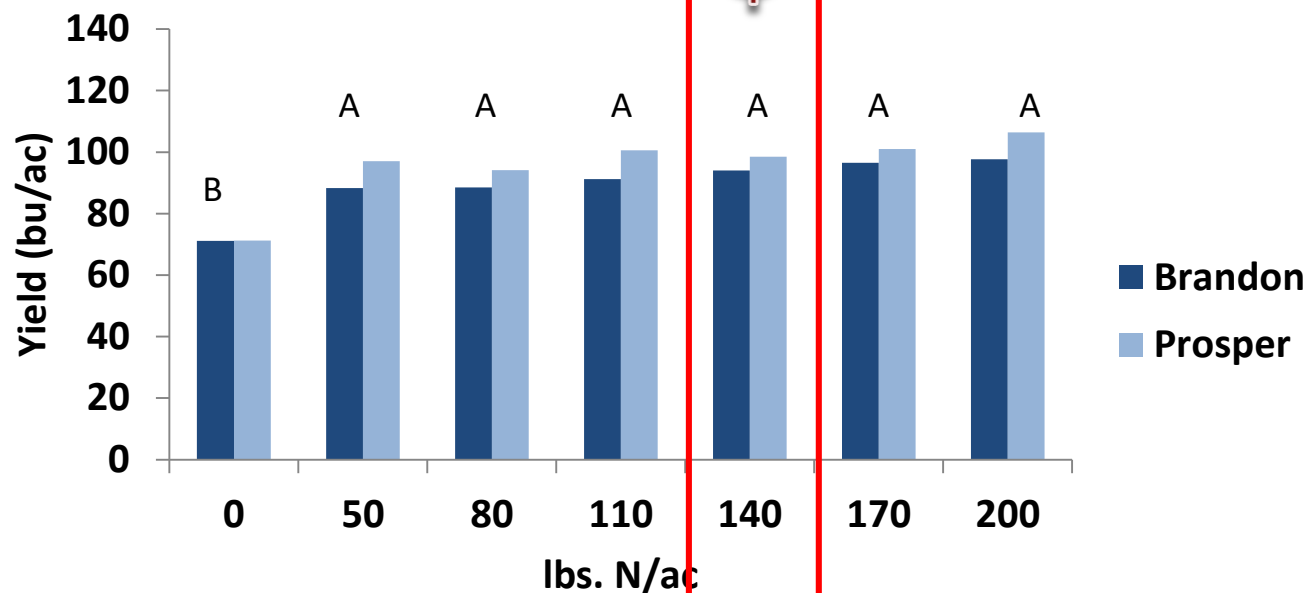
*Yields adjusted to
13.5% moisture*



Carman 2017

Residual NO₃-N:
43 lbs/ac

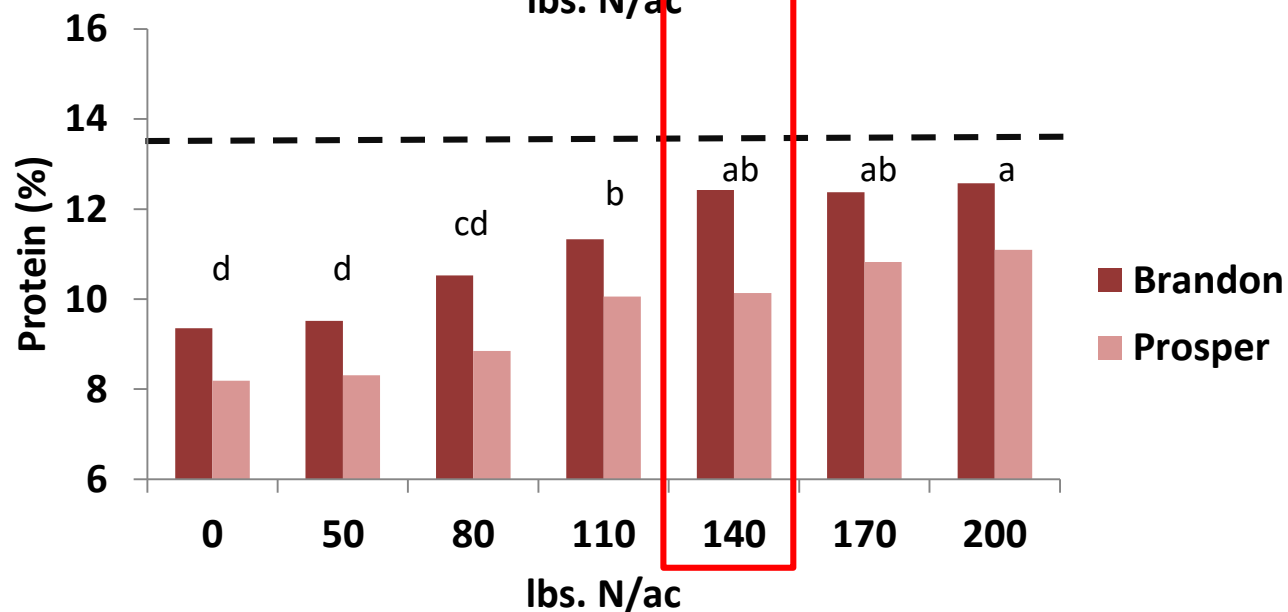
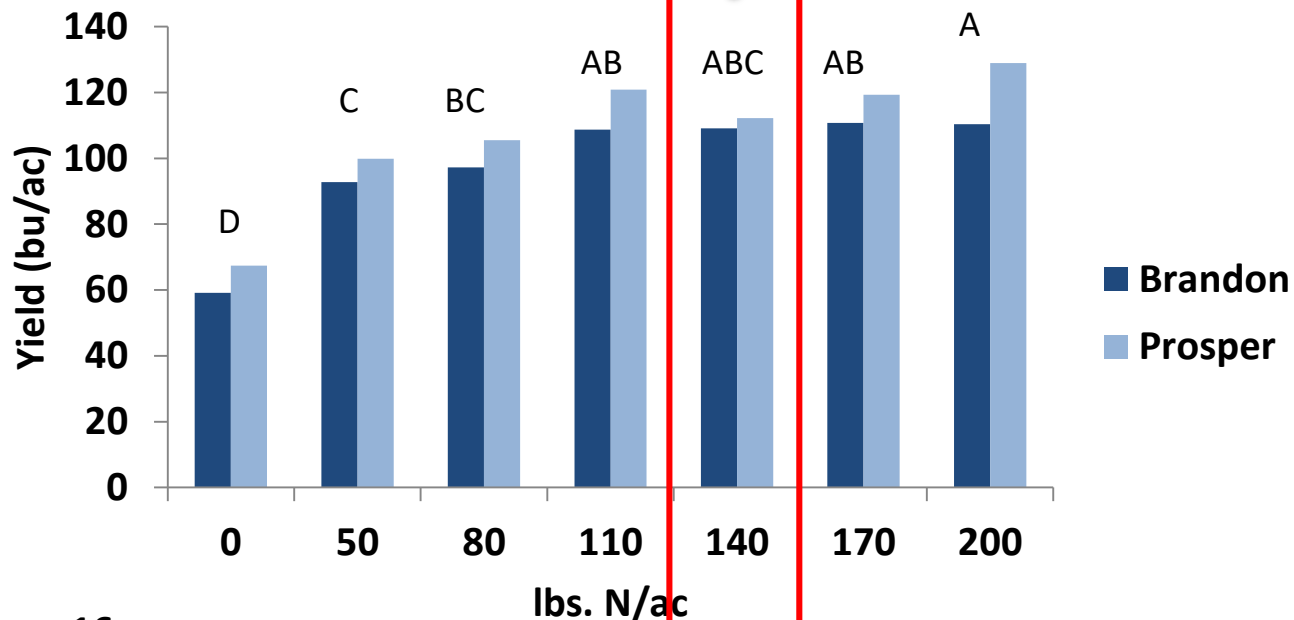
Yields adjusted to
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Brunkild 2017

Residual NO₃-N:
43 lbs/ac

Yields adjusted to
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N Rate: Gold Level Sites

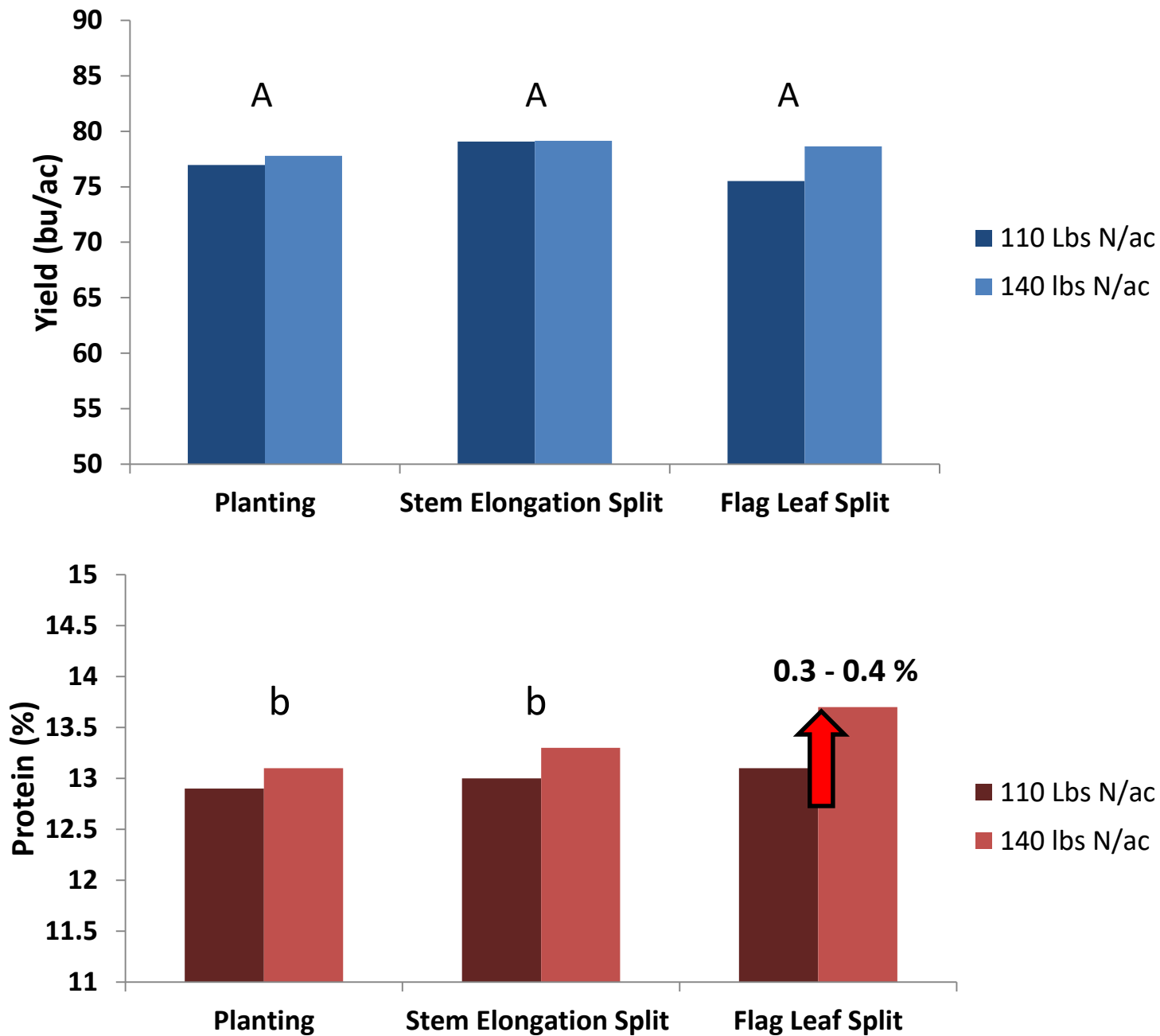
Site-year	Spring NO3-N	Fert N @ Economic Optimum*	Total N @ Economic Optimum*	Yield at Economic Optimum*	Nitrogen Supply per bushel
	lbs N/ac	lbs N/ac	lbs N/ac	bu/ac	lbs N/bu
Carman 2016	47	140	187	62	3.0
Brunkild 2016	40	140	180	75	2.4
Carman 2017	43	140	183	96	1.9
Brunkild 2017	43	140	183	110	1.7

Average soil test N + Fertilizer N per bushel:
1.7 – 3.0 lbs N/bu

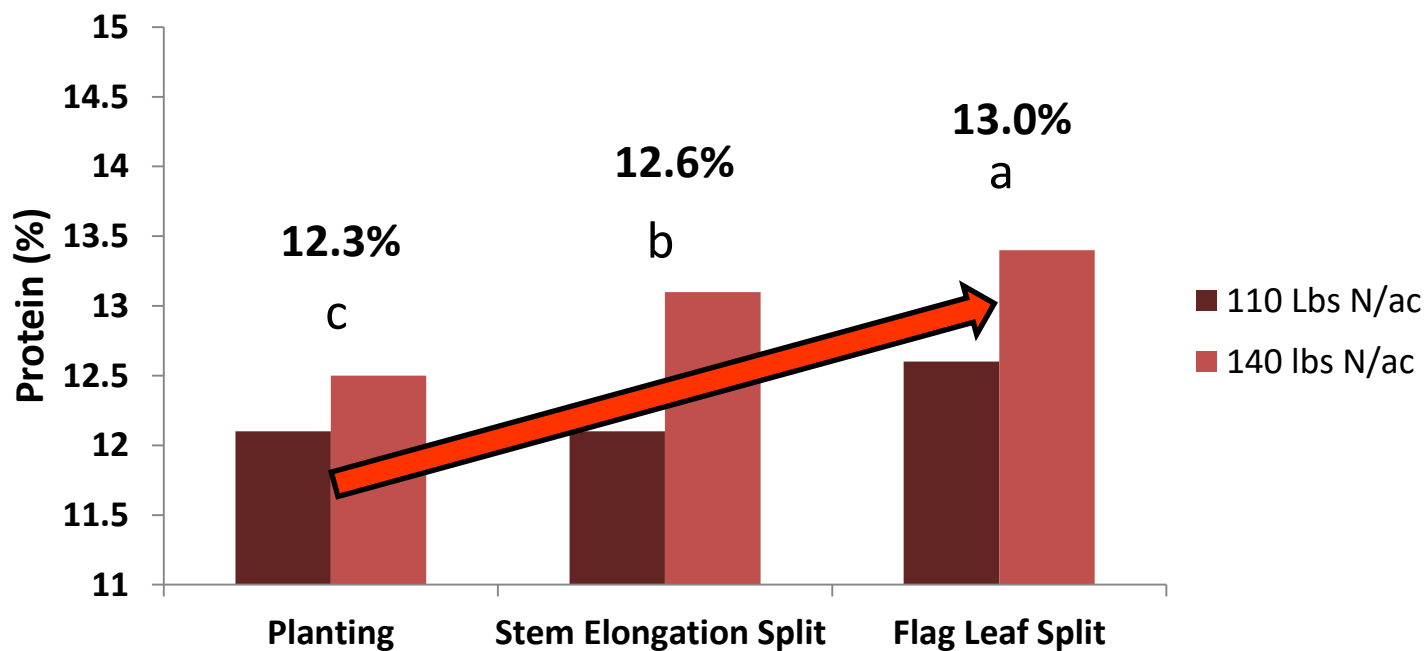
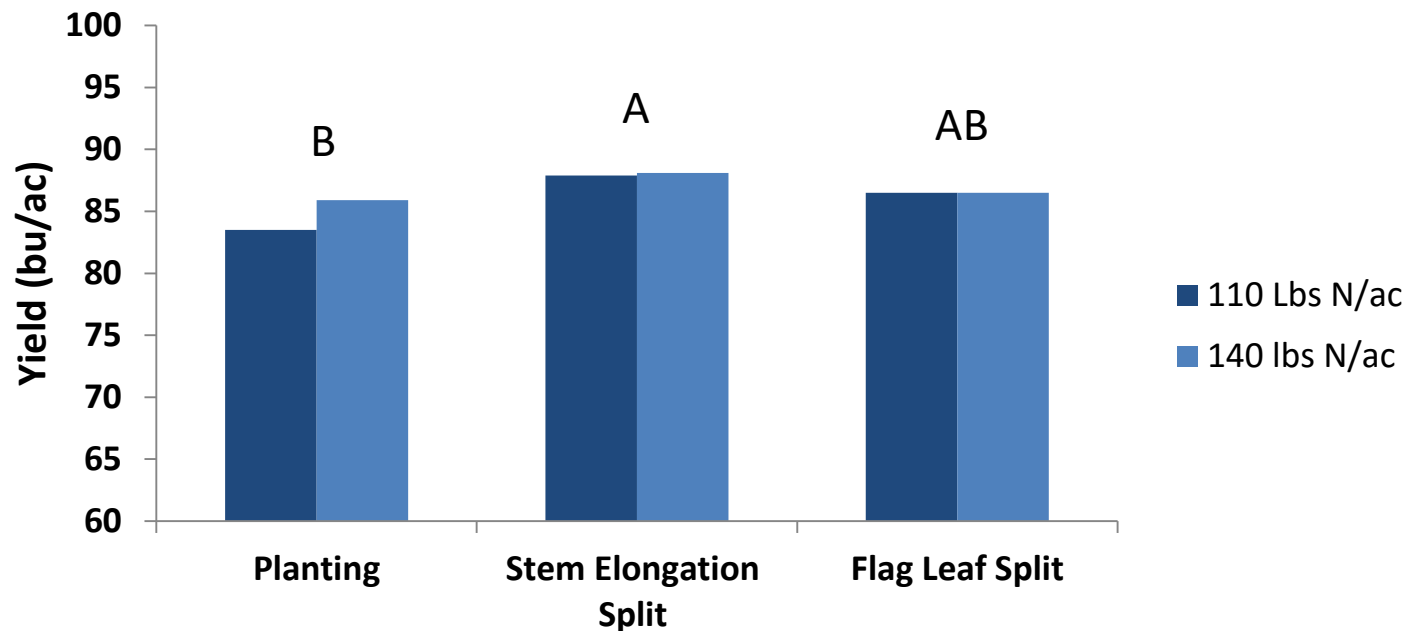
*Wheat prices from Jan 5, 2018, Nitrogen prices based off 5-years AVG urea price (\$0.43/lbs N)

Nitrogen Timing

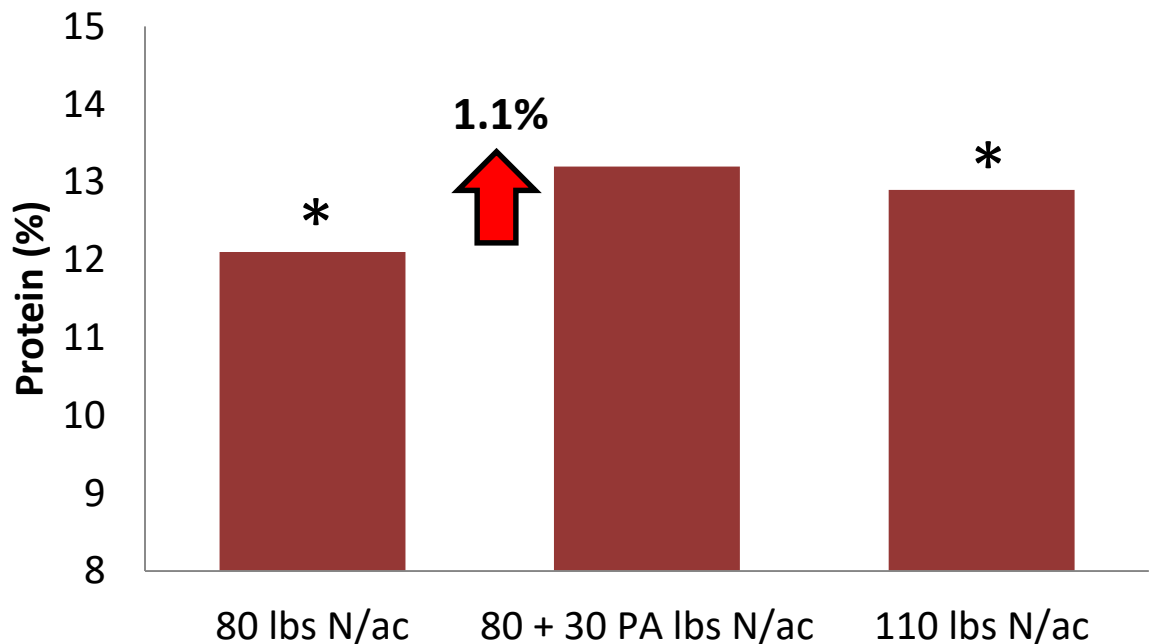
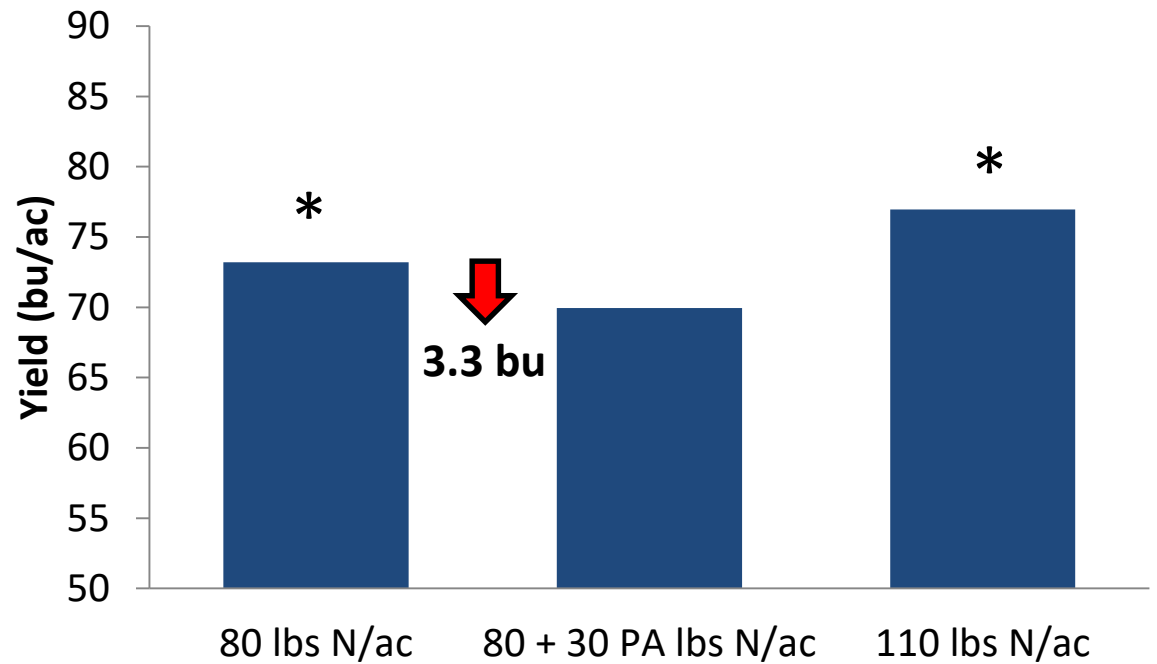
Silver Sites: In Season Splits



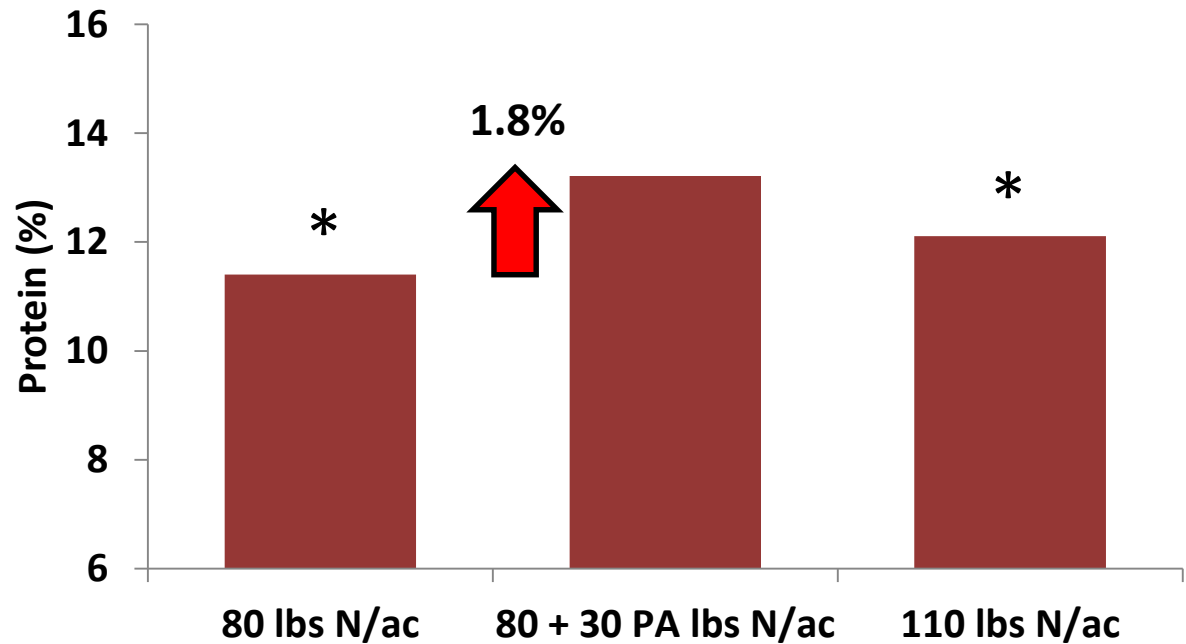
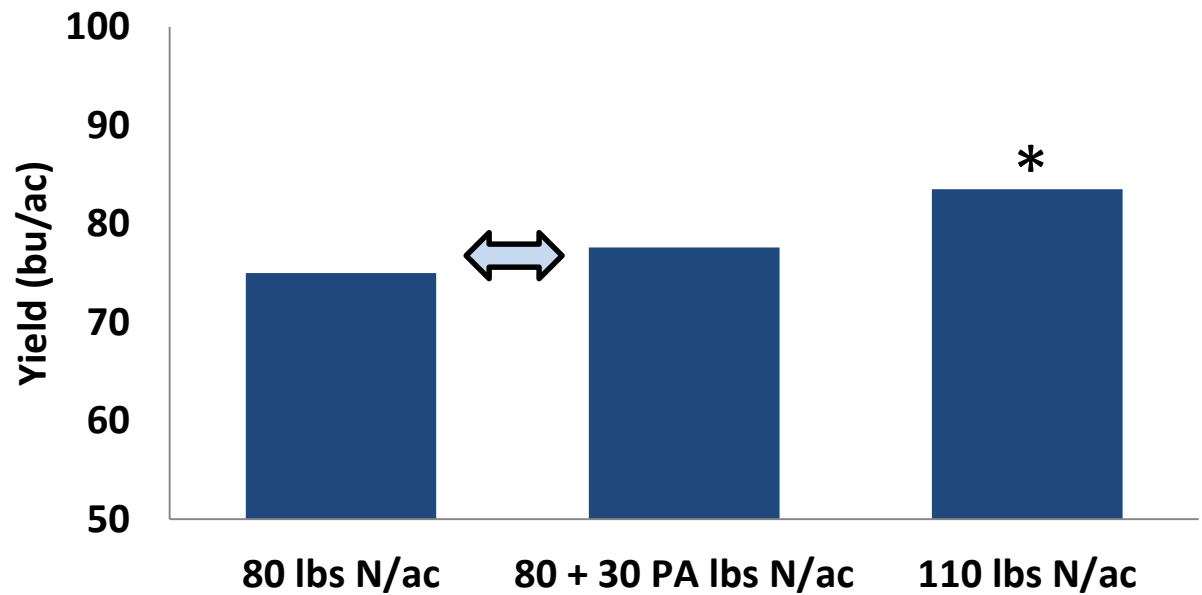
Gold Sites: In Season Splits



Silver Sites:
**Post- Anthesis
Application**

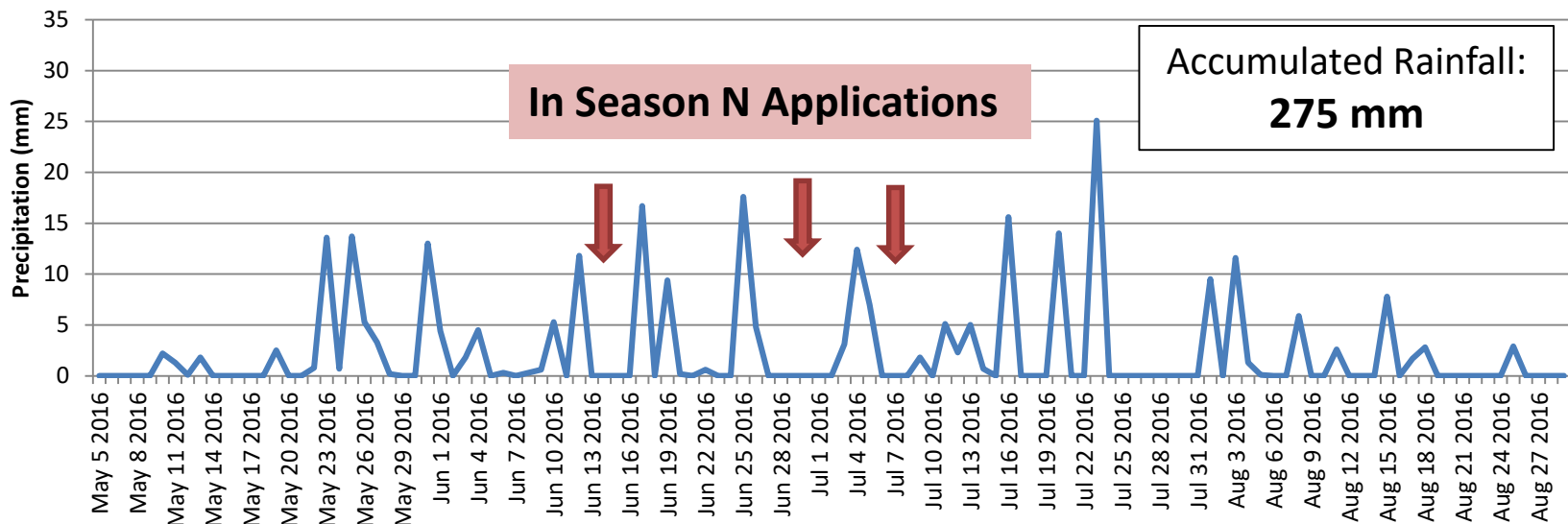


Gold Sites:
**Post- Anthesis
Application**

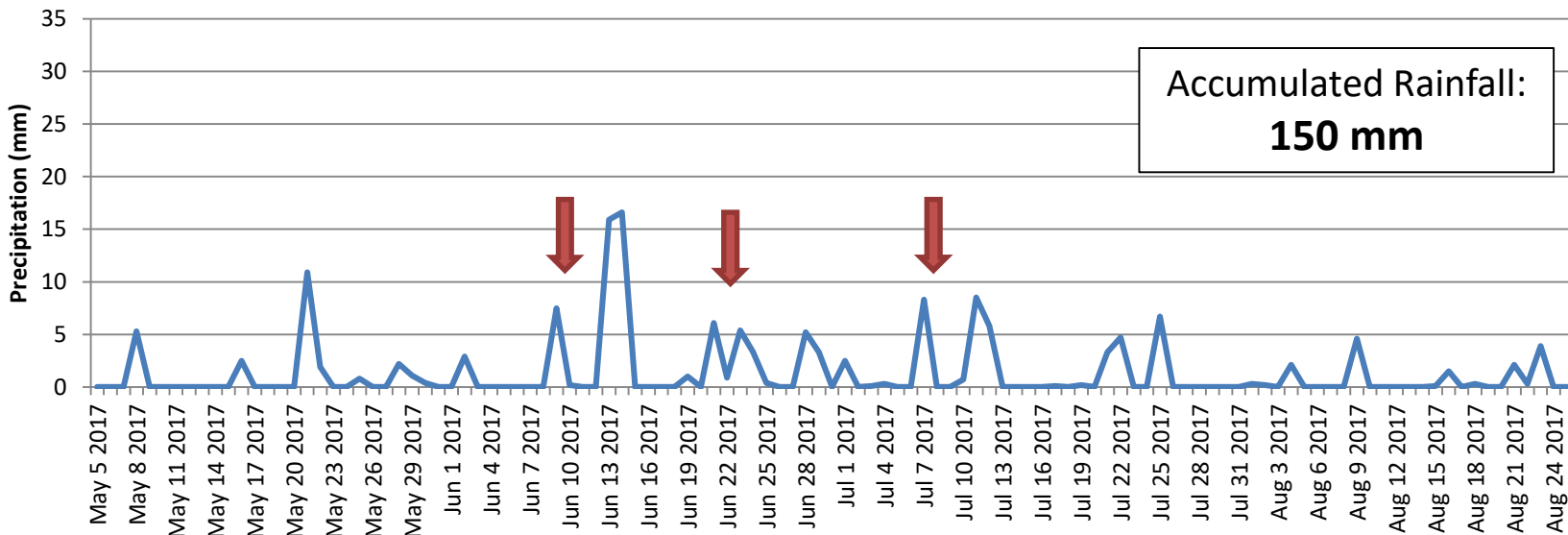


Growing Season Precipitation

Brunkild 2016



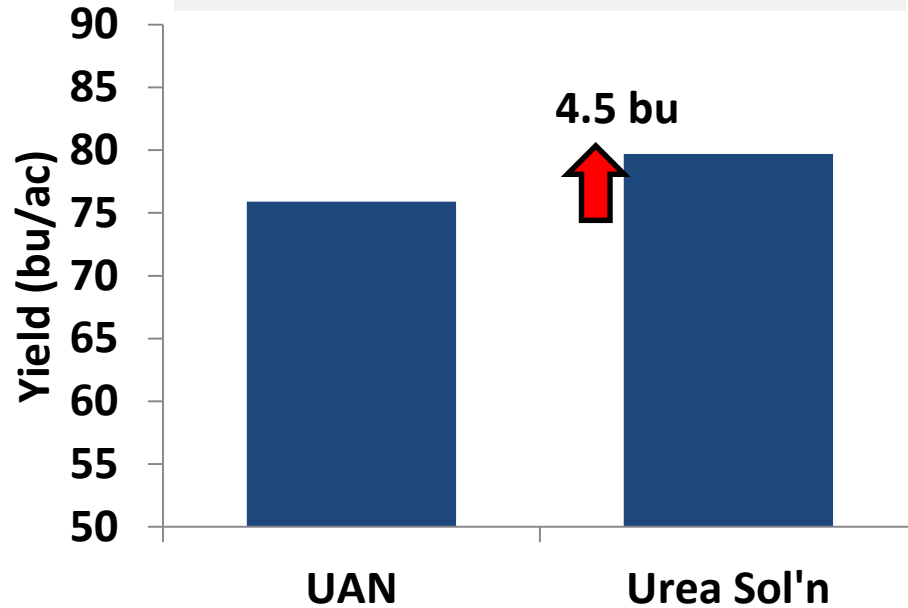
Brunkild 2017



Nitrogen Sources

Post-Anthesis – Gold Sites

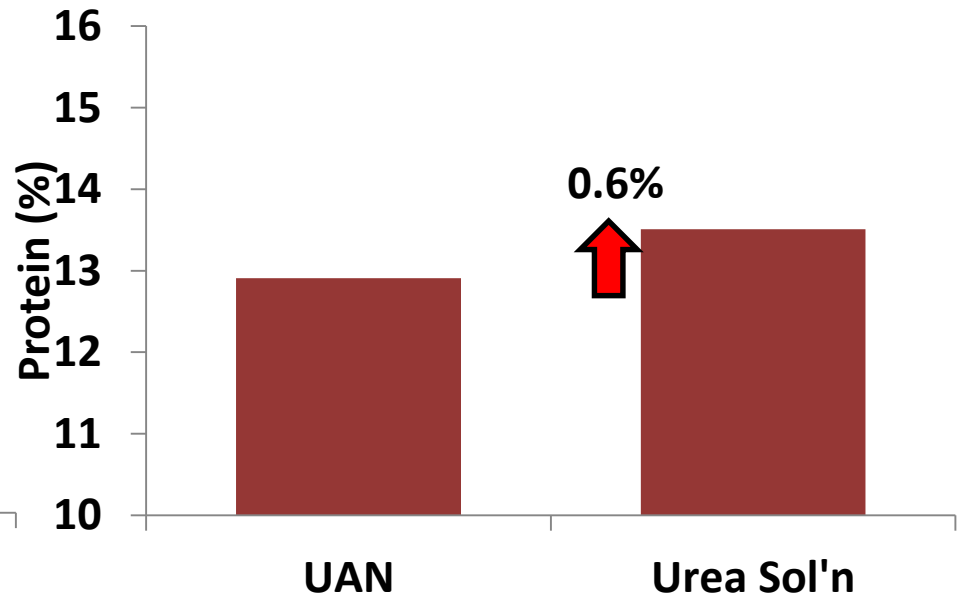
Yield



Carman 2017



Protein

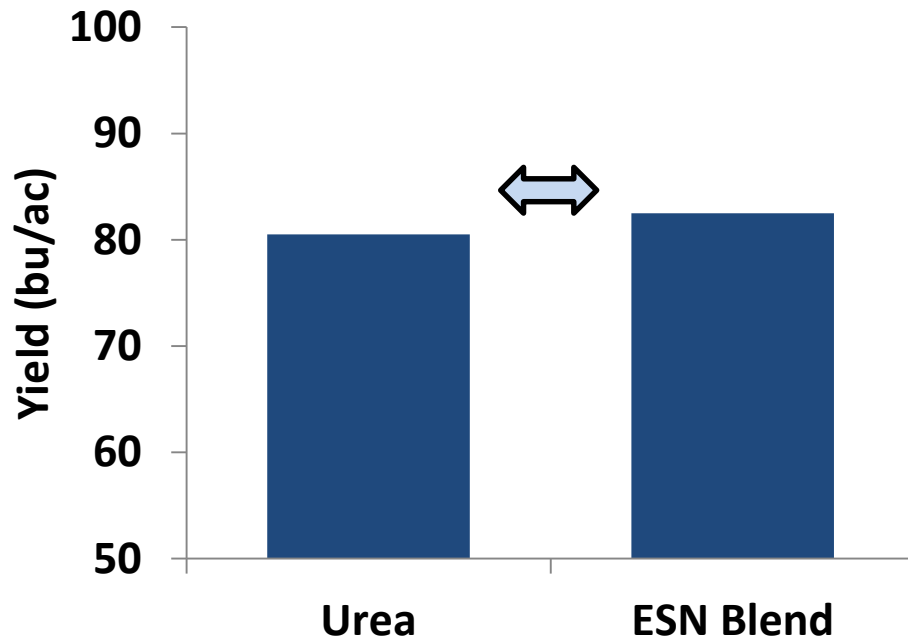


Brunkild 2017

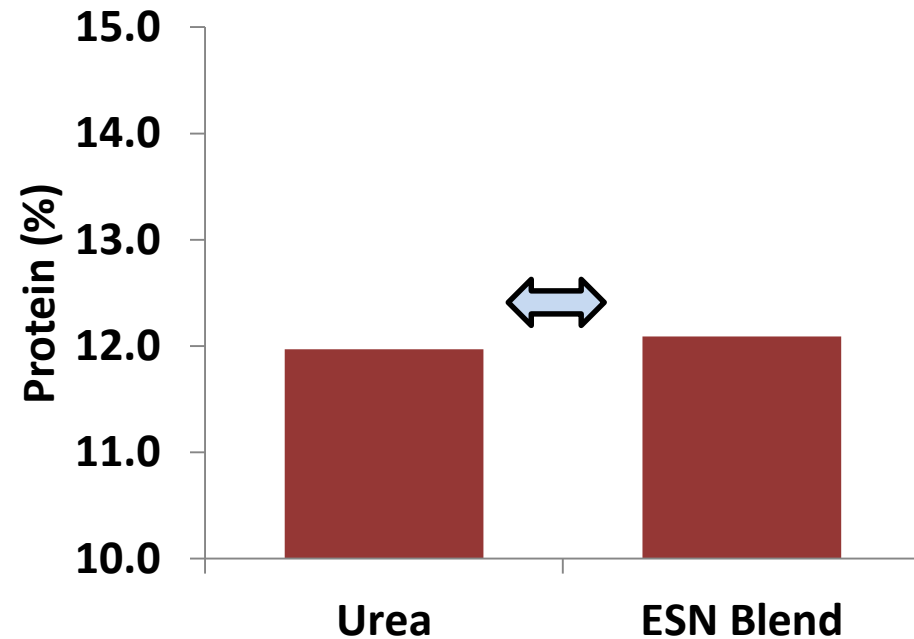


ESN Blends – Gold Sites

Yield



Protein



Preliminary Conclusions

- Total N supply (soil test nitrate-N + fert) required for economic optimum ranged from:
 - Silver Sites: **1.5 – 2.3 lbs N/bu**
 - Gold Sites: **1.7 – 3.0 lbs N/bu**
- Stem elongation and flag leaf split applications yielded at least as well as applications at planting
- Flag leaf split applications increased grain protein content compared to equivalent rates at planting and stem elongation splits.
- Post-anthesis applications increased grain protein content
- Foliar applied urea solution resulted in higher yield and grain protein content compared to UAN
- ESN blends produced yield and protein content similar to conventional urea



Additional Project Data

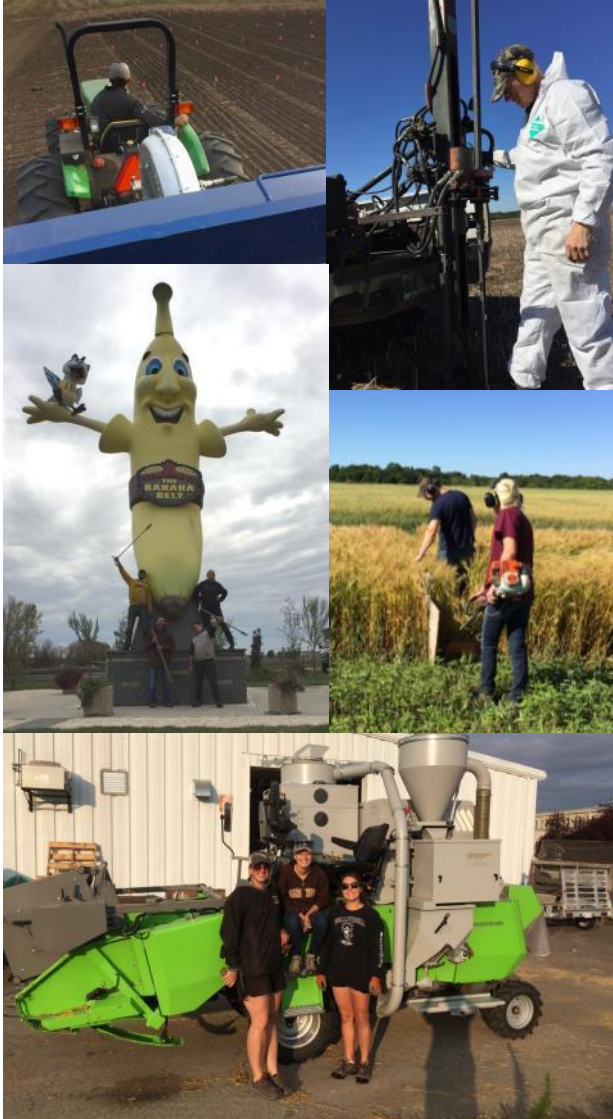


- Soil tests for N mineralization from SOM during growing season
- In season soil and tissue sampling
- GreenSeeker and SPAD Meter relationships to yield and protein
- N Uptake and Removal
- Post-harvest Soil N as an indicator of N sufficiency

Stay posted for full project report!



Acknowledgments



- Manitoba Wheat and Barley Growers Association
- John Heard and colleagues in Manitoba Agriculture
- Crop Diversification Centres (WADO, CMCDC)
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- AGVISE Laboratories
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Questions?



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