Corn Silage with Winter Rye Cover and Forage Crops

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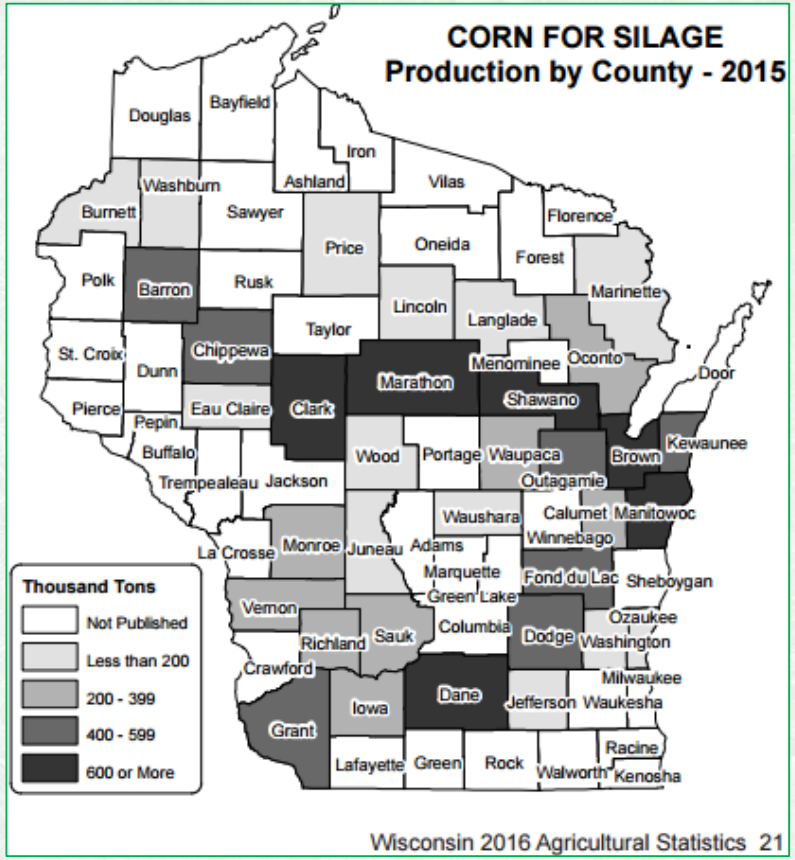


WI Agricultural Statistics, 2015 = 970,000 acres Corn Silage

Why Rye after Corn Silage?

- Fast establishing over-winter cover when planted in fall
- Prevents soil and nutrient losses (erosion & runoff)
- Scavenges soil NO_3^-
  - Is there an N credit to following crop?
- Potential to utilize as an early-season forage crop
  - Add value to the cover crop

Corn Silage with Winter Rye Cover and Forage Crops

Arlington Ag Research Station 2012 – 2016

Objectives:

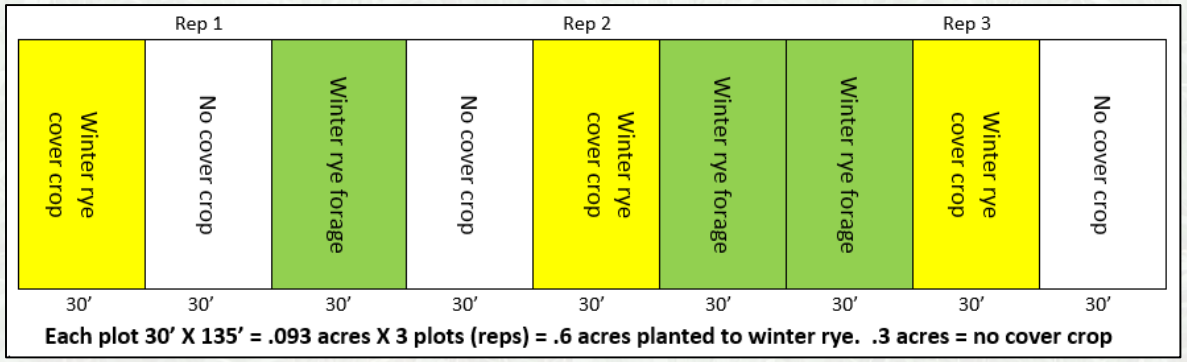
Evaluate winter rye as a cover crop and forage crop following corn silage in a continuous corn silage rotation

- How does the rye cover or forage crop affect Nitrogen availability to, and the N requirement of, the following crop?
- Do rye cover and forage crops affect the yield of a following corn silage crop?
- What is the economic impact (+/-) from including rye as cover or forage in a continuous corn silage rotation?

Corn Silage with Winter Rye Cover and Forage Crops

Arlington Ag Research Station 2012 - 2016

- Continuous corn silage rotation
  - –Manure injected, No-till planted
  - –Corn silage followed by
    - **Winter rye as a cover crop**
    - **Winter rye as a forage crop**
    - **No rye**

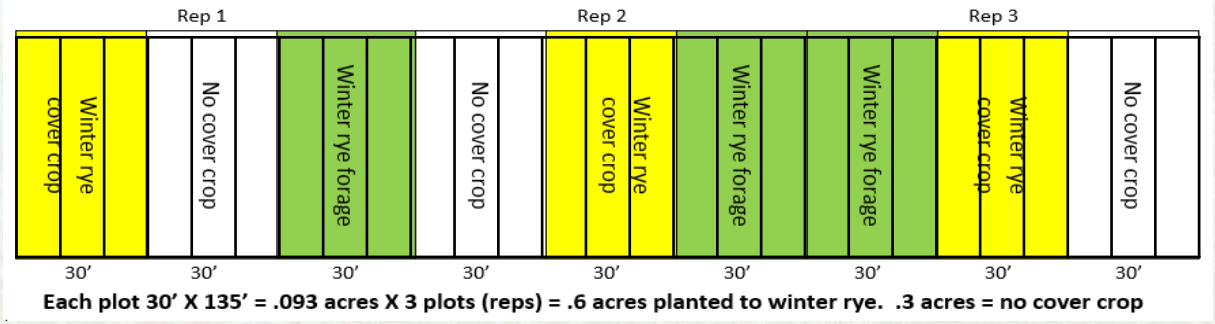


Plano silt loam,
(Typic Argiudoll)
OM=3%

Corn Silage with Winter Rye Cover and Forage Crops

Arlington Ag Research 2012 - 2016

- Nitrogen Management
  - –Fall-applied manure (target = 11,000 gpa)
    - ≈80 lbs N Credit
  - –Side dressed $NH_4^+NO_3^-$
    - **60 lbs N – below MRTN rate**
    - **100 lbs N – MRTN rate**
    - **160 lbs N – above MRTN rate**

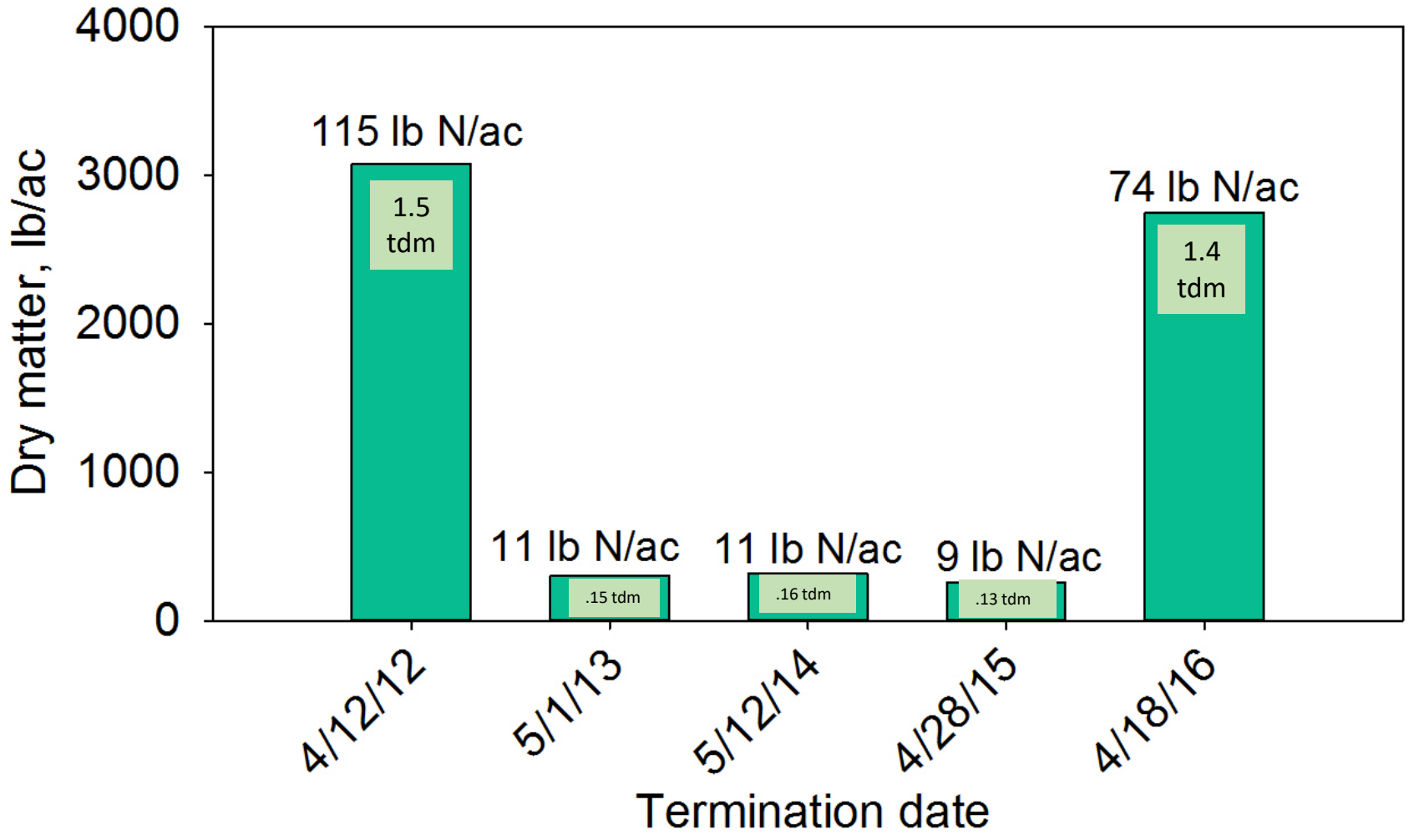


Corn silage – rye management

	2011/12	2012/13	2013/14	2014/15	2015/16
Liquid dairy manure applied	9,700 gpa N credit = 64	11,800 gpa N credit = 106	12,000 gpa N credit = 80	12,300 gpa N credit = 72	10,000 gpa N credit = 80
Rye planted Lbs Seed/acre	10/5 119	10/11 100	10/18 93	10/10 109	9/23 93
Rye forage harvest/stage	5/10 boot	5/21 pre-boot	5/30 boot	5/21 Late boot	5/12 Late boot/head
Corn planted No rye/cover crop Rye forage	5/14 5/14	6/3 6/3	5/23 6/5	5/8 5/22	5/6 5/16

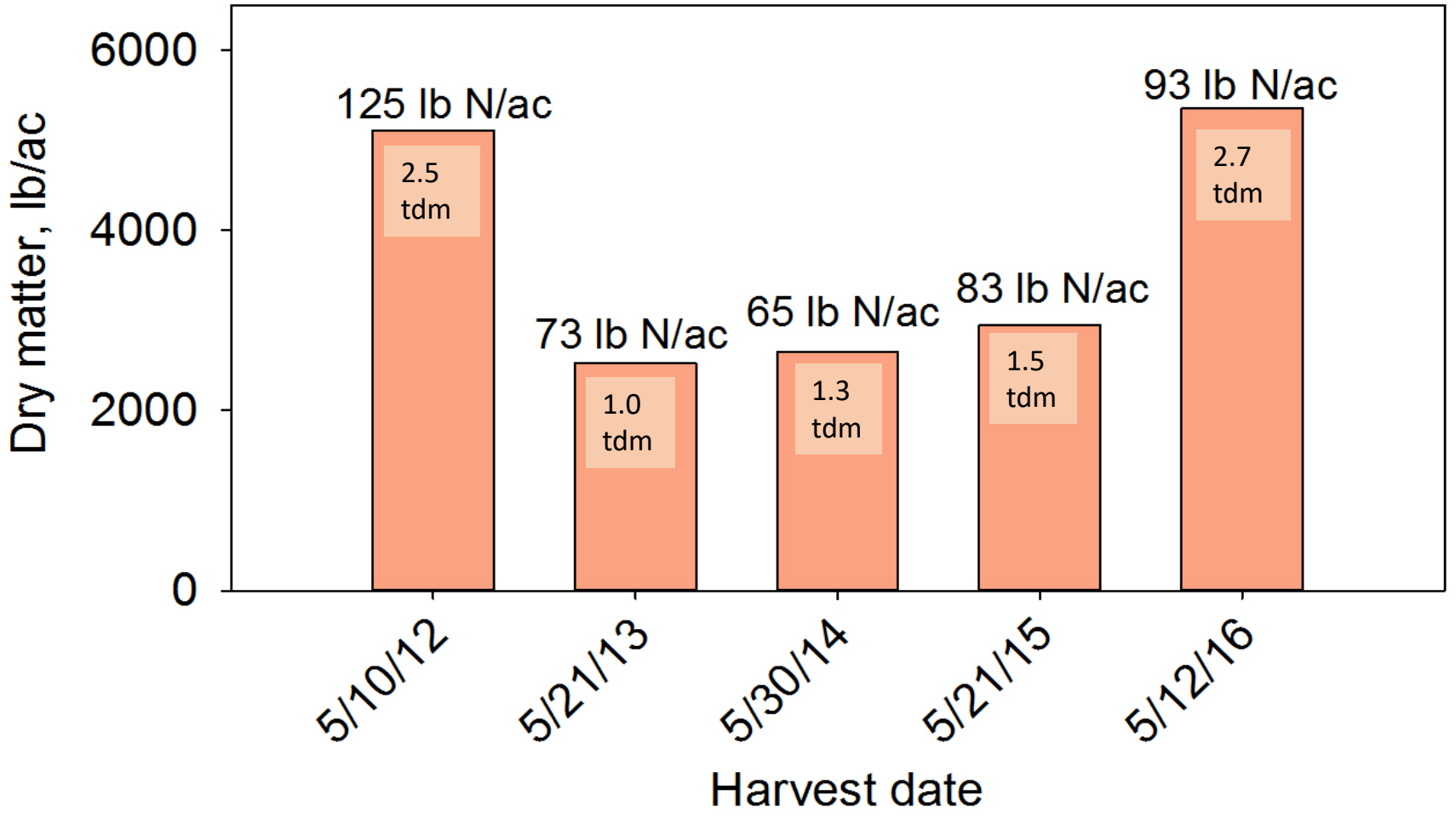
How does the rye cover or forage affect N availability from manure and the N credit to the following corn crop?

N Uptake - Rye Cover Crop Biomass



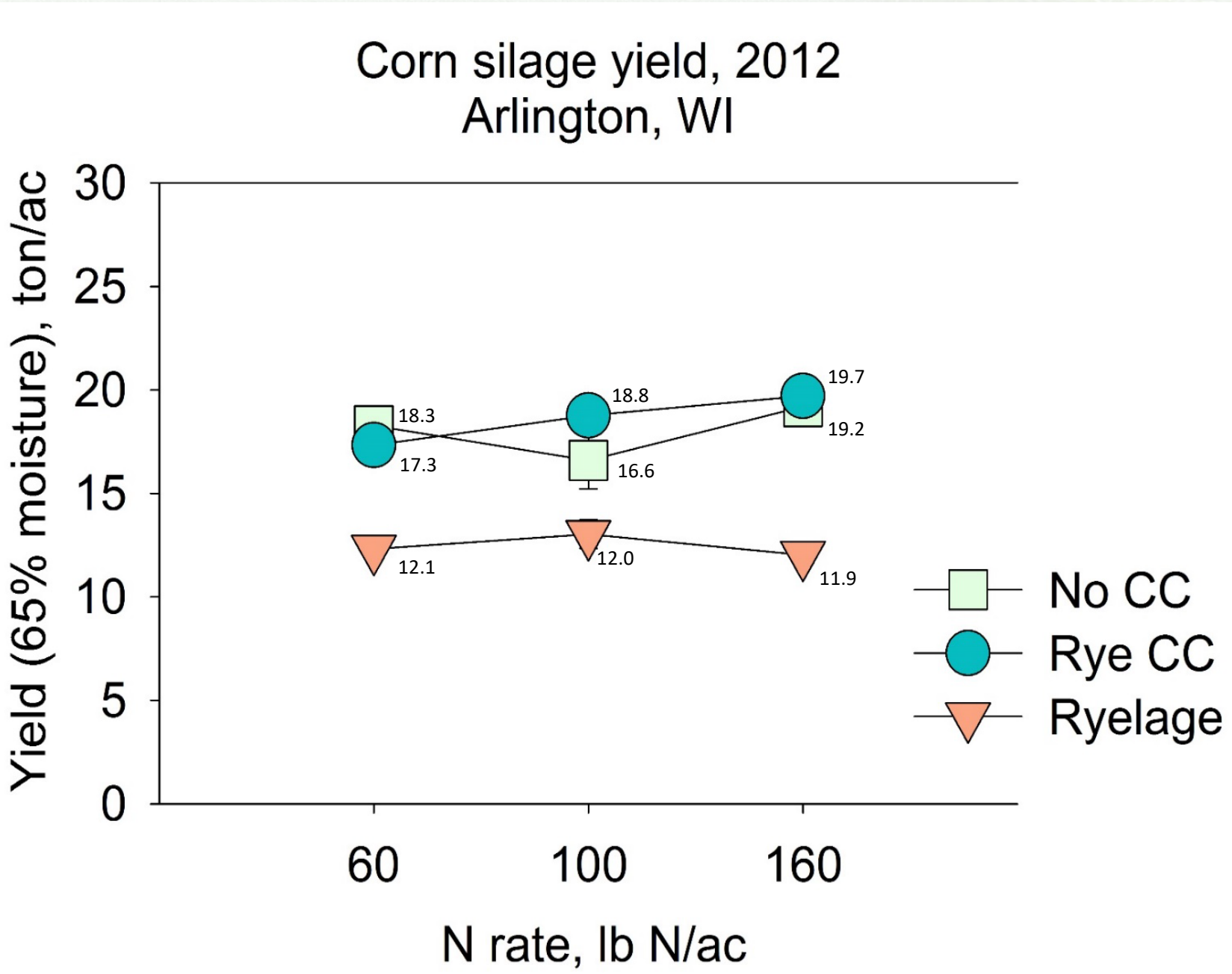
How does the rye cover or forage affect N availability from manure and the N credit to the following corn crop?

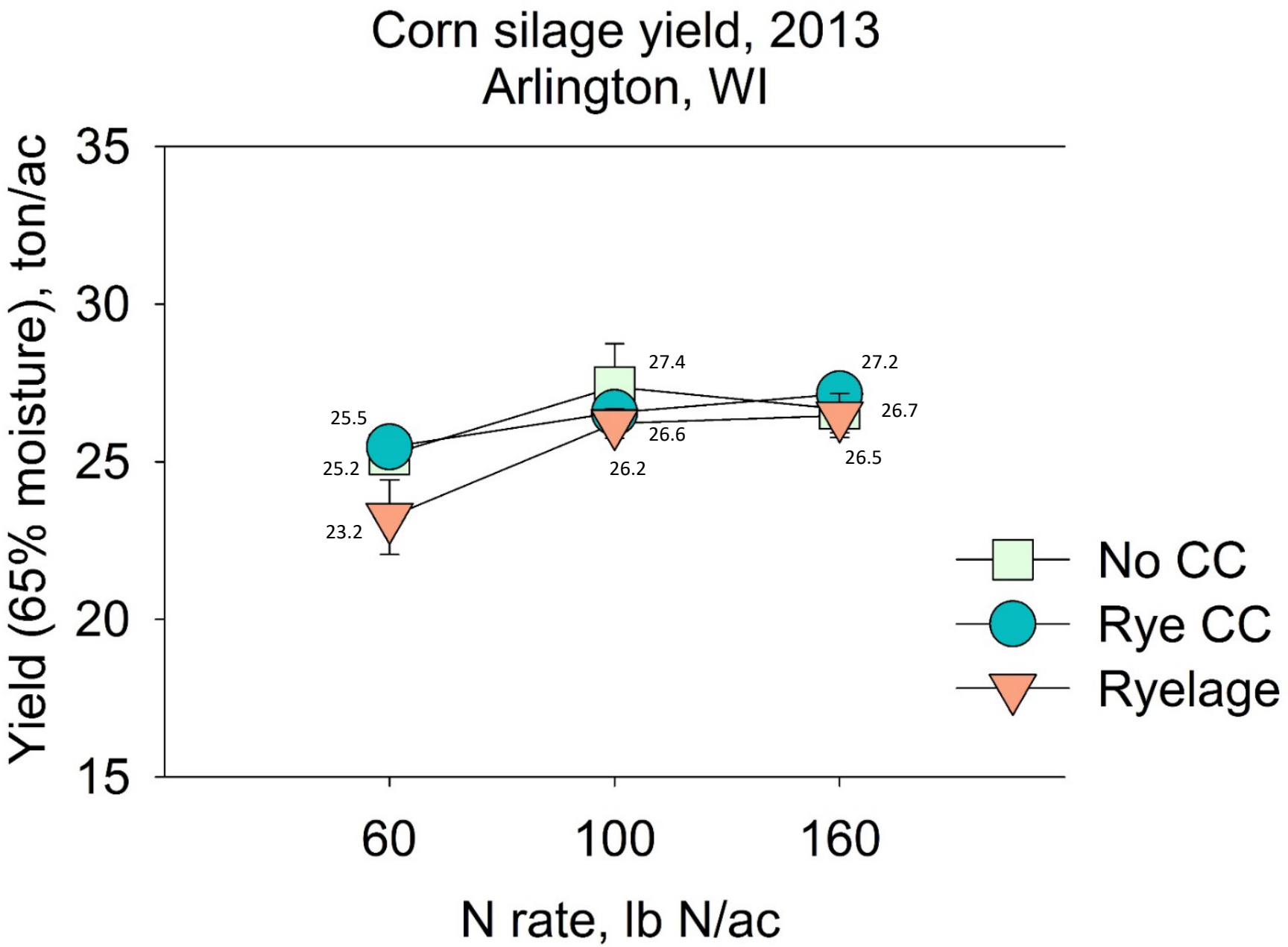
N Removal - Rye as Forage

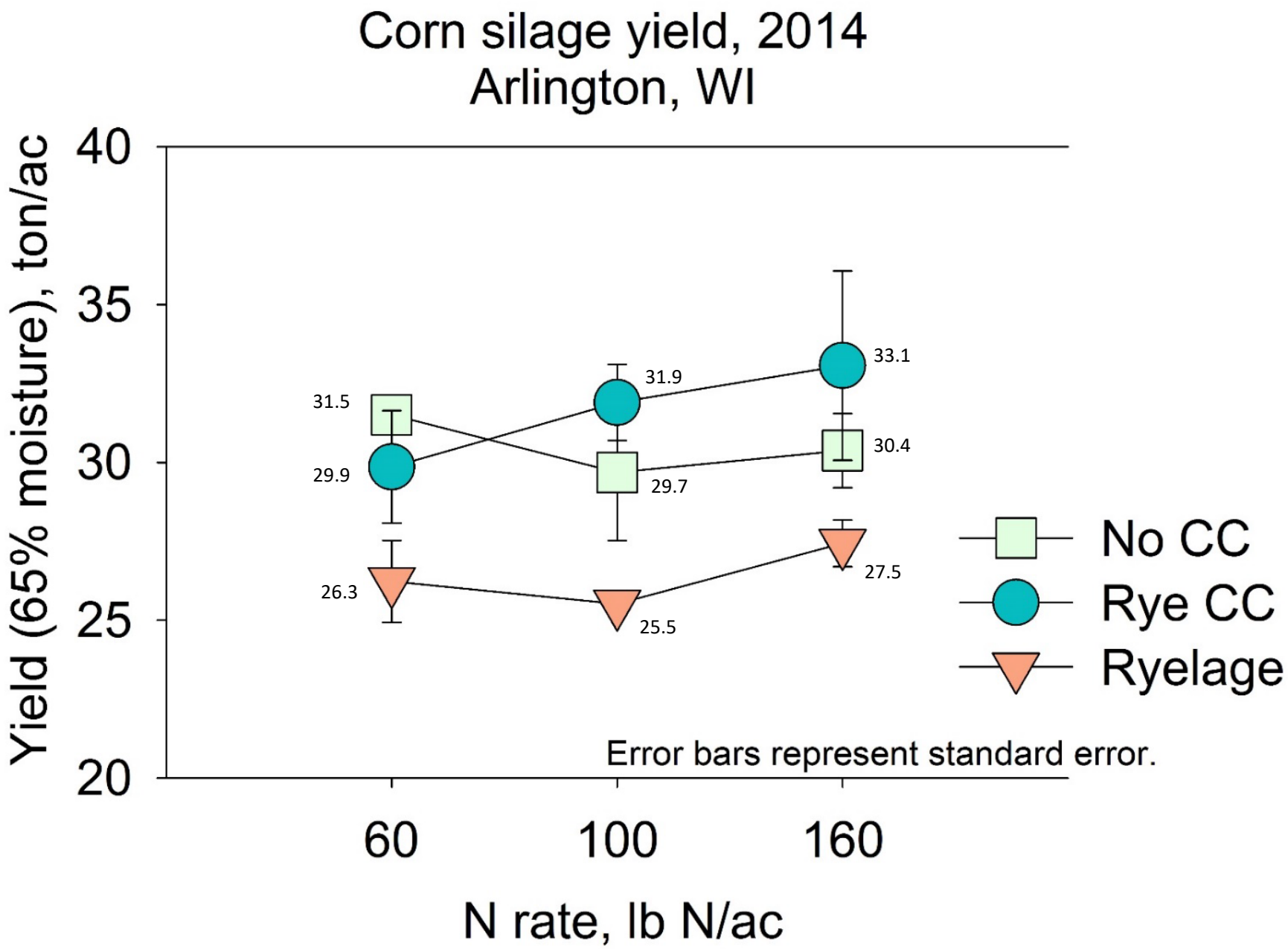


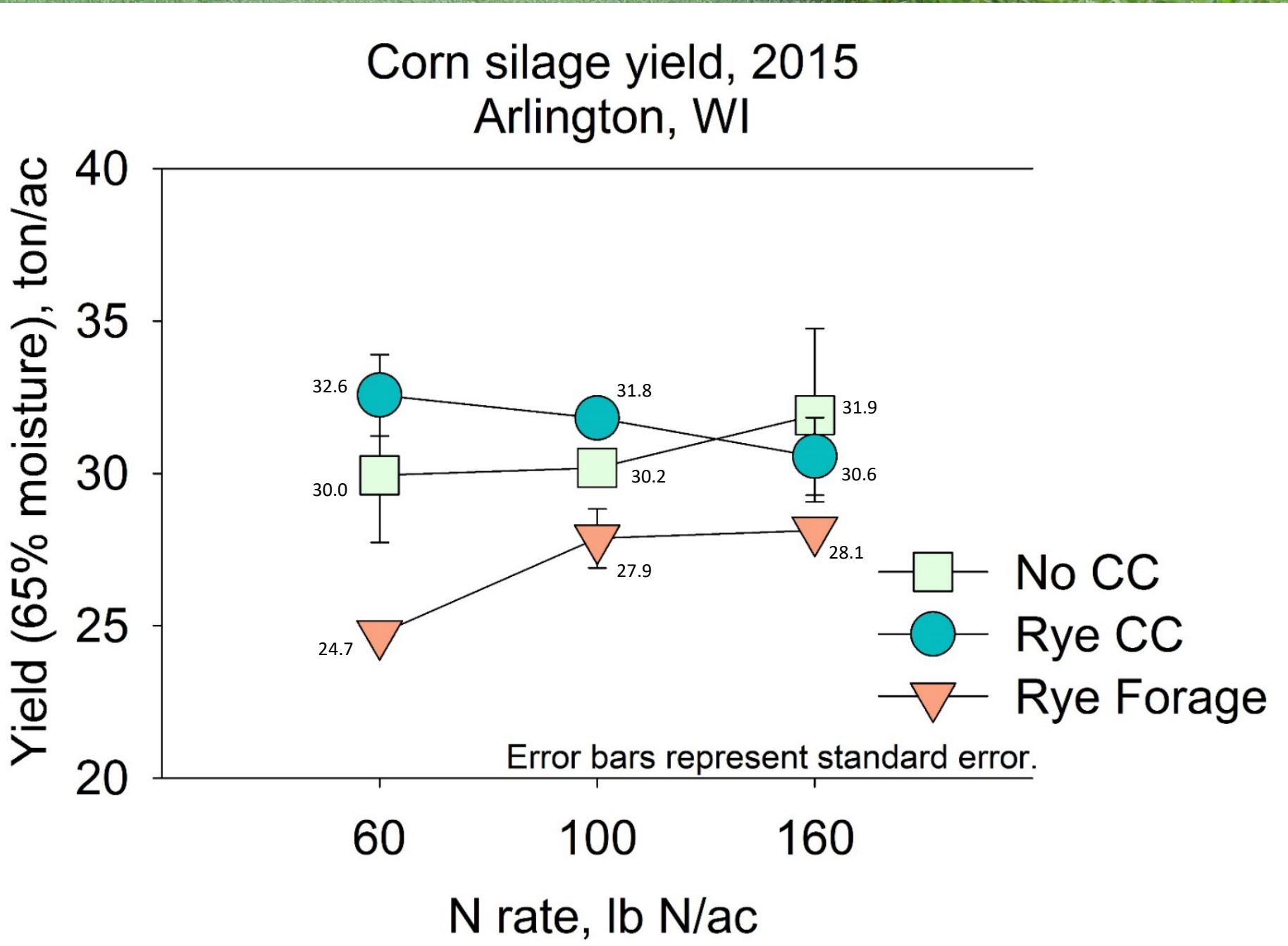

Rye as forage crop
Rye as cover crop

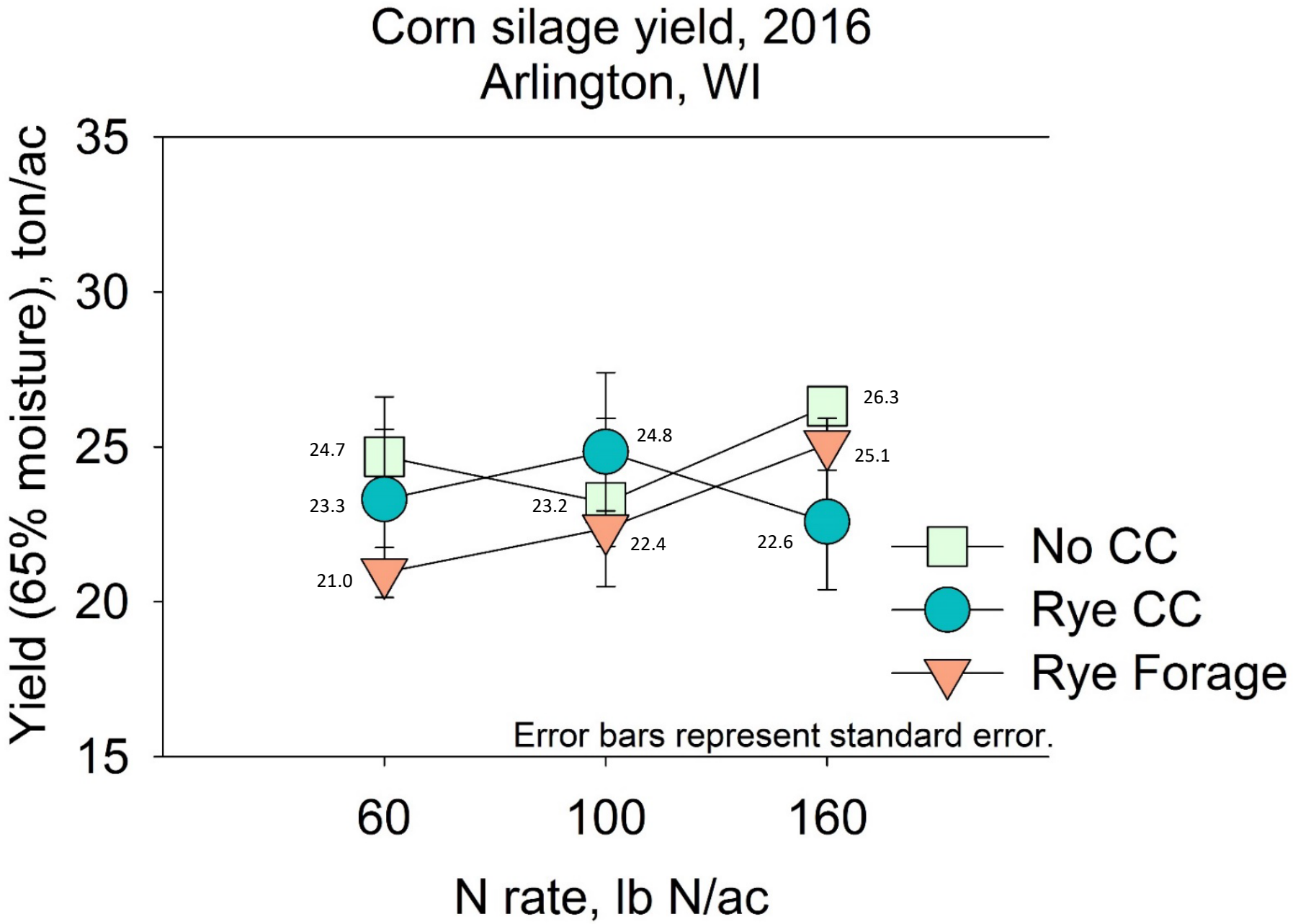

Rye as a forage crop
Rye as a cover crop


Corn silage yield, 2012
Arlington, WI
Yield (65% moisture), ton/ac
30
25
20
15
10
5
0
18.3
17.3
18.8
16.6
19.7
19.2
12.1
12.0
11.9
60
100
160
N rate, lb N/ac
No CC
Rye CC
Ryelage


Corn silage yield, 2013
Arlington, WI
Yield (65% moisture), ton/ac
35
30
25
20
15
60
100
160
N rate, lb N/ac
25.5
25.2
23.2
27.4
26.6
26.2
27.2
26.7
26.5
No CC
Rye CC
Ryelage


Corn silage yield, 2014
Arlington, WI
Yield (65% moisture), ton/ac
40
35
30
25
20
31.5
29.9
26.3
31.9
29.7
25.5
33.1
30.4
27.5
No CC
Rye CC
Ryelage
Error bars represent standard error.
60
100
160
N rate, lb N/ac


Corn silage yield, 2015
Arlington, WI
Yield (65% moisture), ton/ac
40
35
30
25
20
32.6
31.8
31.9
30.0
30.2
30.6
24.7
27.9
28.1
No CC
Rye CC
Rye Forage
Error bars represent standard error.
60
100
160
N rate, lb N/ac


Corn silage yield, 2016
Arlington, WI
Yield (65% moisture), ton/ac
35
30
25
20
15
24.7
23.3
21.0
24.8
23.2
22.4
26.3
25.1
22.6
No CC
Rye CC
Rye Forage
Error bars represent standard error.
60
100
160
N rate, lb N/ac

How does the rye cover or forage affect corn silage yield and response to nitrogen (N) rates?

- Winter rye as a **cover crop** took up soil NO_3^-, winter rye as a **forage crop** removed soil NO_3^- **.** Both appeared to reduce early season soil NO_3^- levels.
- Winter rye did not have a significant effect on N rate response for corn silage.
  - No penalty, no advantage to rye cover or forage w/respect to N rate compared to no rye
  - Soil N removed by rye forage did not affect N rate response as might be expected
- **Corn silage following rye forage** has significantly lower yield 3/5 years
  - Cause of yield reduction not determined
  - Yield reduction could not be overcome with higher N rate (side dress).
- Winter rye as a cover crop did not affect subsequent corn silage yield

Economic return from Adding rye as a cover crop or forage crop - Partial budget analysis:

Value of all forages produced **–** Relevant costs associated with adding rye

Milk/TDM forage[1] * TDM forages[2] * Milk price[3]

<u>- Input costs relevant to rye cover or forage[4]</u>

= Net value to adding rye ($/acre)

[1]Milk/TDM forage: Index of milk production potential based on energy content using forage analysis parameters CP, NDF, in vitro NDF digestibility, starch, and non-fiber carbohydrate and an estimate of DM intake (Shaver, et al. 2001).

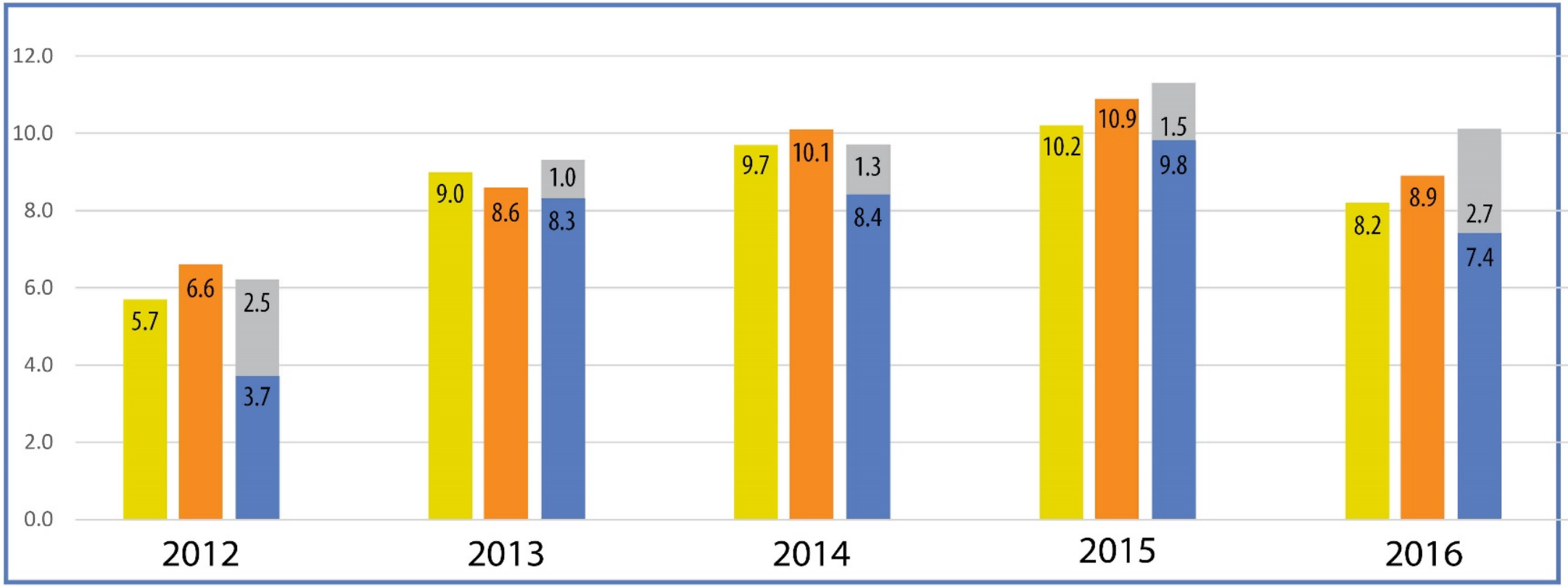
[2]Corn silage yields at 100 lb/acre N rate + Rye forage yield

[3]Mailbox milk price, 5-year average

[4]Input costs differing between the three systems: Rye seed and planting, rye forage harvest and soil nutrient removal (P_2O_5 and K_2O) in all harvested forages.

Forage yields (tons DM/acre)

Observed yields at 100 lbs N per-acre



5-year average yields

Corn silage with no rye	8.6
Corn silage following rye cover	9.2
Corn silage following rye forage	7.5
Rye forage	1.8

Rye forage quality % DM – average/3 reps (sampled at harvest)

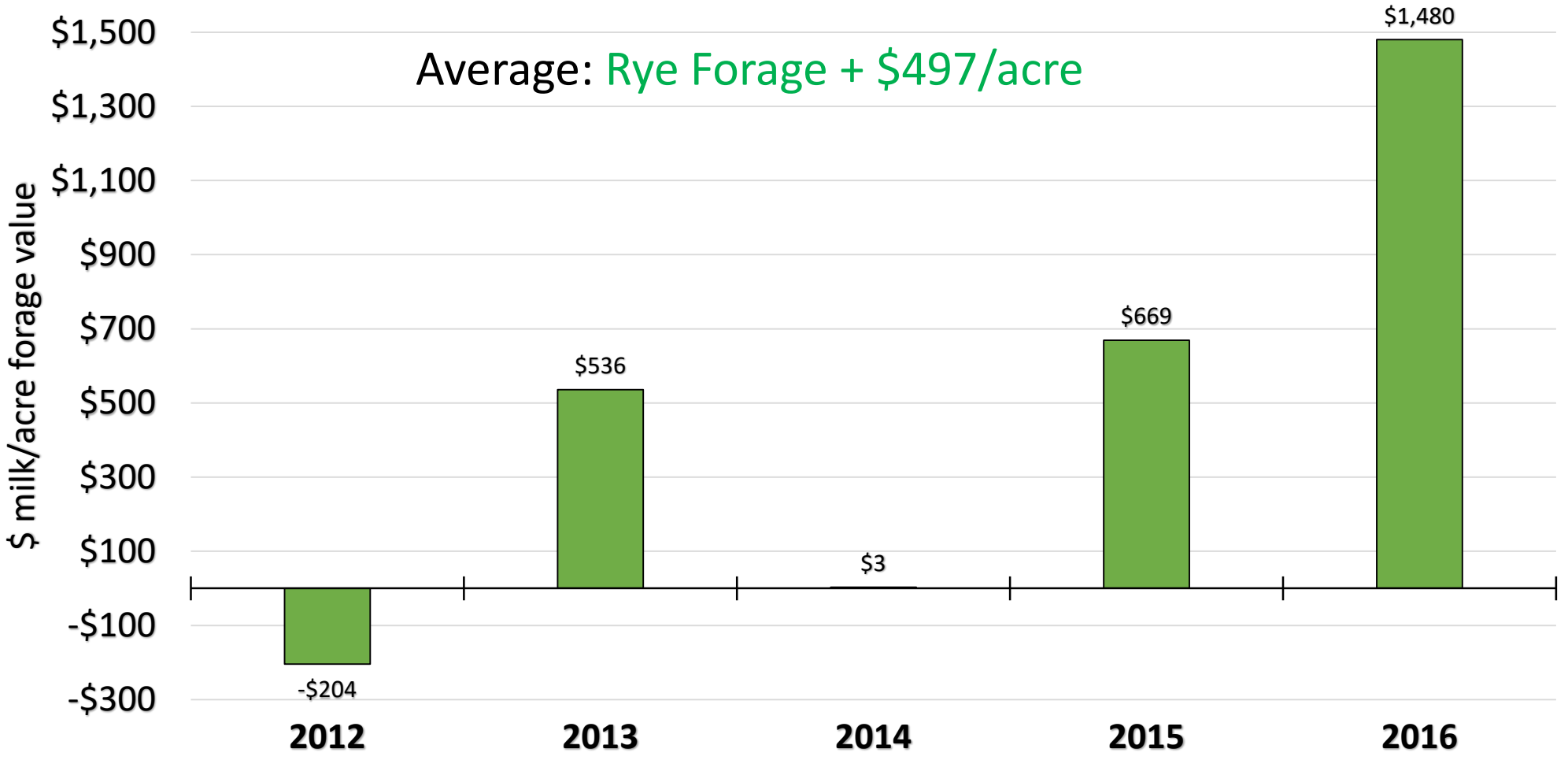
	Crude Protein	NDFD	RFQ	**Milk/ TDM**	K
2012	16.4	64.39	149	**3213**	2.33
2013	20.1	70.54	189	**3638**	3.15
2014	19.7	66.60	169	**3480**	2.55
2015	17.6	83.62	235	**4114**	2.37
2016	10.9	65.93	139	**3270**	1.98

Corn silage quality – Milk/TDM

average/3 reps

	No Rye	Rye cover crop	Rye forage
2012	3146	3201	3149
2013	3151	3135	3178
2014	3043	2835	2982
2015	3191	3165	3236
2016	2873	3021	2990

Net Value of Milk from Rye Forage to Corn Silage relative to Corn Silage w/no Rye (horizontal axis) ($/acre)



Trial Results – Economics

- Winter rye forage crop decreased subsequent corn silage yield 3/5 years
  - However, total forage production (w/rye) was equivalent or higher
- Economic returns considering potential milk yield from all forages produced favored the rye forage system 3 of the 5 study years compared to the no rye treatment
- Return to rye forage negative only one year.

Thank you!

And, thanks to:
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