

Verifying Nitrogen Application Rates for Corn

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Corn N rate guidelines - MRTN

- Introduced in winter 2005/2006
- In response to high N costs & low corn price
- Based on results of numerous N response experiments
- Goal: Maximize economic return on N fertilizer

Info. needed to use MRTN

- Soil yield potential
- Previous crop
- N:corn price ratio
 - \$/lb N : \$/bu corn

N:Cor Price Ratio

Price of N (\$/lb N)	Price of corn (\$/bu)								
	3.40	3.60	3.80	4.00	4.20	4.40	4.60	4.80	5.00
0.36	0.11	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.07
0.40	0.12	0.11	0.11	0.10	0.10	0.09	0.09	0.08	0.08
0.44	0.13	0.12	0.12	0.11	0.10	0.10	0.10	0.09	0.09
0.48	0.14	0.13	0.13	0.12	0.11	0.11	0.10	0.10	0.10
0.52	0.15	0.14	0.14	0.13	0.12	0.12	0.11	0.11	0.10
0.56	0.16	0.16	0.15	0.14	0.13	0.13	0.12	0.12	0.11
0.60	0.18	0.17	0.16	0.15	0.14	0.14	0.13	0.13	0.12
0.64	0.19	0.18	0.17	0.16	0.15	0.15	0.14	0.13	0.13
0.68	0.20	0.19	0.18	0.17	0.16	0.15	0.15	0.14	0.14
0.72	0.21	0.20	0.19	0.18	0.17	0.16	0.16	0.15	0.14



Nitrogen Guidelines for Corn in Wisconsin

N:Corn Price Ratio (see other side)

		0.05	0.10	0.15	0.20
SOIL	PREVIOUS CROP	LBS N/ACRE (total to apply) ³			
high/very high yield potential soils	Corn , Forage legumes, Legume vegetables, Green manures ⁴	165 ¹ 135-----190 ²	135 120---155	120 100---135	105 90---120
	Soybean , Small grains ⁵	140 110-----160	115 100---130	100 85---115	90 70---100
medium/low yield potential soils	Corn , Forage legumes, Legume vegetables, Green manures ⁴	120 100---140	105 90---120	95 85---110	90 80---100
	Soybean , Small grains ⁵	90 75---110	60 45---70	50 40---60	45 35---55
sands/ loamy sands	Irrigated— All crops ⁴	215 200---230	205 190---220	195 180---210	190 175---200
	Non-irrigated— All crops ⁴	120 100---140	105 90---120	95 85---110	90 80---100

1-3-2006-10M

¹ Maximum return to N (MRTN) rate. ² Range within \$1/acre of MRTN rate. ³ Includes N in starter. ⁴ Subtract N credits for forage legumes, legume vegetables, animal manures, green manures. ⁵ Subtract N credits for animal manures and second year forage legumes.



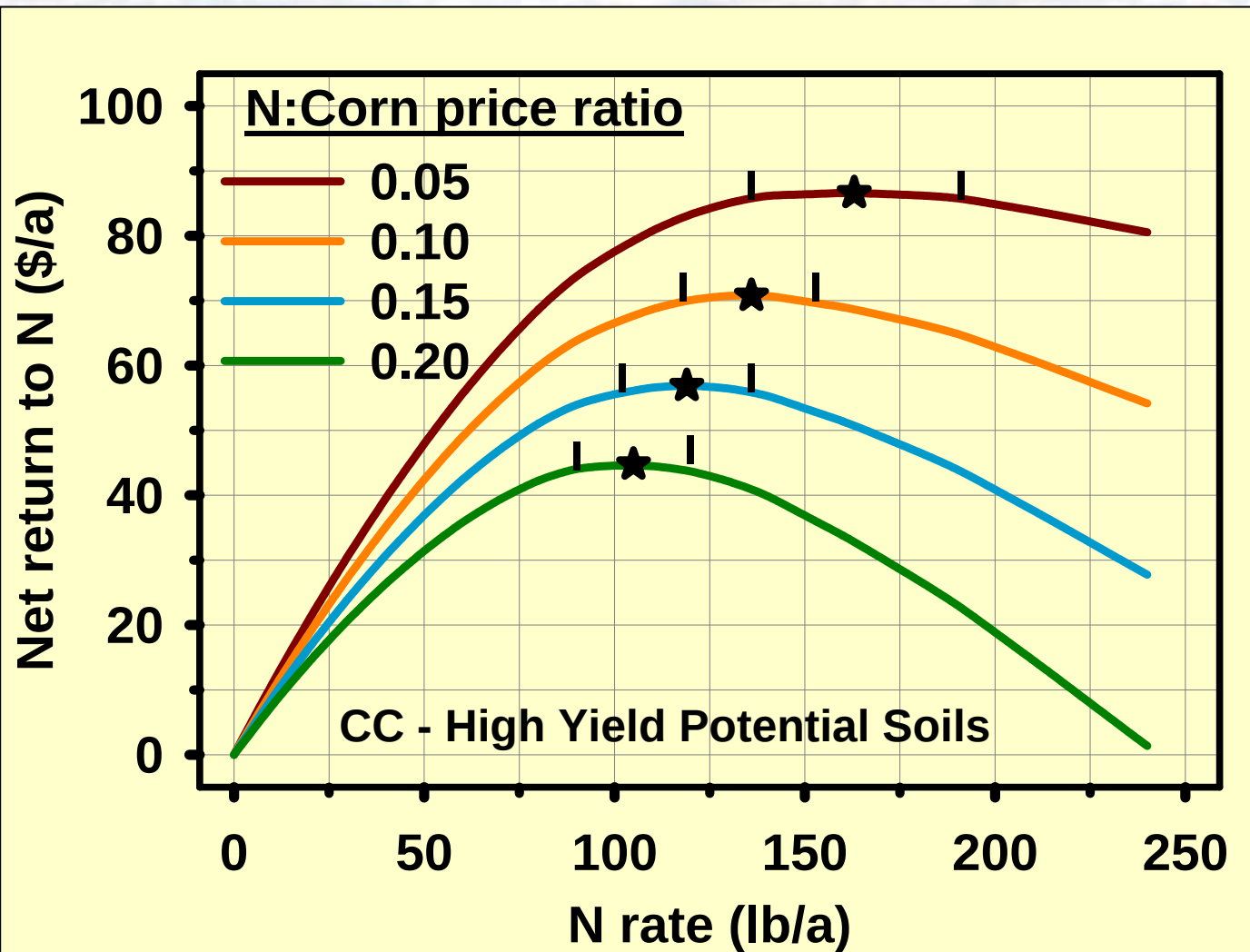
Some guidelines for using ranges

Situation	Portion of Range to Use		
	low	mid	high
> 50 % residue cover at planting			✓
Previous crop is small grain on medium/fine textured soils	✓	✓	
100 % of N is from organic sources			✓ Plus up to 20 lb N/a in starter fertilizer may be applied
If there is a likelihood of residual N (carryover N)	✓		Or use PPNT

Some guidelines for using ranges

Situation	Portion of Range to Use		
	low	mid	high
Medium & fine-textured soils with < 2.0 % OM			✓
Medium & fine-textured soils with > 10.0 % OM	✓		
Course-textured soils with < 2.0 % OM			✓
Course-textured soils with > 2.0 % OM	✓	✓	

Profitable N Rates

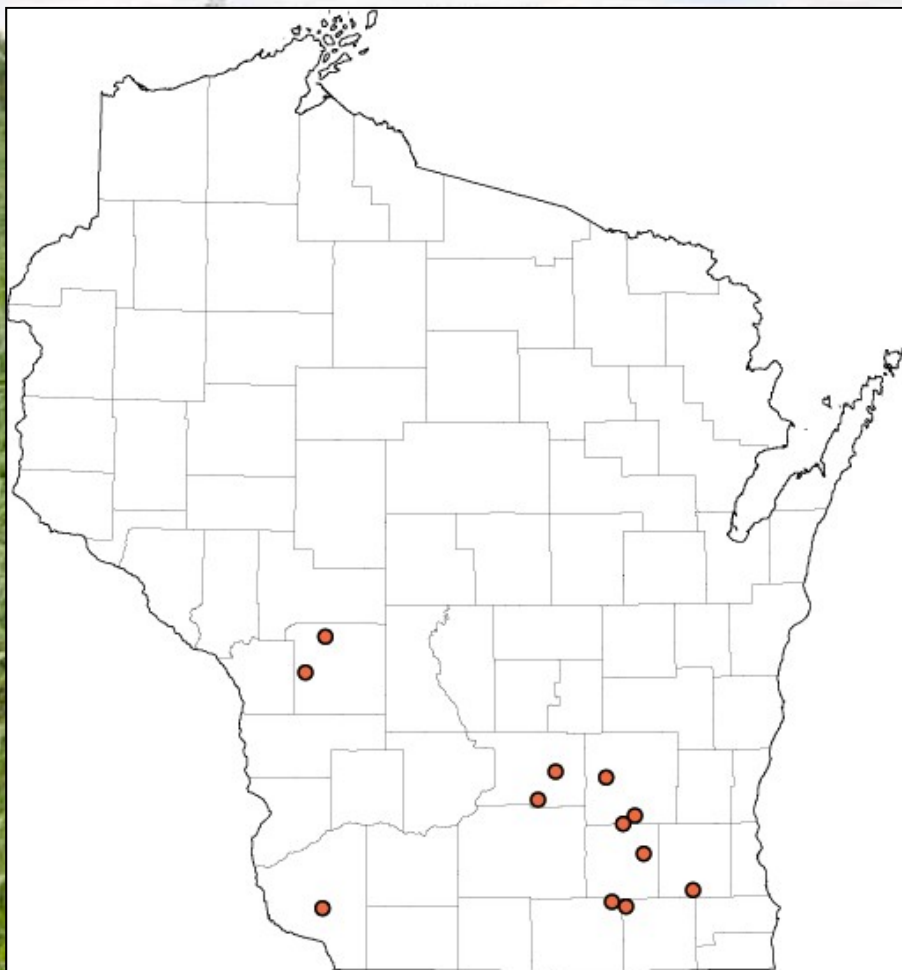


- A range of N rates can produce profitable yields
- Economics clearly drives the profitable N rate

Objective

- Establish plots on grower fields throughout the state
 - Demonstrate how MRTN performs
 - Collect more data to add to the database

13 Locations



- Range of soil yield potentials
- Previous crop:
 - Soybean at 7 sites
 - Corn at 6 sites
- N rates:
 - 0, 40, 80, 120, 160 lb N/a
 - and 200 lb N/a for HYPS
 - Small amount of starter N at some sites included in total N application
- Replications: at least 3



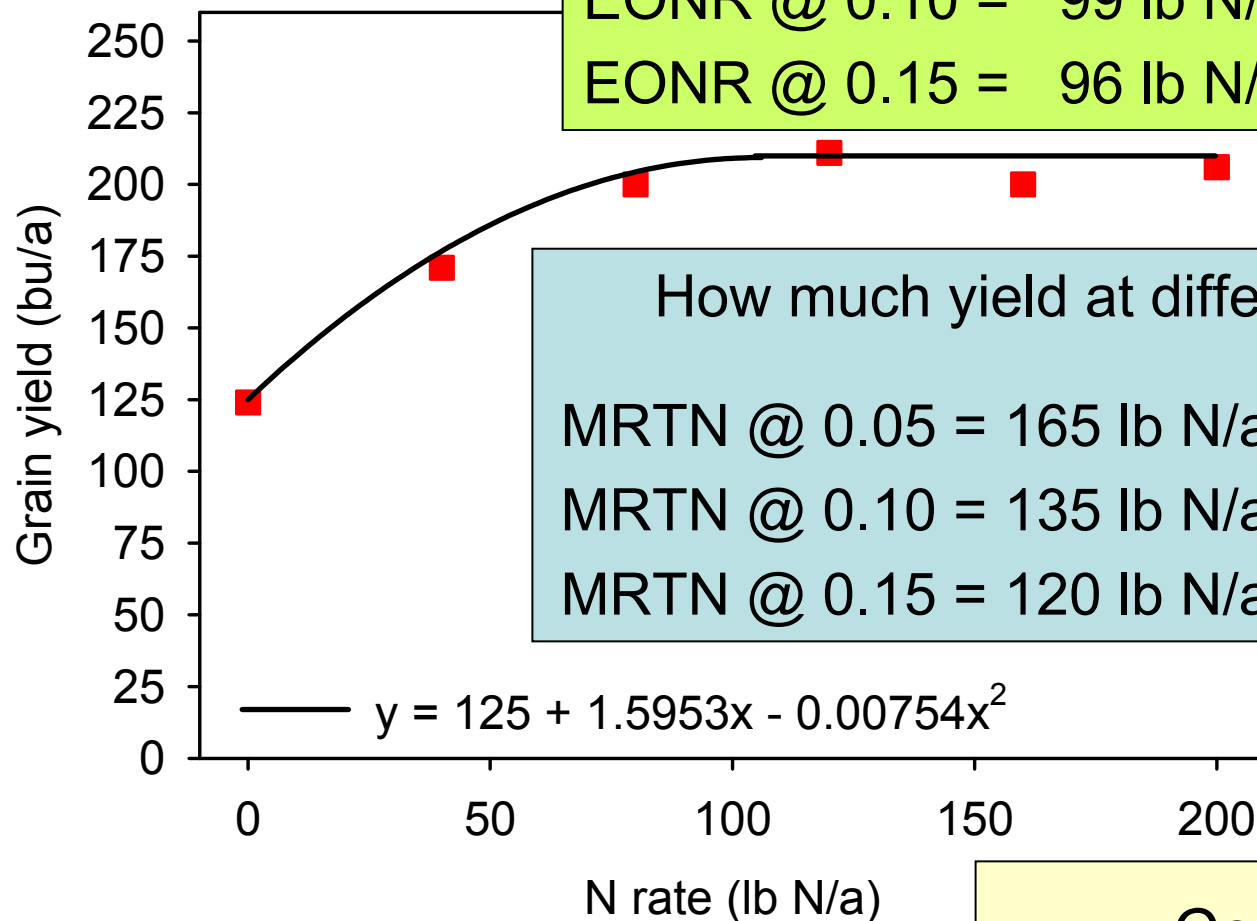
Bill Halfman UWEX Monroe Co.

Data Analysis

EONR @ 0.05 = 102 lb N/a → Yield = 206 bu/a

EONR @ 0.10 = 99 lb N/a → Yield = 206 bu/a

EONR @ 0.15 = 96 lb N/a → Yield = 205 bu/a



How much yield at different MRTN rates?

MRTN @ 0.05 = 165 lb N/a → Yield = 206 bu/a

MRTN @ 0.10 = 135 lb N/a → Yield = 206 bu/a

MRTN @ 0.15 = 120 lb N/a → Yield = 206 bu/a

Corn: \$4.00/bu
N: \$0.20, 0.40, 0.60/lb

MRTN v. EONR

(Example: 0.05 N:corn price ratio)

Site ID	Observed EONR	
	N rate	Yield
	lb N/a	bu/a
33	42	228
40	144	167
49	108	206
⋮	⋮	⋮



MRTN v. EONR

(Example: 0.05 N:corn price ratio)

Site ID	Observed EONR		MRTN rate guidelines	
	N rate	Yield	N rate	Yield
	lb N/a	bu/a	lb N/a	bu/a
33	42	228	140	228
40	144	167	140	166
49	108	206	165	206
⋮	⋮	⋮	⋮	⋮

MRTN v. EONR

(Example: 0.05 N:corn price ratio)

Site ID	Observed EONR		MRTN rate guidelines		Difference (MRTN – EONR)		
	N rate	Yield	N rate	Yield	N rate	Yield	Econ.
	lb N/a	bu/a	lb N/a	bu/a	lb N/a	bu/a	\$/a
33	42	228	140	228	98	0	-19.60
40	144	167	140	166	-4	-1	-3.20
49	108	206	165	206	57	0	-11.40
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮

Under application

Over application

MRTN v. EONR

(Example: 0.05 N:corn price ratio)

Site ID	Observed EONR		MRTN rate guidelines		Difference (MRTN – EONR)		
	N rate	Yield	N rate	Yield	N rate	Yield	Econ.
	lb N/a	bu/a	lb N/a	bu/a	lb N/a	bu/a	\$/a
33	42	228	140	228	98	0	-19.60
40	144	167	140	166	-4	-1	-3.20
49	108	206	165	206	57	0	-11.40
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
Average MRTN under applied (n=3)					-3	0	-0.80
Average MRTN over applied (n=10)					63	0	-12.54

MRTN v. EONR Comparison

Average for all sites

N: Corn	MRTN: Under Applied				MRTN: Over Applied			
	n	N Rate	Yield	Return	n	N Rate	Yield	Return
		lb N/a	bu/a	\$/a		lb N/a	bu/a	\$/a
0.05	3	-3	0	-0.80	10	63	0	-12.54
0.10	4	-13	-2	-4.90	9	40	0	-16.04
0.15	6	-18	-7	-16.33	7	38	0	-21.48

Under and over application \$ losses are balanced

2007 Yield loss with MRTN – Not considering economics

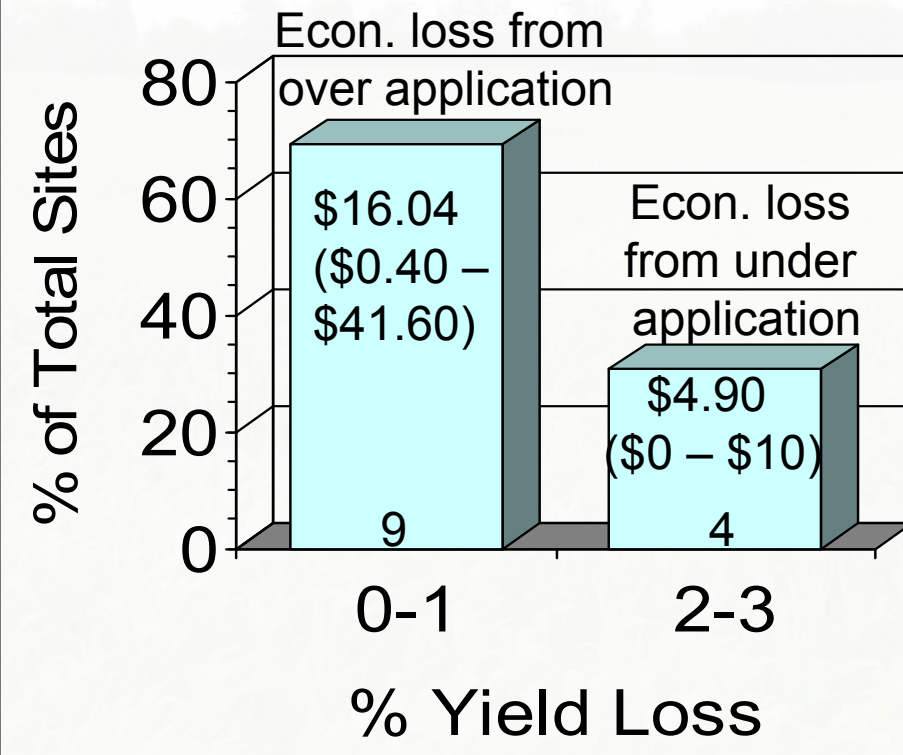
% Yield loss = 100 – relative yield

Relative yield = $\frac{\text{Yield calculated @ MRTN rate}}{\text{divided by the max. yield achieved at the site}}$

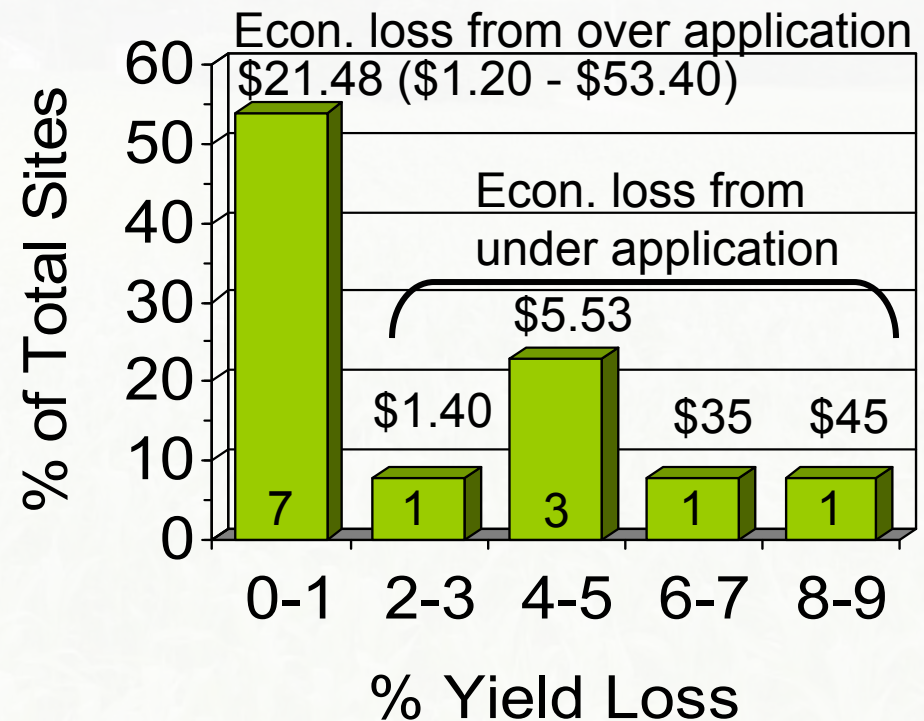


2007 Yield loss with MRTN – Not considering economics

0.10 Price Ratio



0.15 Price Ratio



% Yield loss = 100 – relative yield

Relative yield =
$$\frac{\text{Yield calculated @ MRTN rate}}{\text{divided by the max. yield achieved at the site}}$$

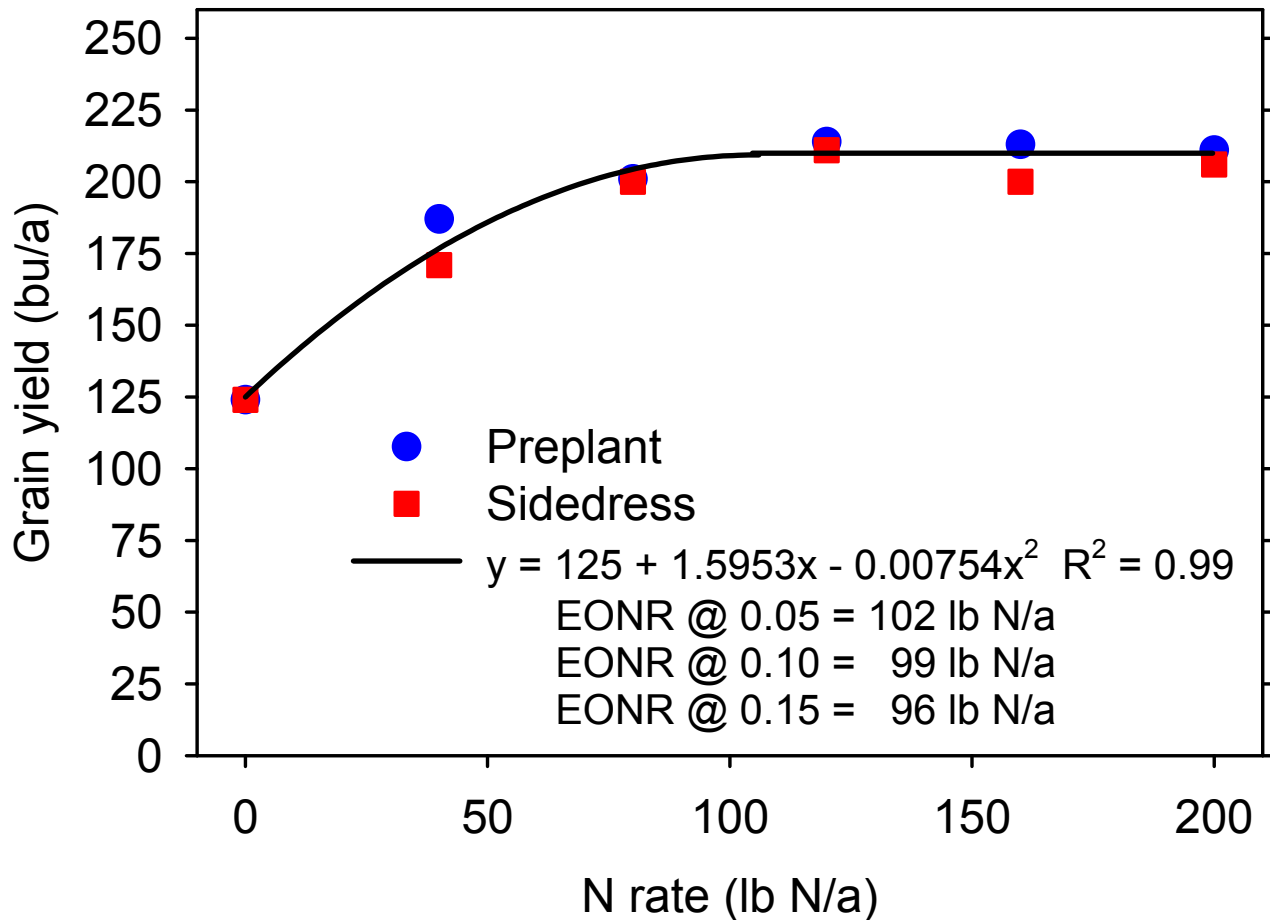
Conclusions

- Data is representative of range of responses that occur on WI farms
- Remember data from just one year
 - On each field variation from year to year
 - Until we can accurately predict soil N mineralization, it will be difficult to determine exactly the amount of N needed each year

Conclusions

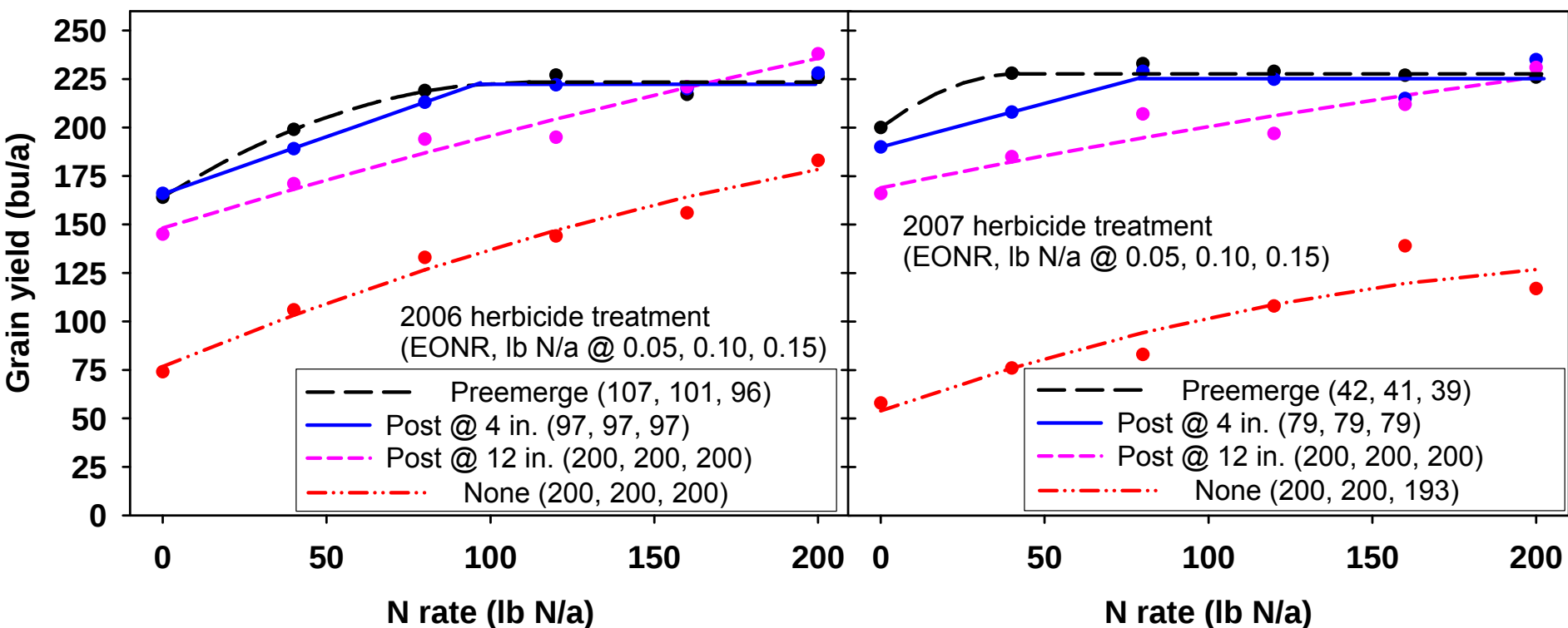
- Power of MRTN is the averaging of data from multiple locations over multiple years
 - A robust estimate of profitability by balancing economic losses from under and over application
- MRTN tends to over recommend N compared to economics

Preplant v Sidedress N Lancaster ARS, 2007



Effect of weed control on EONR

Arlington ARS, 2006 & 2007



Joint project with Chris Boerboom

For more details go to Chris's presentation Thursday afternoon

Acknowledgements

- Bill Halfman, Matt Hanson, Kevin Shelley, Tim Wood, Chris Boerboom, Tim Trower
- Cooperating farmers
- UW-Extension Nutrient Management Team
- UW Nonpoint Pollution Demonstration Project