

Approaches to N Recommendations in the North Central Region

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N Recommendations

- Two prevailing theories
 - Yield goal based
 - Non-yield goal based

N Recommendations

- Yield goal based

- Illinois

- $\text{lb N/A} = (1.2 \times \text{YG}) - \text{N credits}$; soybean credit = 40 lb/A

- Michigan/Indiana/Ohio

- $\text{lb N/A} = (1.36 \times \text{YG}) - 27 - \text{N credits}$; soybean credit = 30 lb/A

- Minnesota

PC	OM*	----- Expected Yield (bu/A) -----				
		100-124	125-149	150-174	175-199	200+
		----- N to apply (lb N/A) -----				
Corn	Low	130	160	190	210	230
Corn	Med/High	100	130	160	180	200
Soybean	Low	90	120	150	170	190
Soybean	Med/High	60	90	120	140	160

* Low OM < 3.0%; Med/High OM ≥ 3.0%

soybean credit = 40 lb/A

N Recommendations

- Not yield goal based

- Iowa

PC	N rec. (lb N/A)
Corn	150 to 200
Soybean	100 to 150

- Wisconsin

OM %	--- Sands/loamy sands ---		----- Other soils -----	
	Irrigated	Non-irrigated	Low/Med YP	High/Very High YP
	----- lb N/A -----			
< 2	200	120	150	180
2-9.9	160	110	120	160
10-20	120	100	90	120
> 20	80	80	80	80

(soybean credit = 40 lb N/A)

N Recommendation Comparison

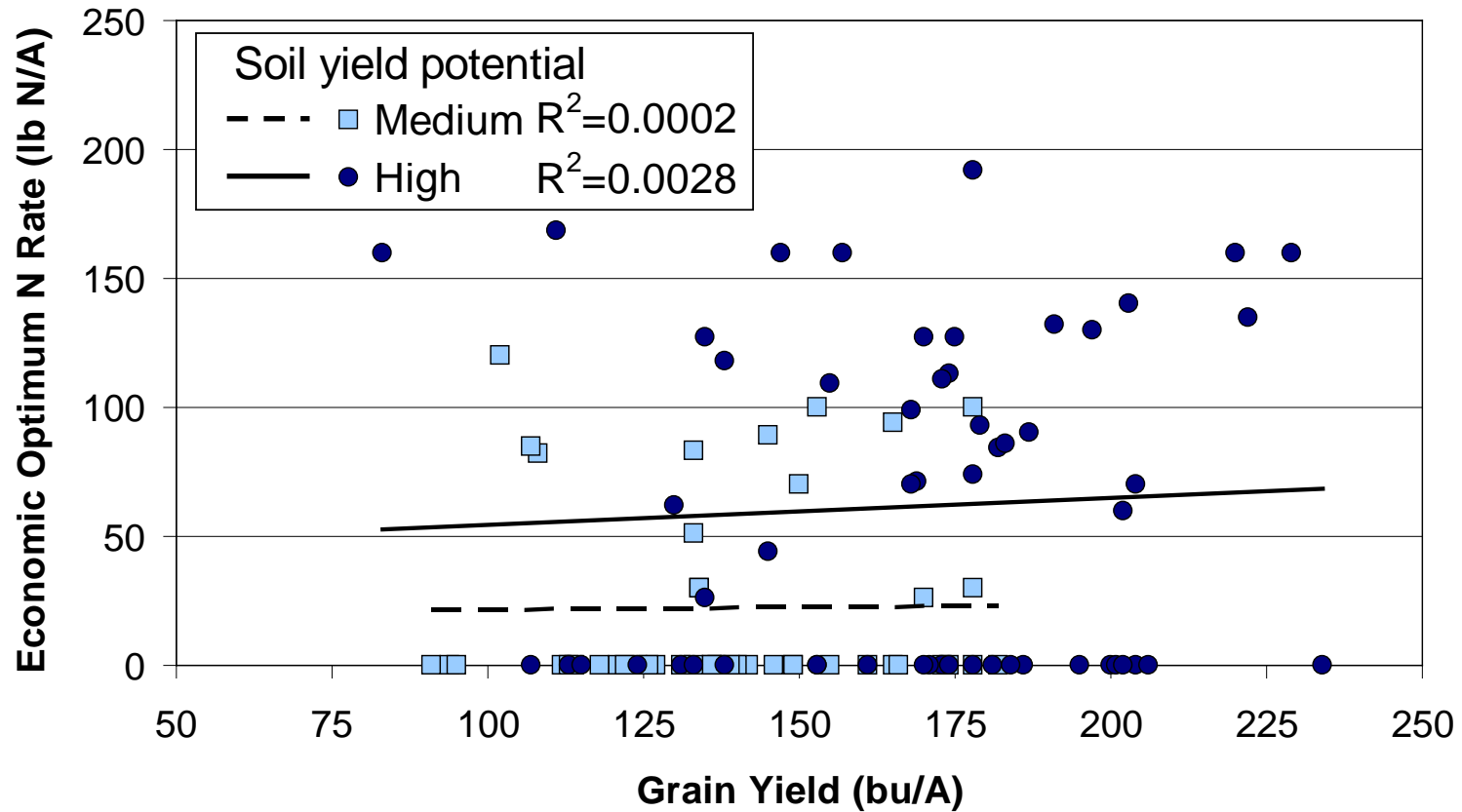
Previous Crop:	Corn		Soybean	
Yield Goal (bu/A):	150	200	150	200
	----- lb N/A -----			
IL	180	240	140	200
MI/IN/OH	177	245	147	215
MN	160	200	120	160
IA	150-200		100-150	
WI	160		120	

Soil with 3.1% OM, considered high yield potential

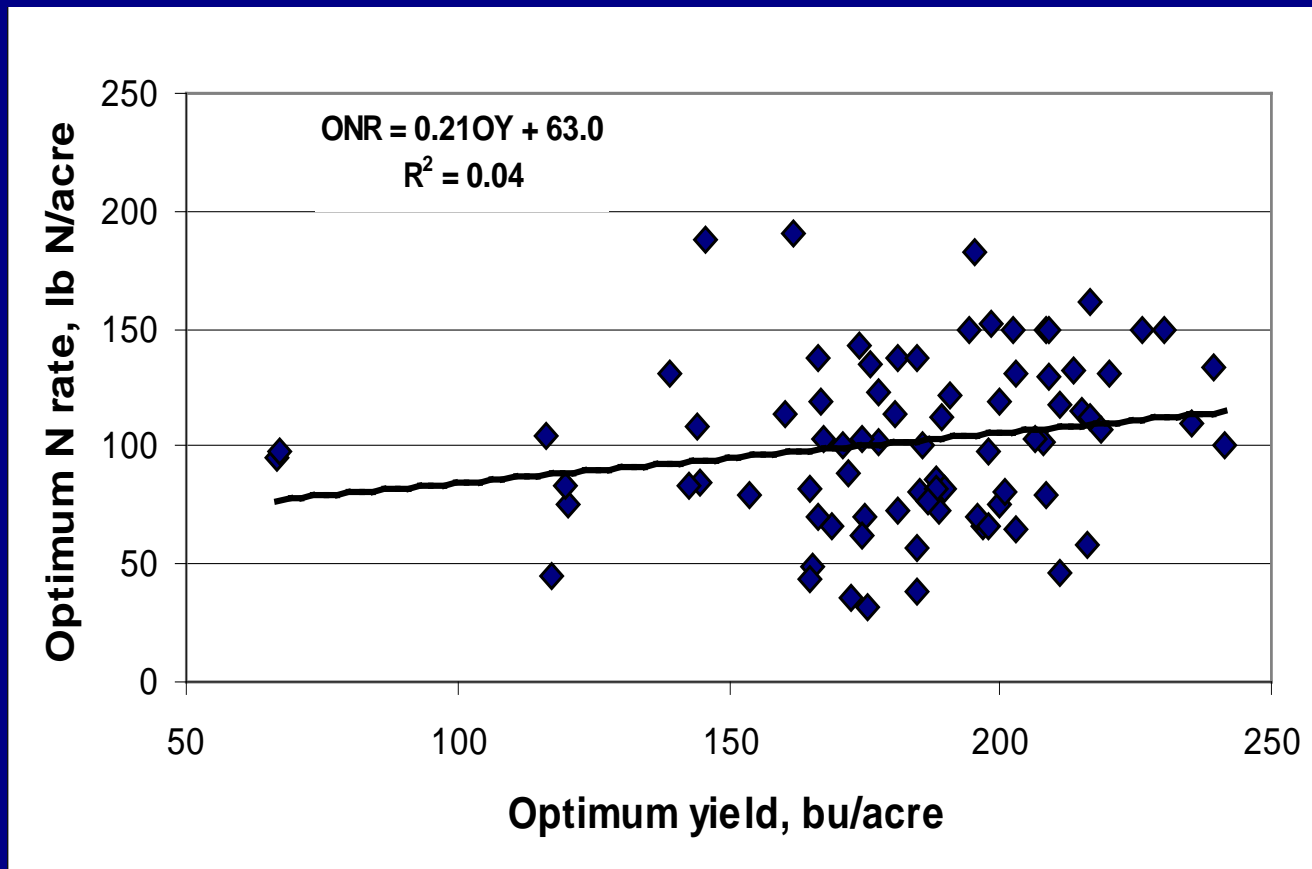
Are Yield Goal Based N Recommendations Valid ?

- If so, there will be a relationship between economic optimum N rate (EONR) and yield obtained at EONR

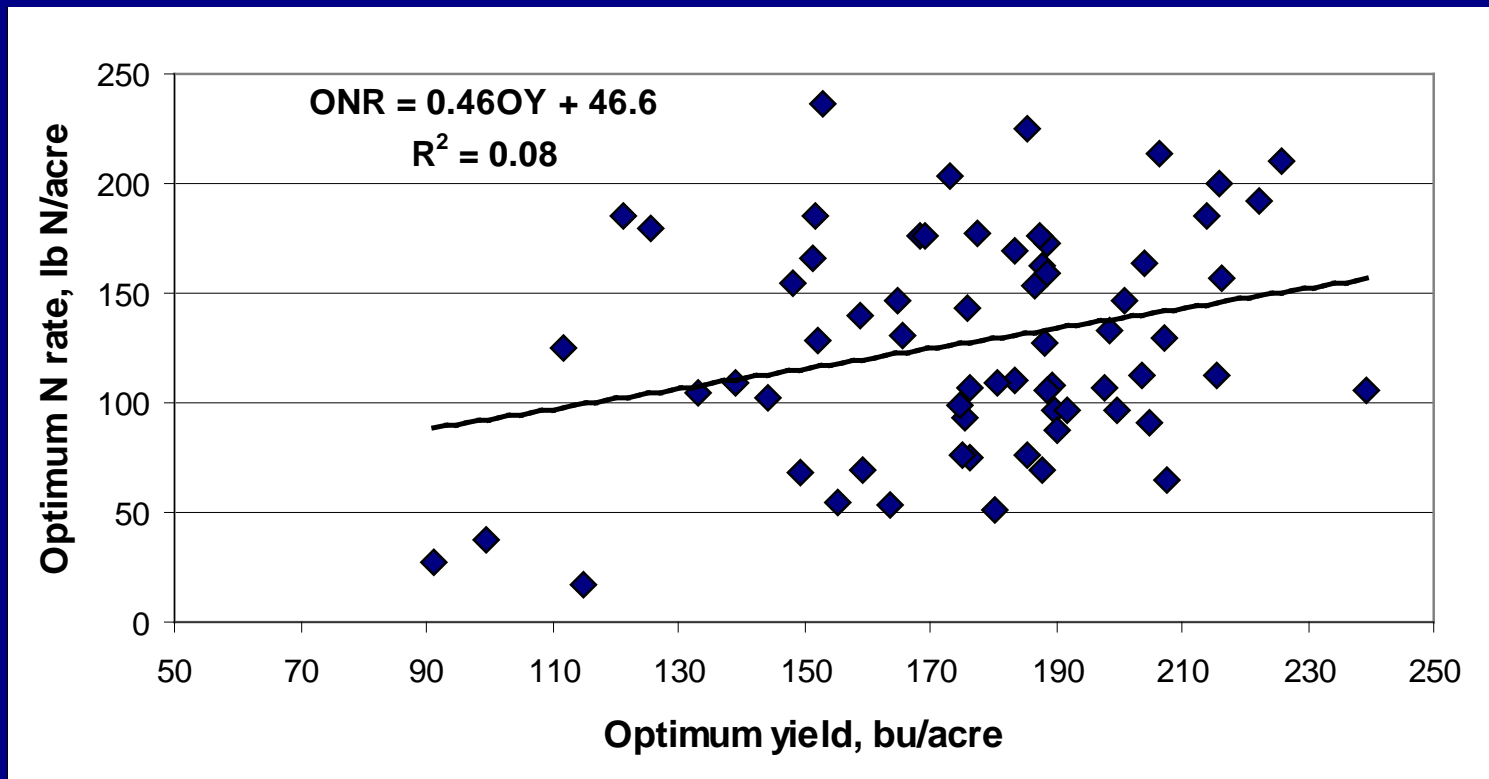
Relationship between optimum N rate and corn yield (101 WI sites; 1989-1999)



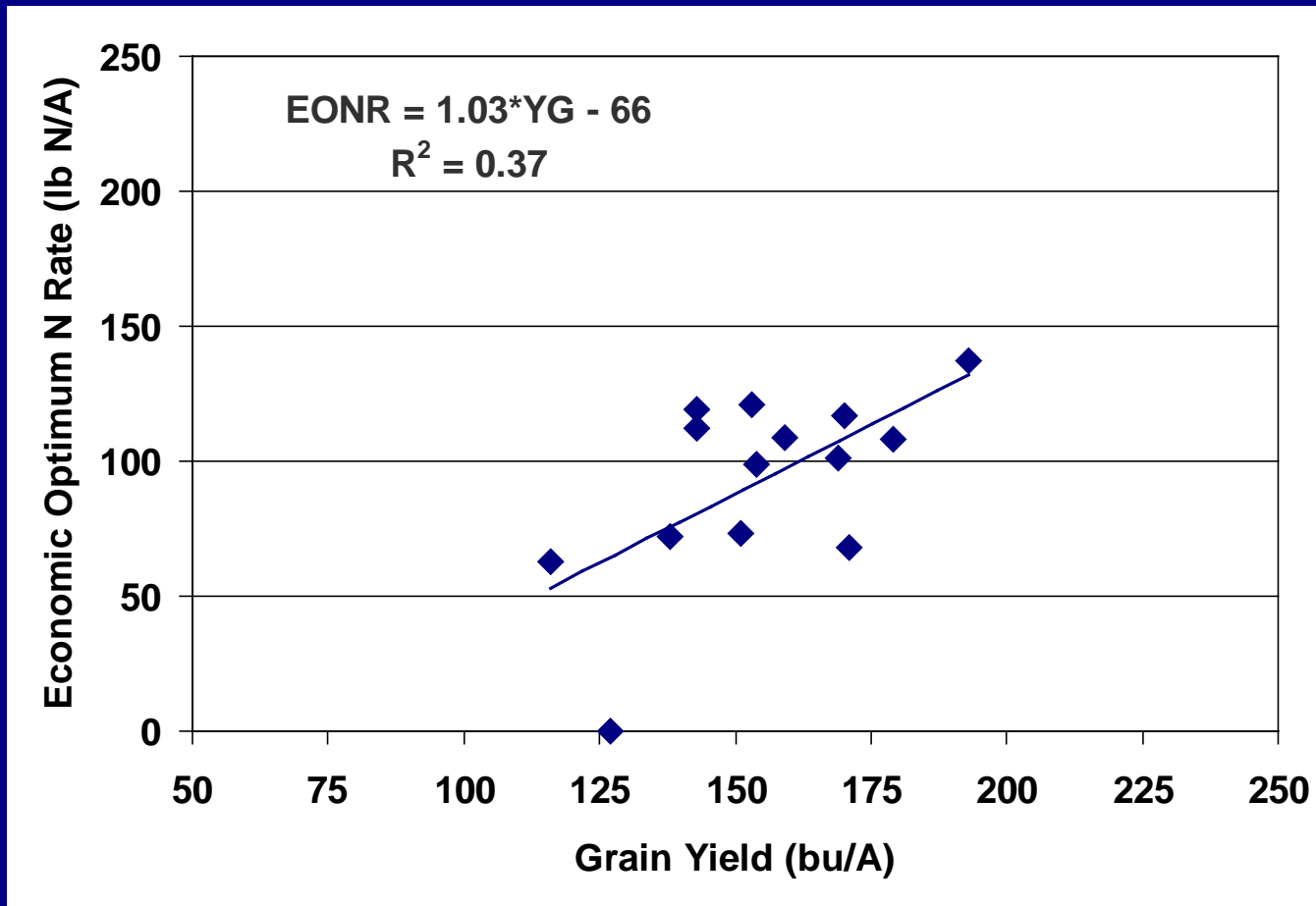
Relationship between optimum N rate and yield in IA (81 site years; pc = soybean)



Relationship between optimum N rate and yield in IL (72 site years; pc = soybean)



Relationship between optimum N rate and yield in MI (14 site years; 2002-2003)



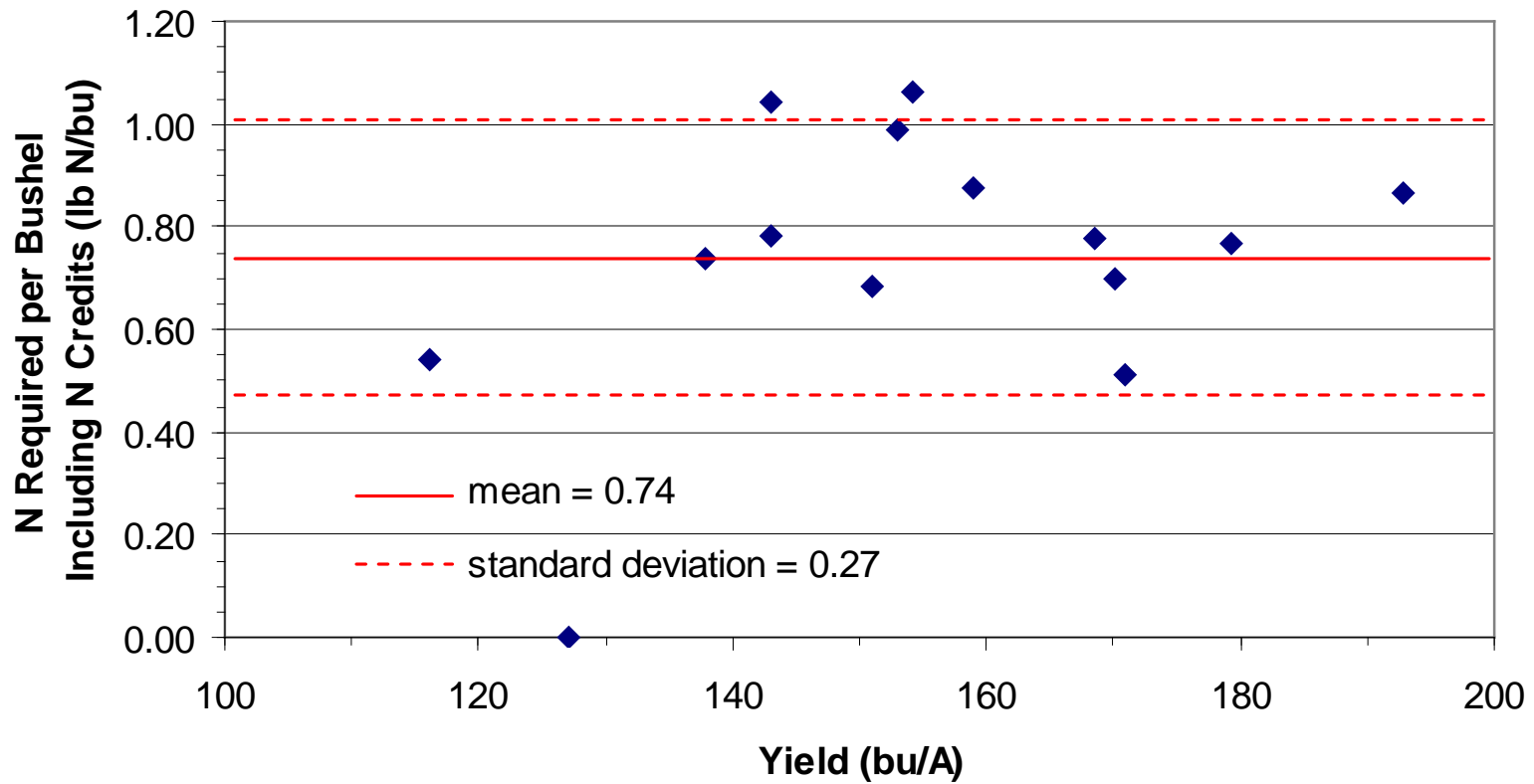
Relationship between optimum N rate and yield in MN

- Data across southern and south east MN show a poor/no relationship between yield and economic optimum N rate

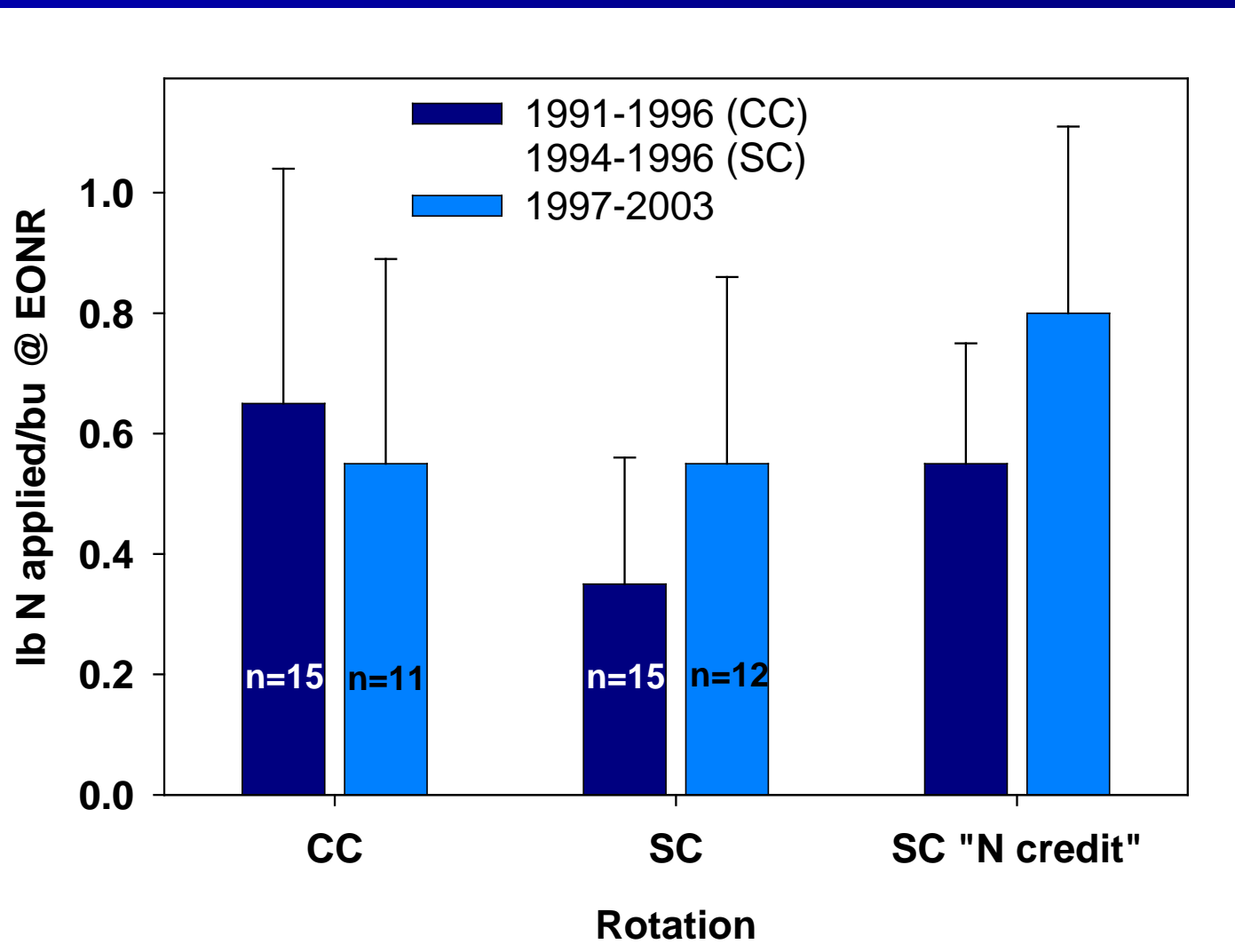
Are Yield Goal Based N Recommendations Valid ?

- If so, there will be a relationship between economic optimum N rate (EONR) and yield obtained at EONR
 - Relationship is poor
- If so, the pounds of N required per bushel would be relatively stable over time/ across sites

N required per bushel in MI (2002-2003)



N required per bushel in WI with and without 40 lb N credit added to EONR



Are Yield Goal Based N Recommendations Valid ?

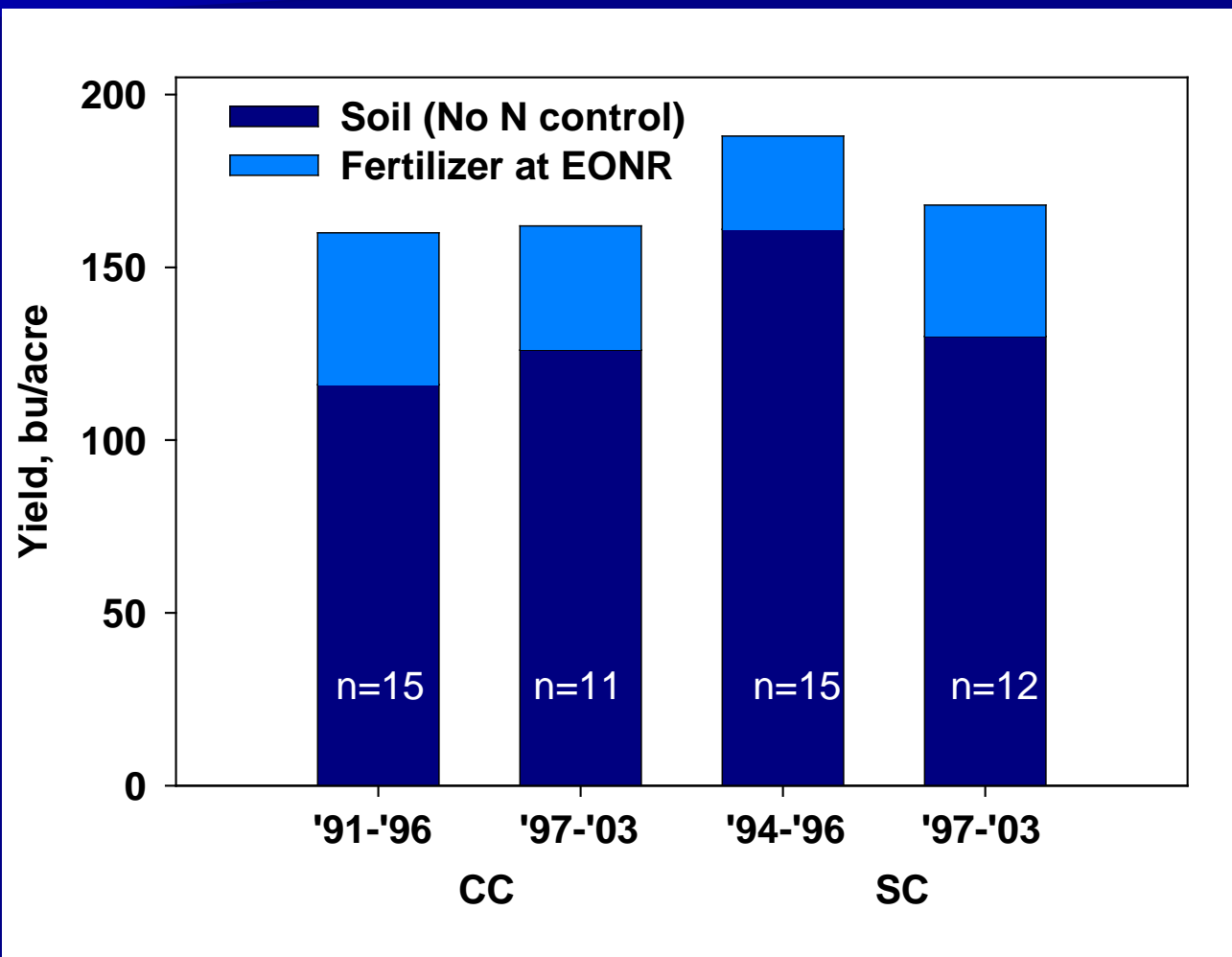
- If so, there will be a relationship between economic optimum N rate (EONR) and yield obtained at EONR
 - Relationship is poor
- If so, the pounds of N required per bushel would be relatively stable over time/across sites
 - N required per bushel is:
 - Highly variable
 - Much less than 1.2

Let's look at factors in Wisconsin's N recommendations

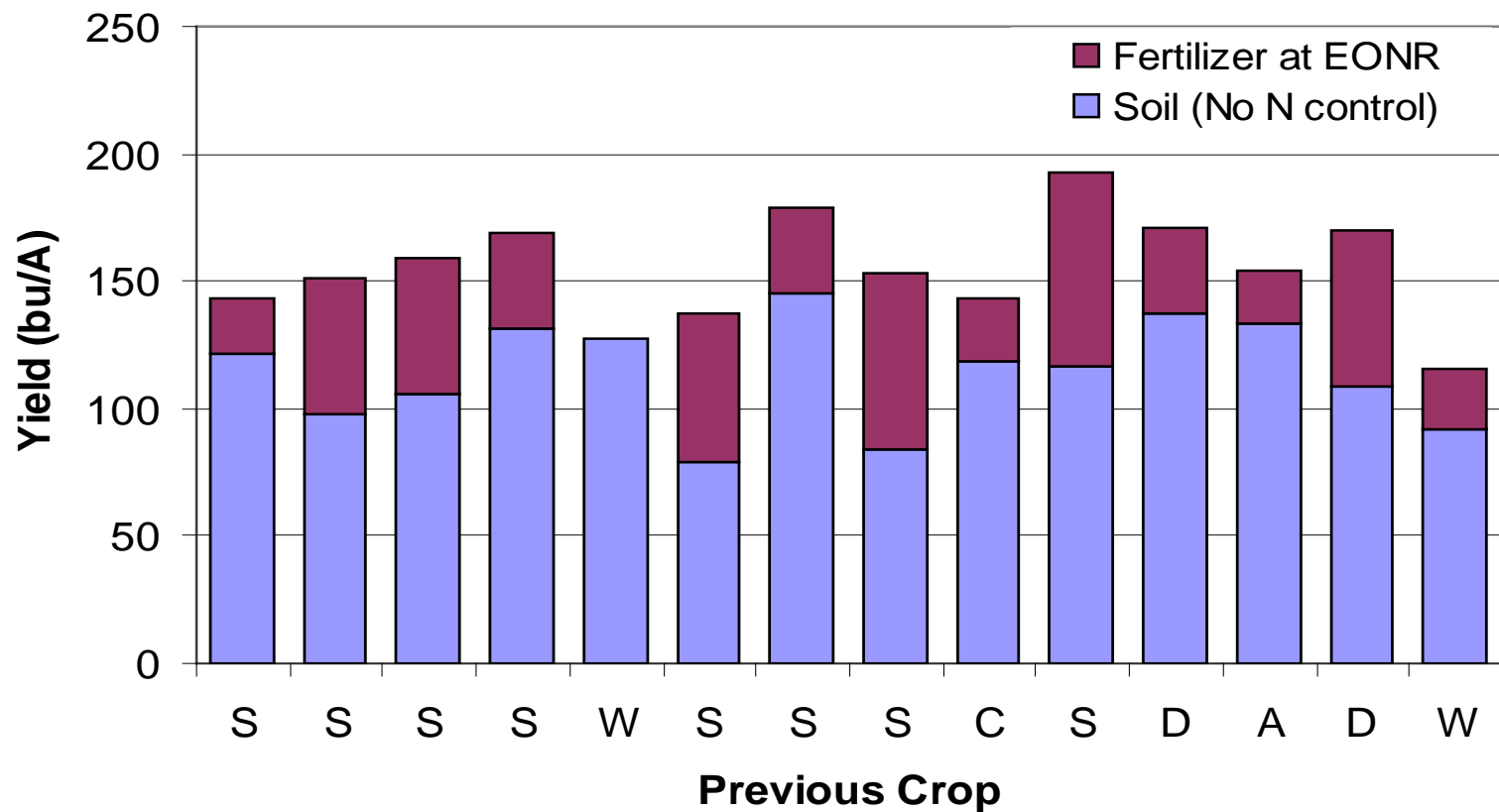
- Yield potential
 - Based on:
 - Drainage
 - Depth of root zone
 - Water holding capacity
 - Length of growing season
- Soil organic matter

How much N does soil supply?

Contribution of soil N and fertilizer N to yield in WI



Contribution of soil N and fertilizer N to yield in MI (2002-2003)

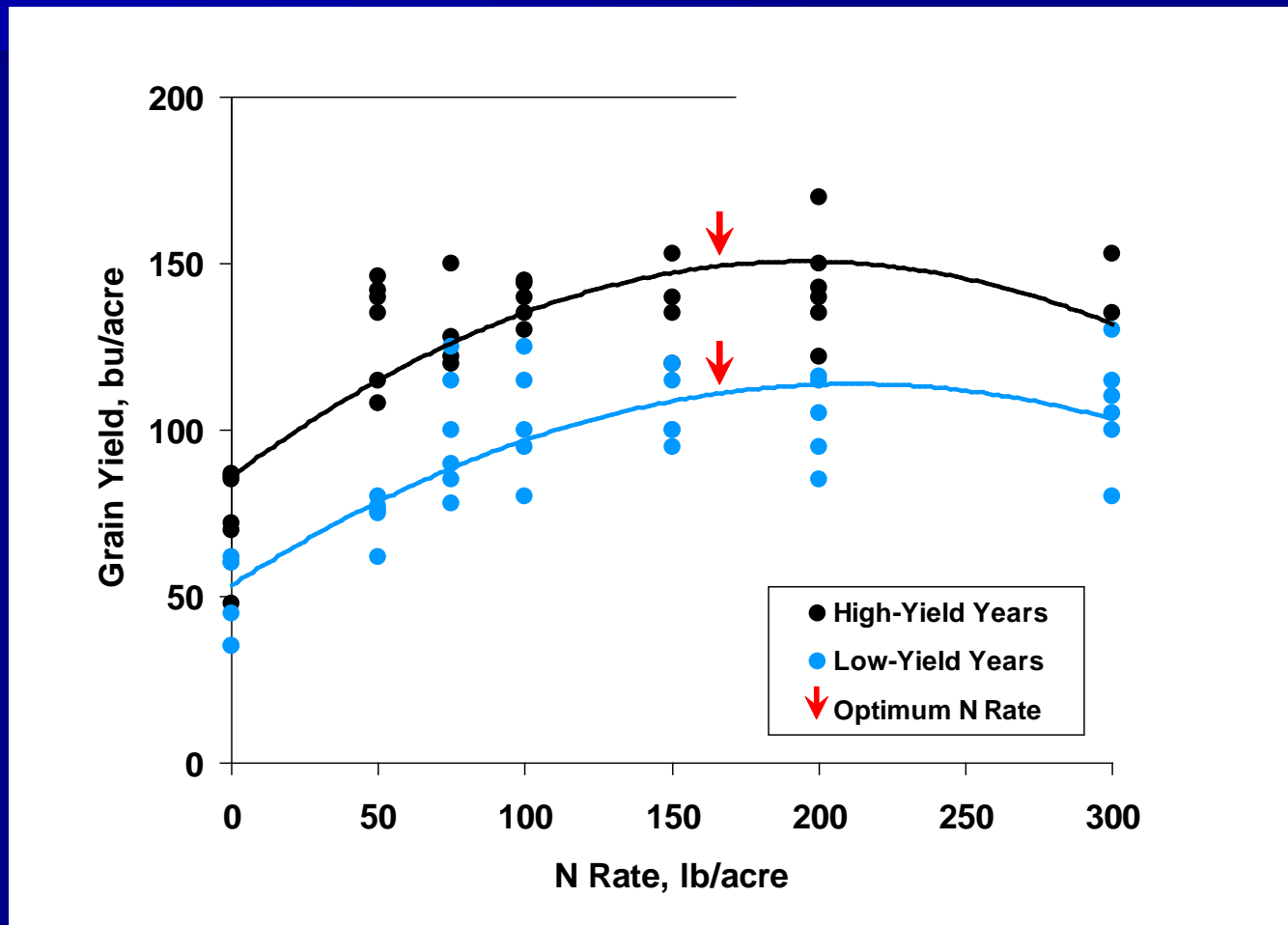


How much N does soil supply?

- A majority of N needed is supplied by the soil
 - WI: Soil N contributed 79% of total yield
 - 53 sites, 1991-2003, v. high/high YP sites
 - PC = corn and soybean
 - MI: Soil N contributed 74% of total yield
 - 14 sites, 2002-2003
 - PC = corn, wheat, soybean, dry bean, alfalfa
 - Varies with temperature and moisture
 - Acts as a buffer for climate variability

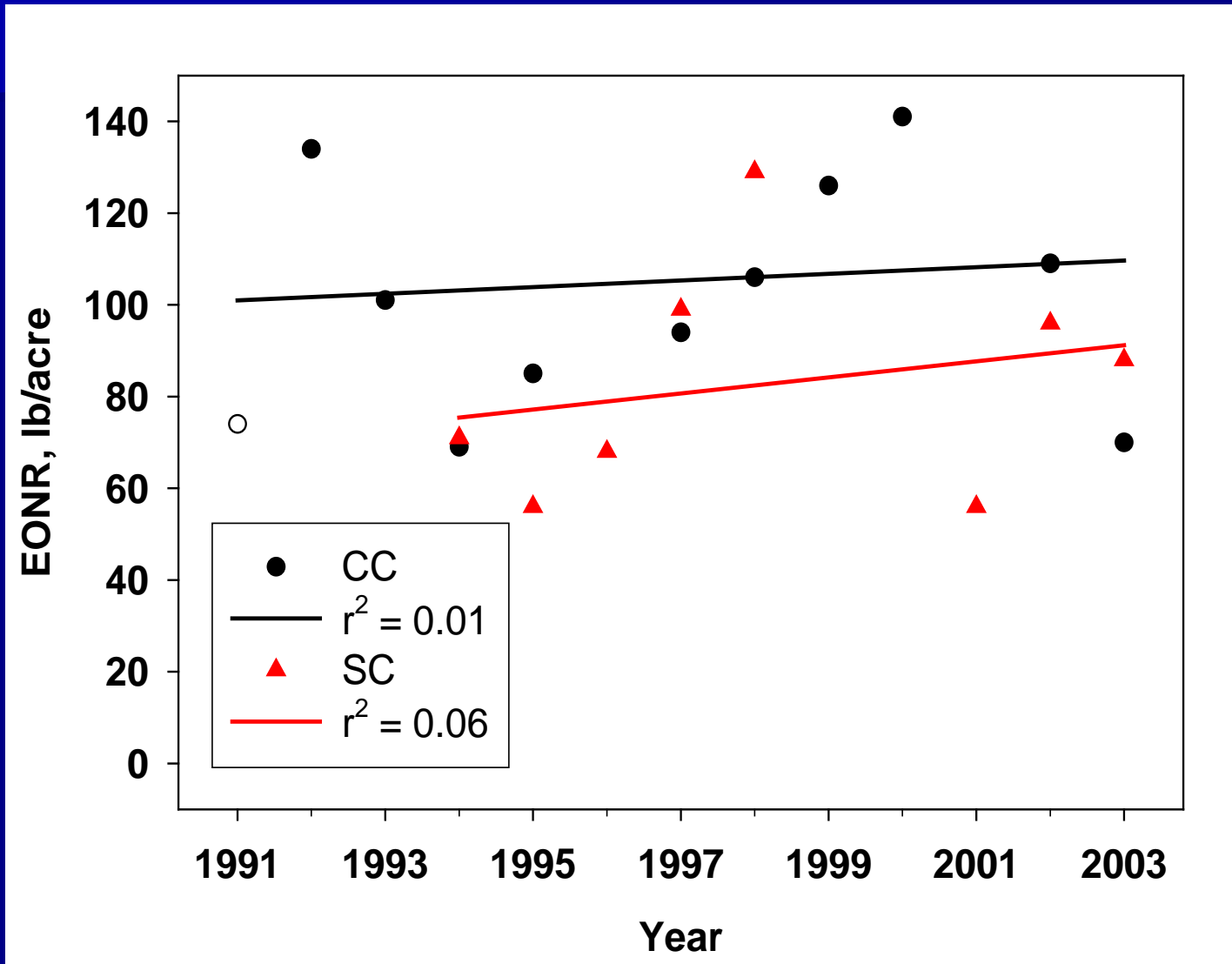
Stability of EONR over time

Optimum N rates for corn in high- & low-yielding years (1967-90), Lancaster, WI

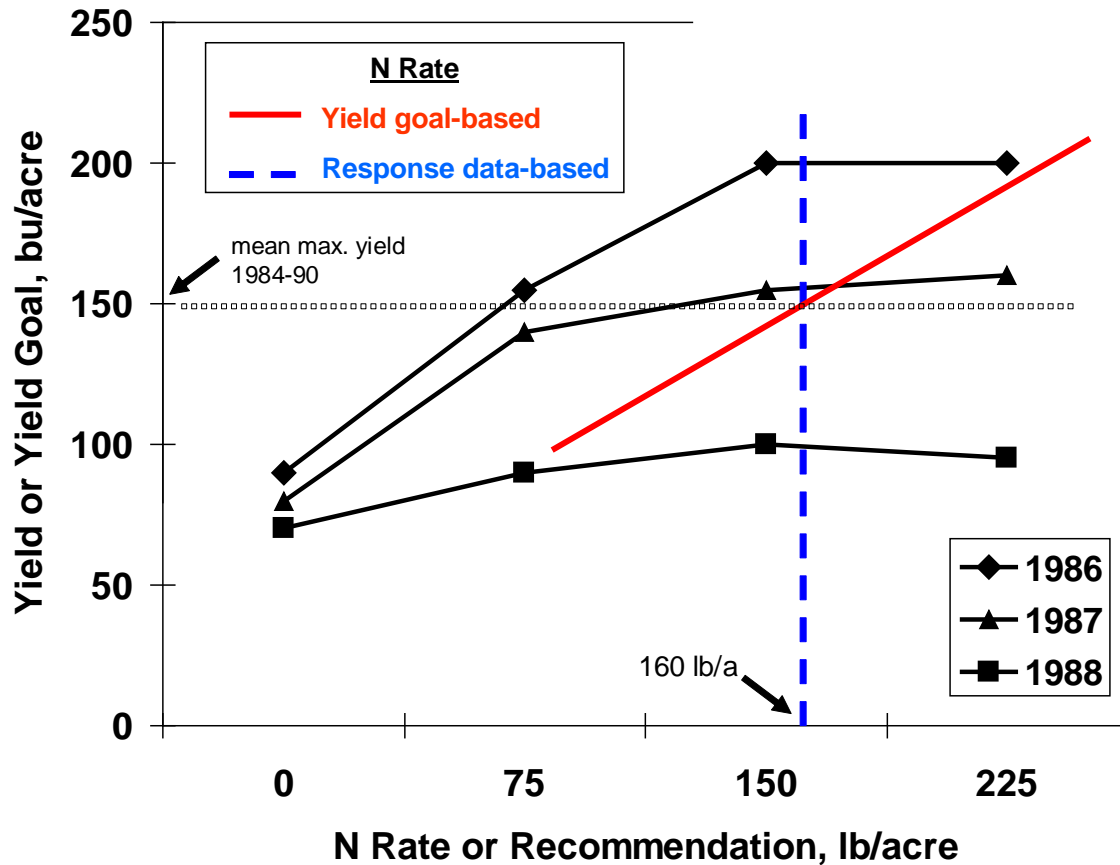


Economic optimum N rates calculated at corn:N price ratio of 13.3:1 (eg. \$2.00:\$0.15)

Annual average EONR for corn in WI



Comparison of corn yield response to N recommendations based on yield goal and soil-specific N response approaches, Arlington, WI



Profitability of Wisconsin's N recommendation system

Net economic return from fertilizer N for corn production on several WI soils

Soil	N rate lb/acre	Yield increase from fertilizer N bu/acre	Net economic return from fertilizer**			
			Corn:N price ratios			
			8.33:1	10.0:1	13.3:1	16.7:1
			----- \$/acre -----			
Plano	130	31.4	14.75	22.60	38.30	54.00
	160*	34.7	14.38	23.05	40.40	57.75
	190	36.5	12.13	21.25	39.50	57.75
Withee	90	24.3	11.88	17.95	30.10	42.25
	120*	27.5	11.38	18.25	32.00	45.75
	150	28.2	7.75	14.80	28.90	43.00
Meridian	90	21.7	8.63	14.05	24.90	35.75
	120*	25.2	8.50	14.80	27.40	40.00
	150	26.7	5.88	12.55	25.90	39.25
Plainfield	170	101.8	96.75	122.20	173.10	224.00
	200*	106.9	98.63	125.35	178.80	232.25
	230	108.1	95.63	122.65	176.70	230.75

* Recommended N rate prior to taking legume/manure N credits

** Value of yield increase due to N - cost of N - cost of application (\$5/acre). All calculations were based on \$0.15/lb N and \$1.25, \$1.50, \$2.00, and \$2.50 per bushel corn for 8.33:1, 10:1, 13.3:1, and 16.7:1 ratios, respectively.

Conclusions

- There is no relationship between yield goal and optimum N rate
 - Even in states that use yield goal to make N recommendations
 - Yield goal based recommendations do not follow curves of corn yield response to N
 - Results in over or under application of N at high and low yield goals, respectively
- Wisconsin's current method of N recommendations allows for profitability as well as environmental protection

So what's next?

- Regional N rate recommendations
- Discussions between WI, MN, IA, IL, IN, OH, MI
 - Pooling data sets to evaluate yield response over range of soils and climates
 - May evaluate probability of N sufficiency for given N rates
 - Producers could determine the level of risk with which they are comfortable and economic outlook