BALANCING FERTILIZER AND ORGANIC N SOURCES FOR AGRONOMIC AND ENVIRONMENTAL BENEFITS

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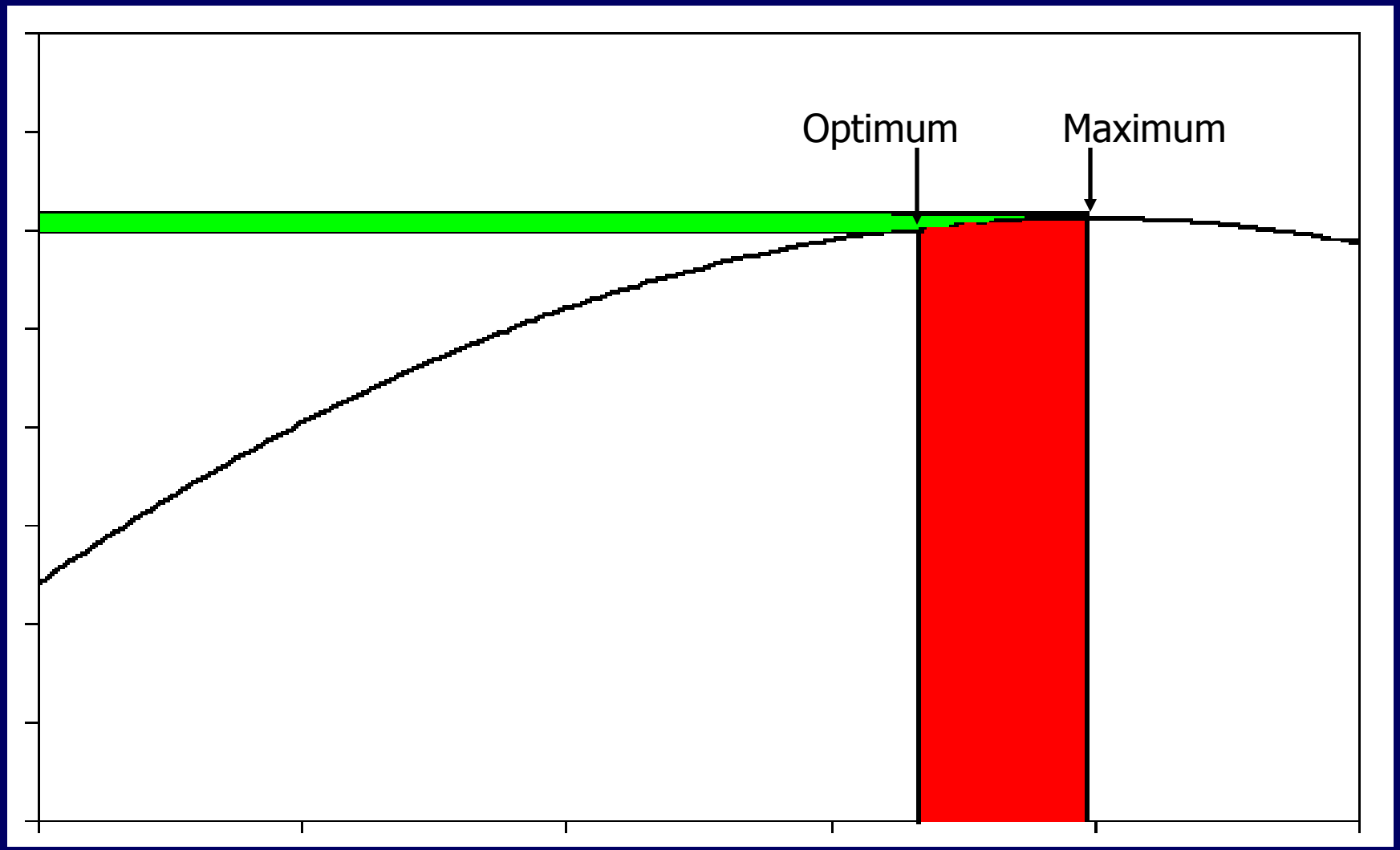
CURRENT RECOMMENDATIONS

- Rates
- Timing
- Nitrogen Credits
- Nitrate Testing

N RATE

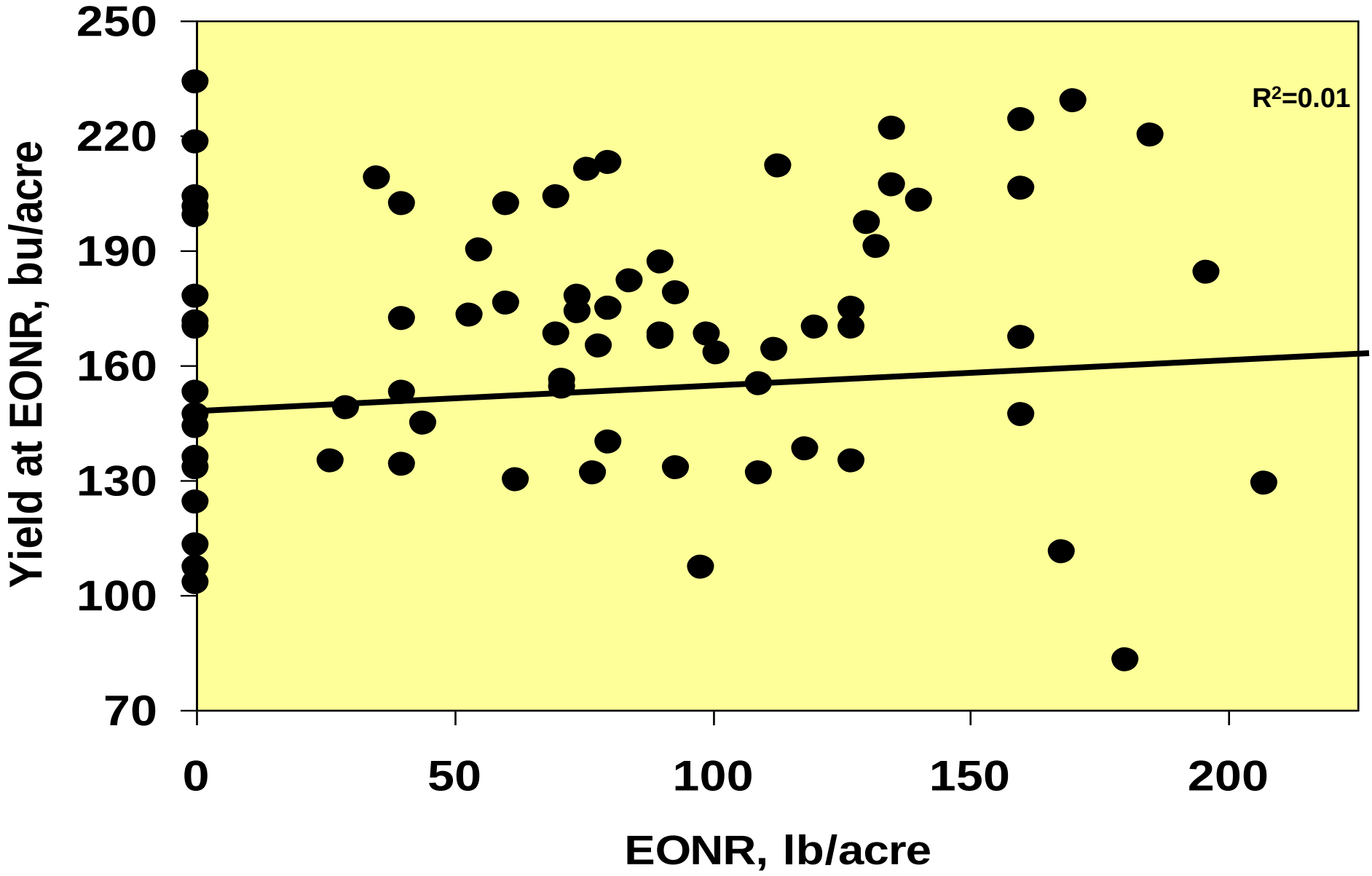
- The most important factor for:
  - Agronomic N Efficiency
  - Potential for N Loss to Environment

Maximum and optimum levels for yield response to applied N



Optimum N Rate for Corn

- Soil-specific characteristic
- Not affected by annual variations in yield
- Year-specific adjustments for soil nitrate and organic N inputs needed

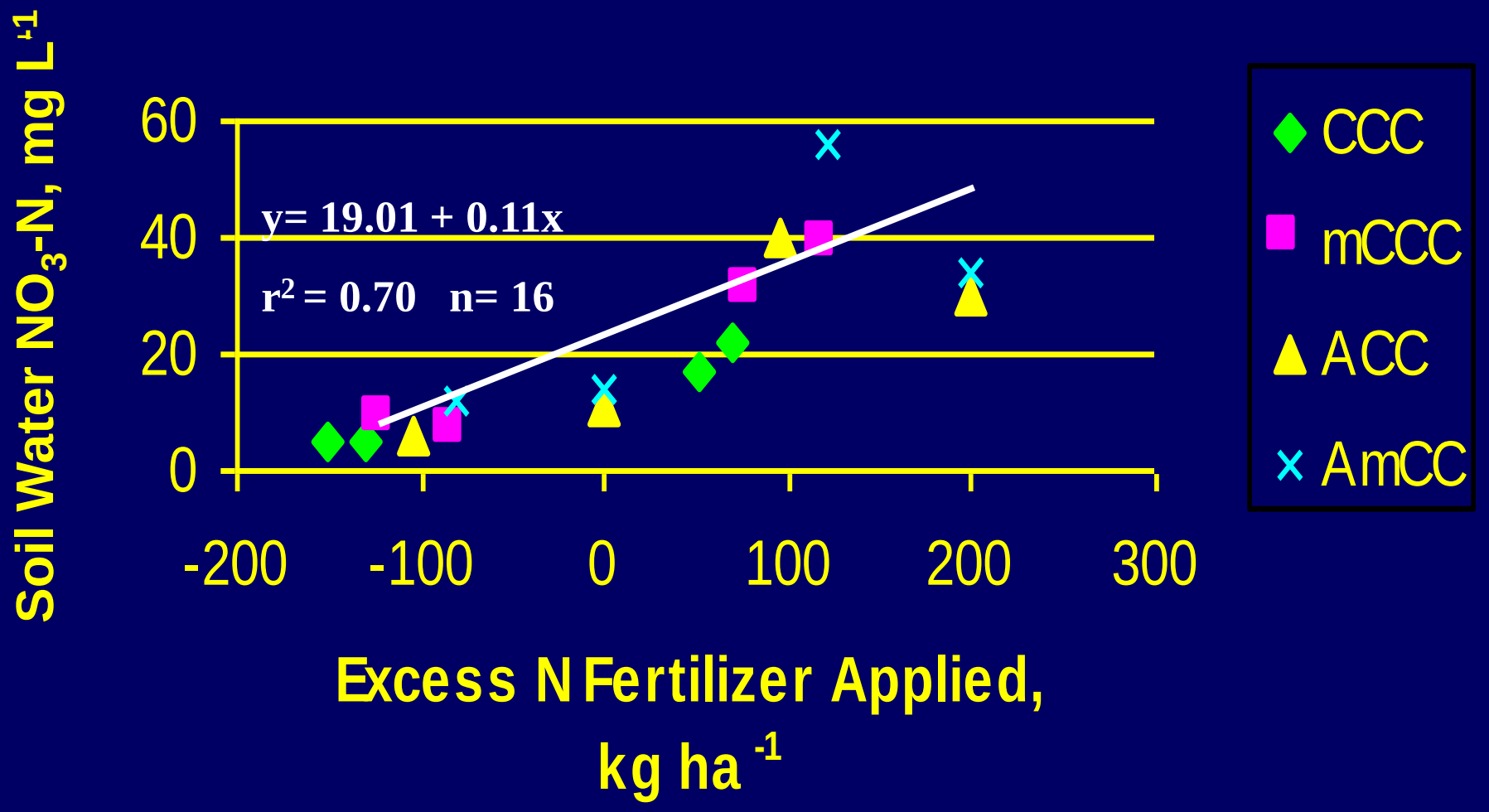


Relationship between economic optimum N rate (EONR) and corn yield at EONR For 77 HYPS, 1992-2003.

Nitrogen Recommendations for Corn

	Sands & loamy sand		Other soils	
			Yield Potential	
Organic matter	Irrigated	Non-irrigated	Med/low	Very high/ high
---%---	----------lb N/acre----------			
<2	200	120	150	180
2-9.9	160	110	120	160
10-20	120	100	90	120
>20	80	80	80	80

Relationship between Excess N applied and soil water nitrate N.



Recommended Timing of Nitrogen Applications for Corn

Soil	Fall	Preplant	Sidedress
Medium/Fine Texture Well-Drained	OK*	Optimum	OK
Medium/Fine Texture Poorly Drained	No	OK	Optimum
Coarse texture	No	No	Optimum

*Includes use of BMPs for fall-applied N.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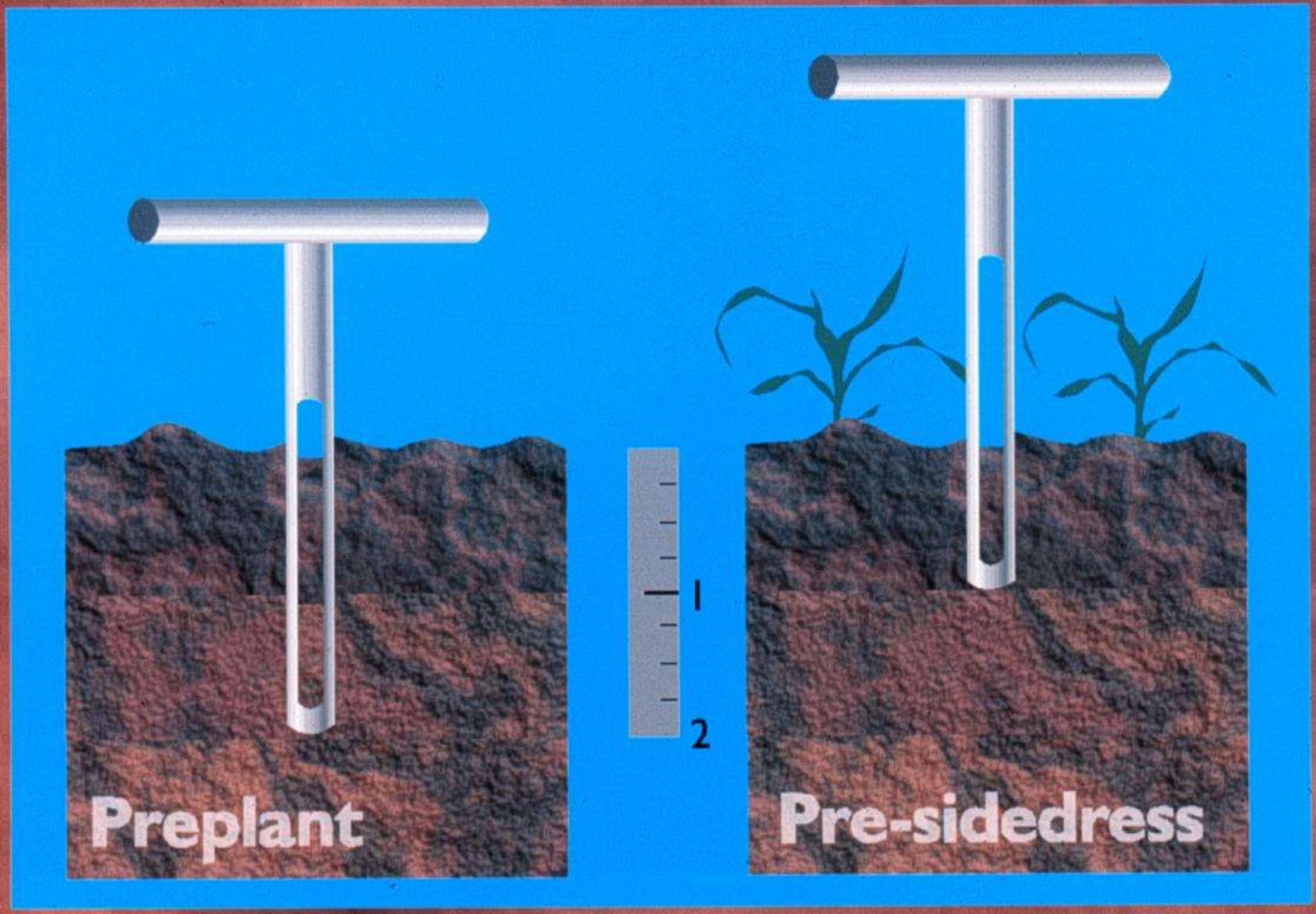
Nitrogen Credits for Alfalfa

Stand density	Sandy soils		Other soils	
	Regrowth			
	≤8”	>8”	≤8”	>8”
	lb N/a			
Good *(70-100%, >4 plants/sq ft)*	100	140	150	190
Fair *(30-69%, 1.5-4 plants/sq ft)*	70	110	120	160
Poor *(0-29%, <1.5 plants/sq ft)*	40	80	90	130

Nitrogen Credits for Manure

Solid Manure

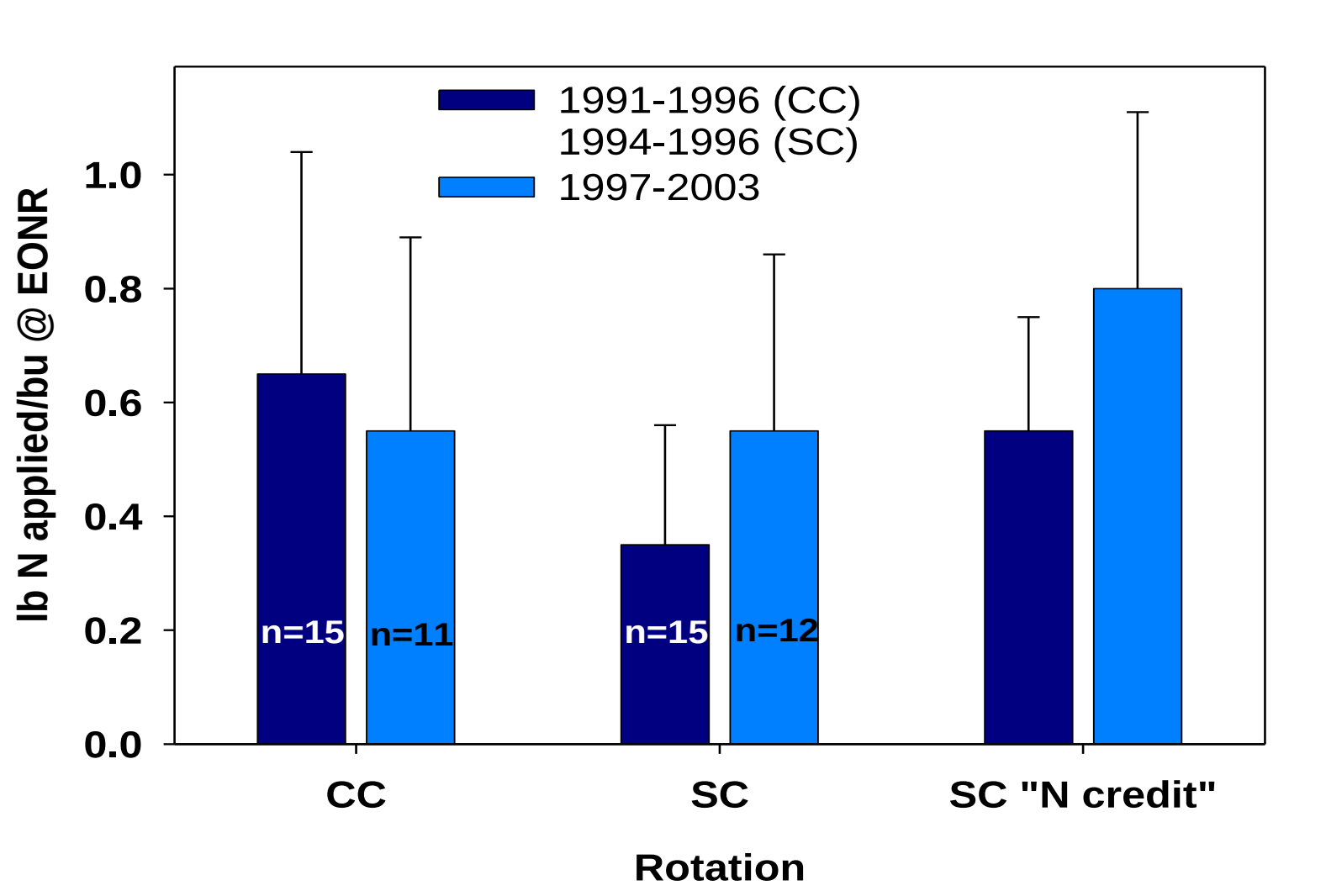
	Surface Applied	Incorporated
	---------- (lb N / ton)	----------
Dairy	3	4
Beef	4	4
Swine	4	5


Preplant
1
2
Pre-sidedress

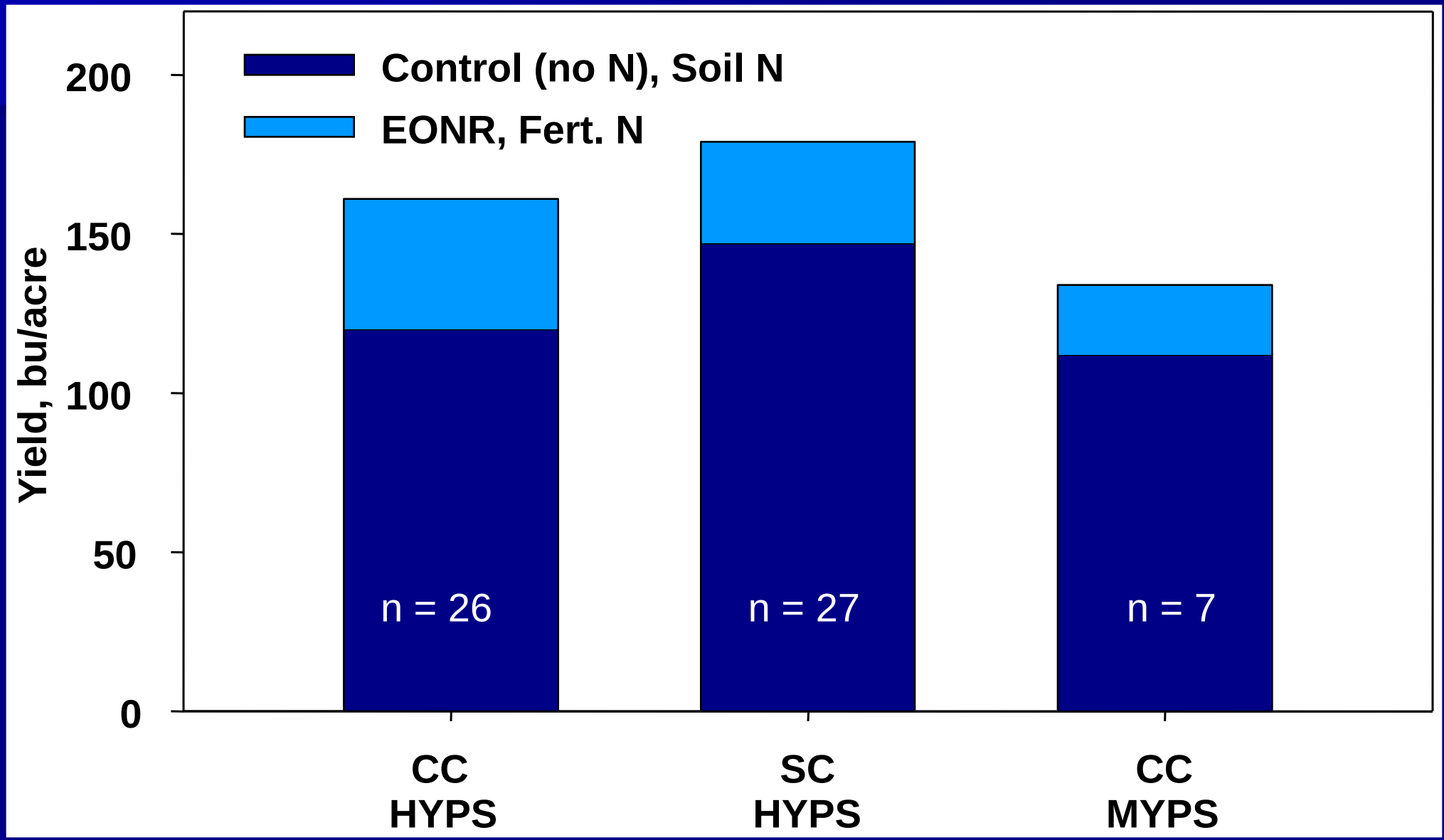
ATTAINABLE EFFICIENCIES

- Corn nitrogen requirements
- Soil nitrogen contribution
- Nitrate leaching losses
- Crop nitrogen recovery

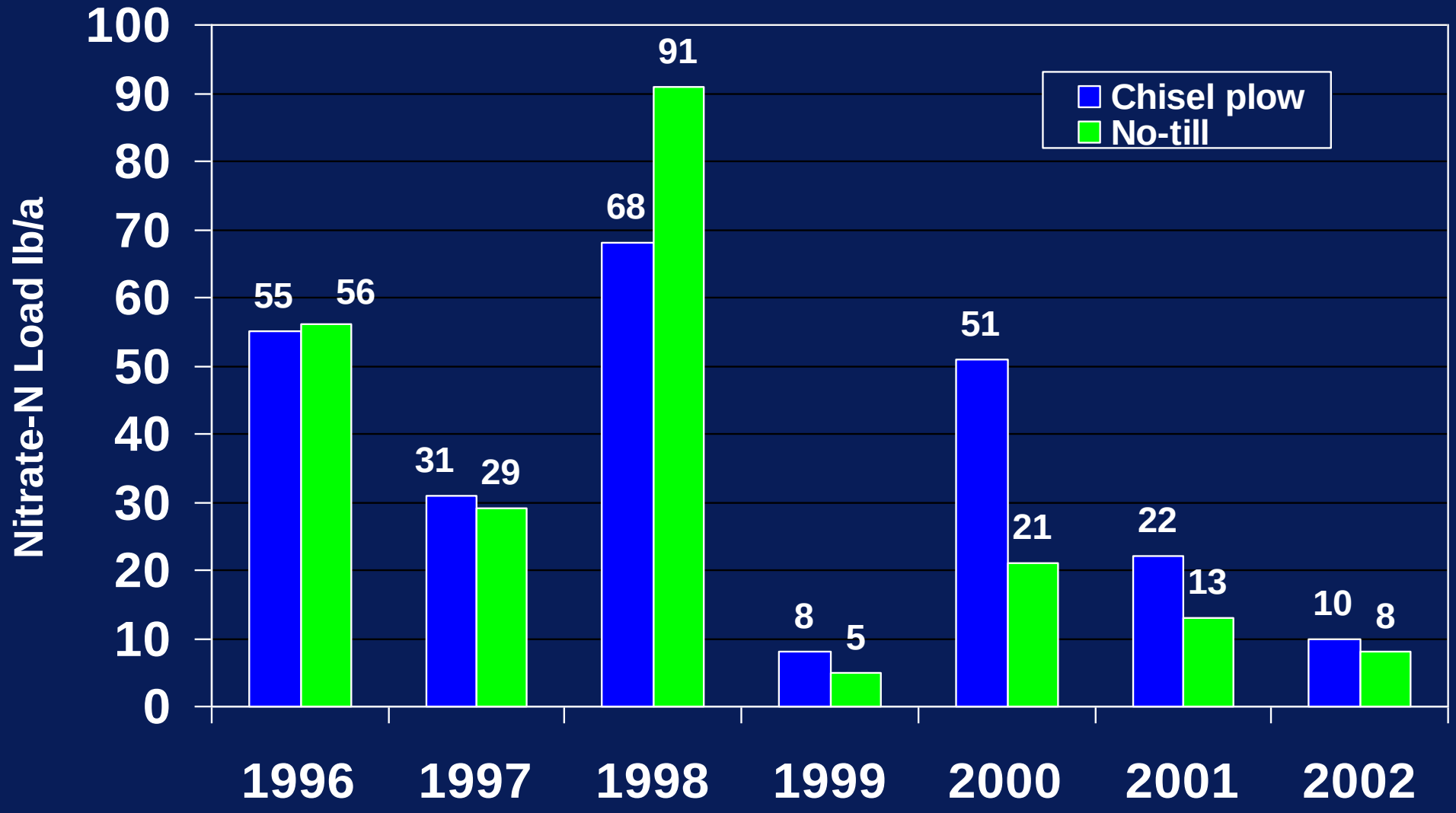
N required per bushel in WI with and without 40 lb N credit added to EONR



Soil N and fertilizer N contributions to corn yield following corn and soybean for high and medium yield potential soils, 1991-2003.



Annual nitrate-N leached from corn fertilized with 160 lb N/a, 1996-2002

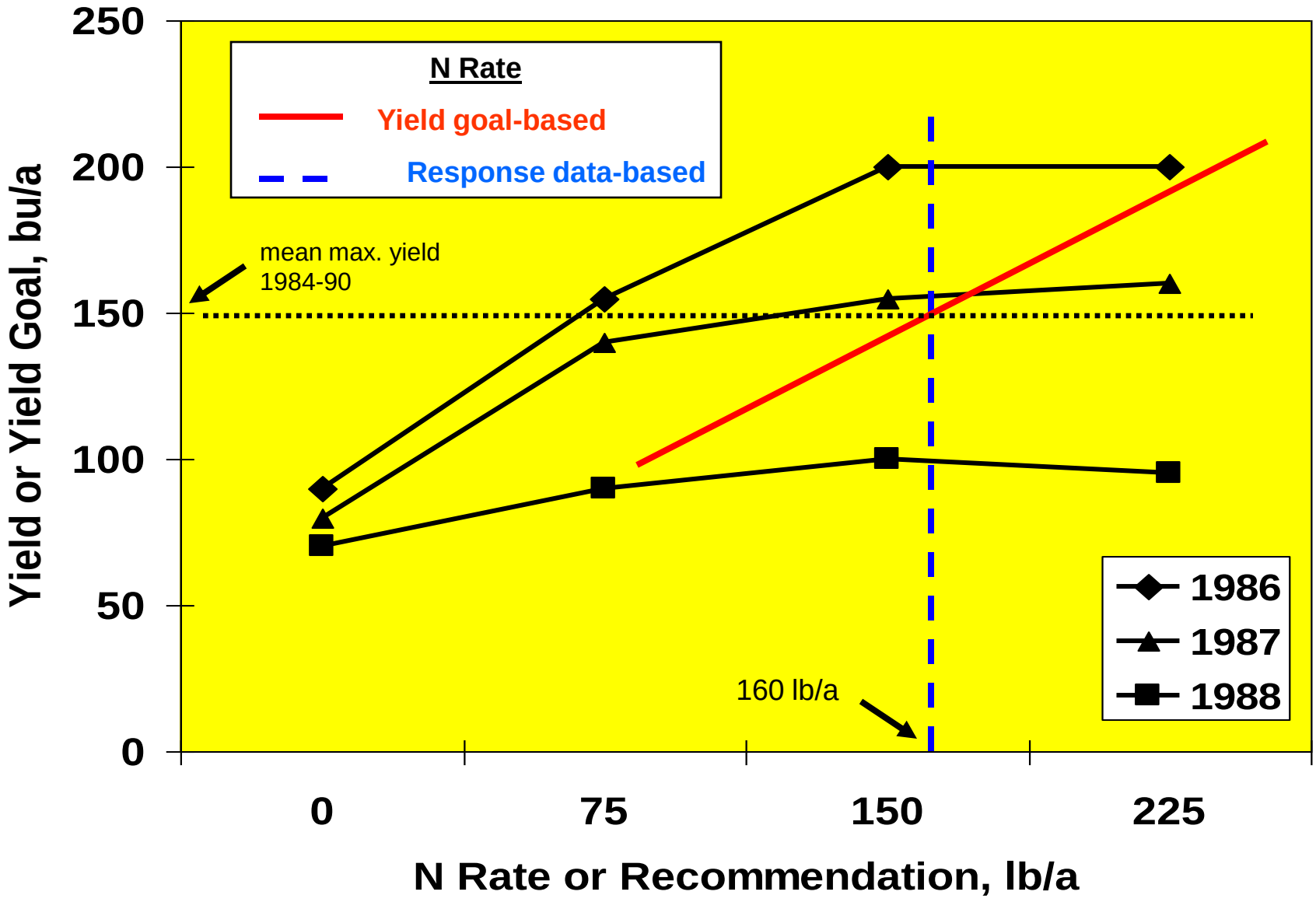


Annual nitrate-N leaching in three studies using different methods of measurement

Source [1/]	Method	Nitrate-N leached, lb/a
Norman et al. (2003)	Lysimeters (ETL)	5-91
Randall & Iragavarapu (1995)	Tile drains	23-123
Andraski et al. (2000) [2/]	Porous cups & water balance	19-79

[1/] N rates ranged from 160-180 lb N/a.

[2/] 18-mo measurement period (June-Sept.).


N Rate
Yield goal-based
Response data-based
mean max. yield
1984-90
160 lb/a
1986
1987
1988
250
200
150
100
50
0
0
75
150
225
Yield or Yield Goal, bu/a
N Rate or Recommendation, lb/a

Nitrogen uptake and fertilizer N recovery by corn. Arlington, WI.

Year	N rate	N uptake	% recovery
	----lb/a----		
1986	0	91	--
	150	247	100
1987	0	70	--
	150	198	85
1988	0	98	--
	150	129	21

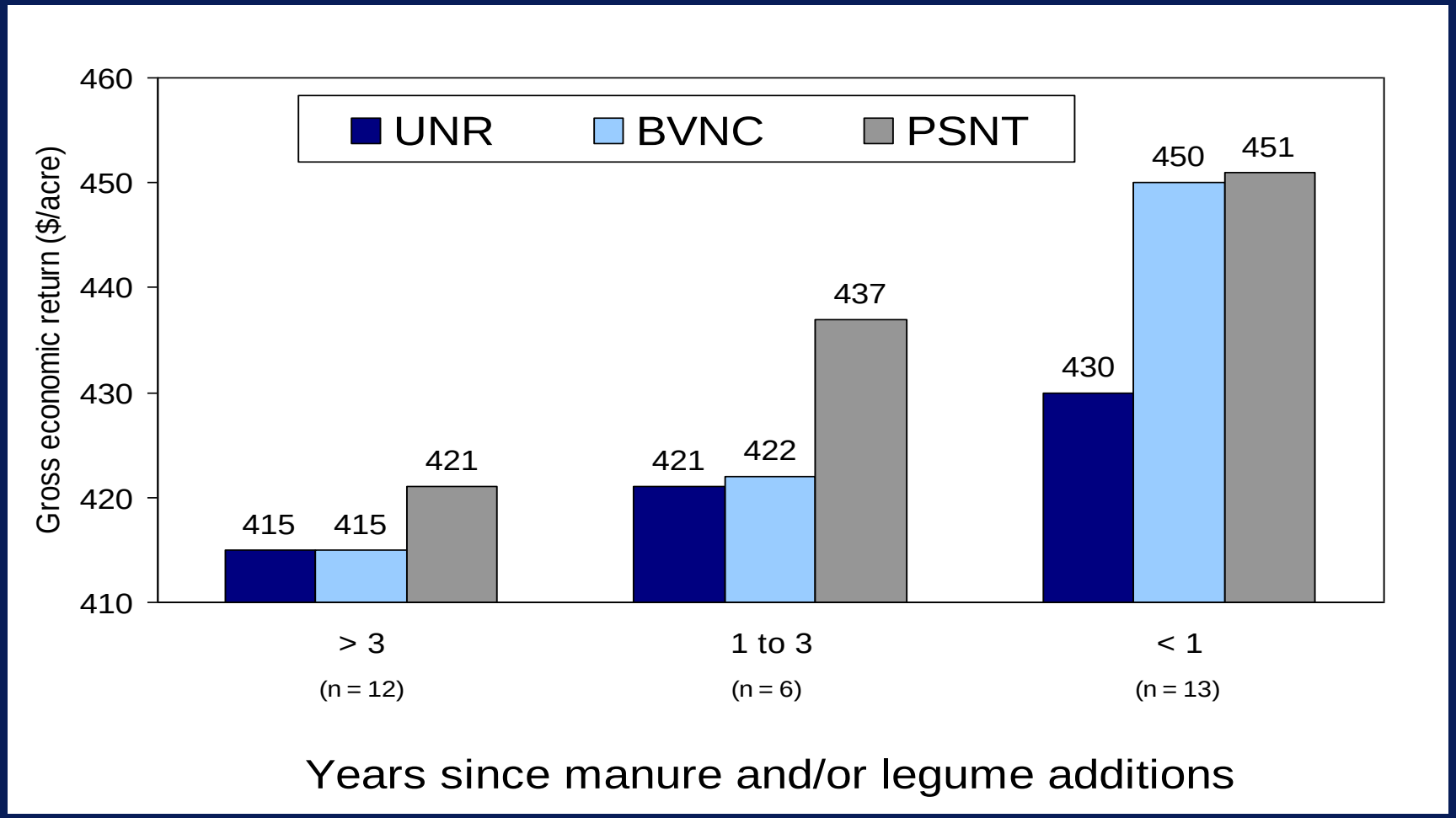
ACTUAL PREVALENT PRACTICES

- Largely unknown, undocumented
- Budgets, surveys, perception indicate excess application
- Progress of nutrient management planning indicates 15-20% of cropland with plans

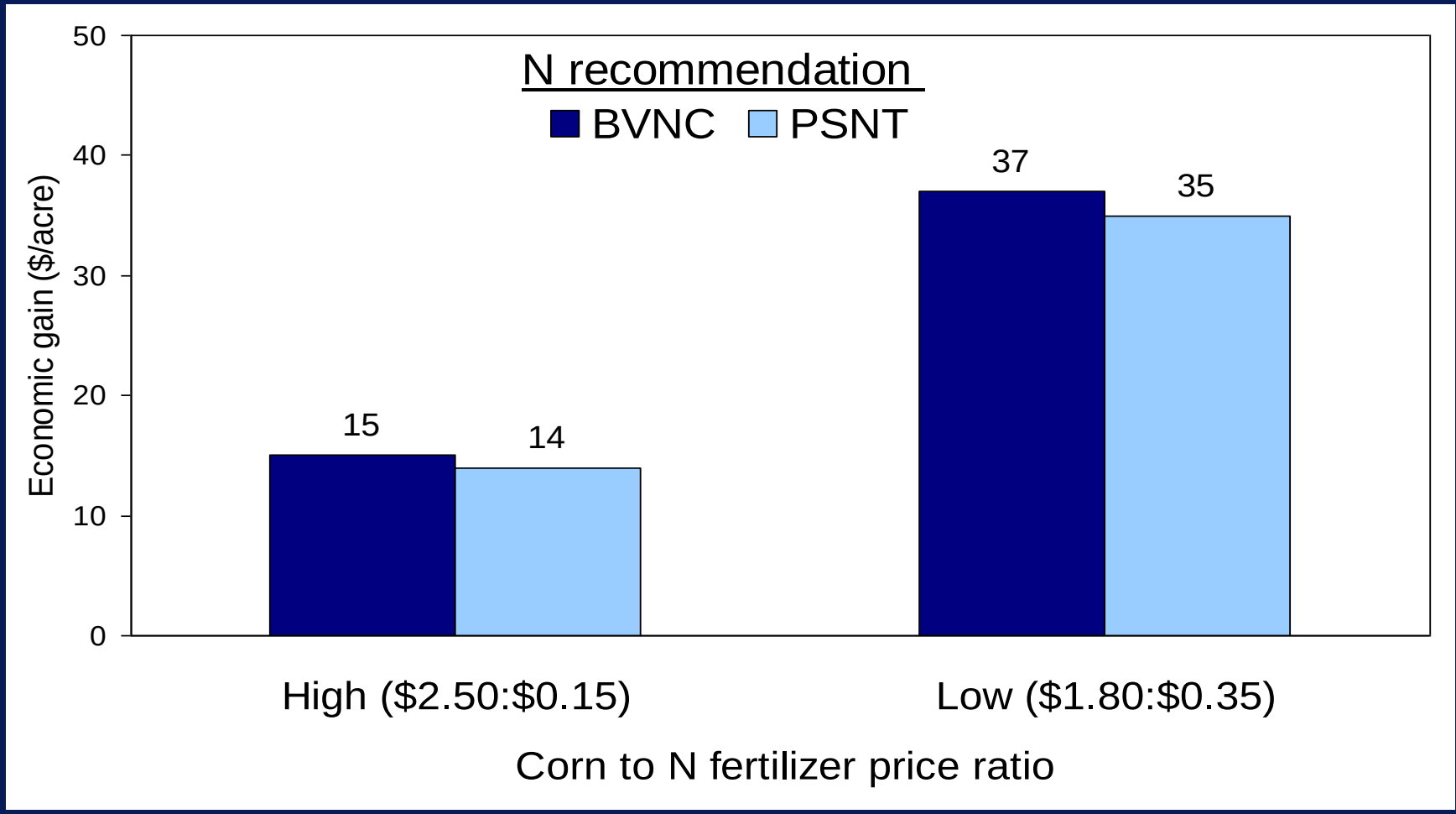
IMPROVING N USE EFFICIENCY

- Implement recommended practices
  - Rates
  - Credits for legumes, manure
- Develop methods to better assess soil nitrogen contribution

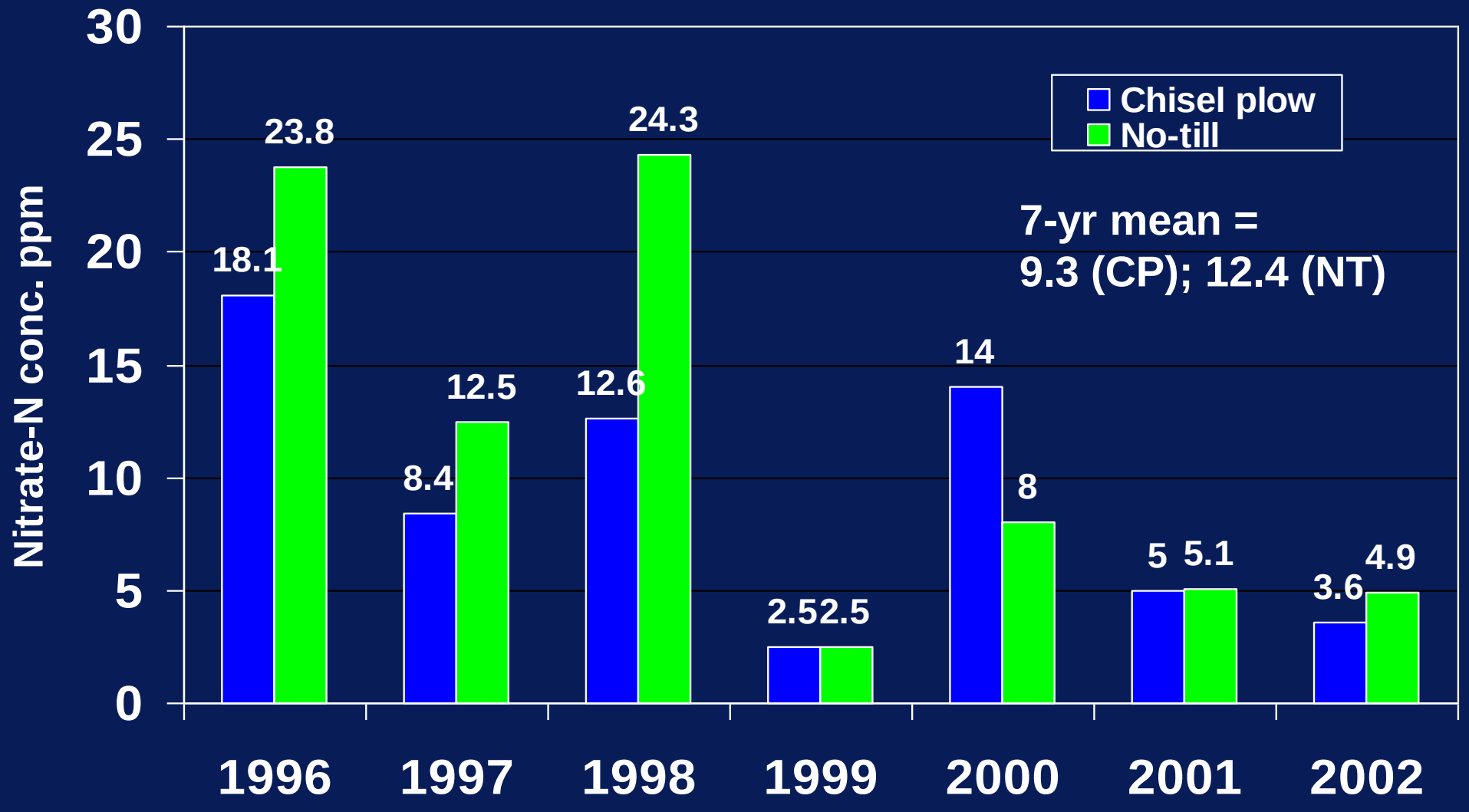
Gross economic return from various nitrogen management practices at 31 Wisconsin locations, 1989 to 1999.



Effect of corn to N price ratio on economic gain from various nitrogen management practices in 50 Wisconsin trials where manure and/or legume additions were made in the study year, 1989-1999.



Mean annual flow weighted nitrate-N concentrations in leachate from corn fertilized with 160 lb N/a, 1996-2002



CHALLENGES TO IMPLEMENTING IMPROVED PRACTICES

- Overcoming persistent, erroneous connection between yield and optimum N rate
- Overcoming perceived financial risk of following recommended practices, particularly N crediting