Impact of Agricultural Practices on Minnesota's Ground Water

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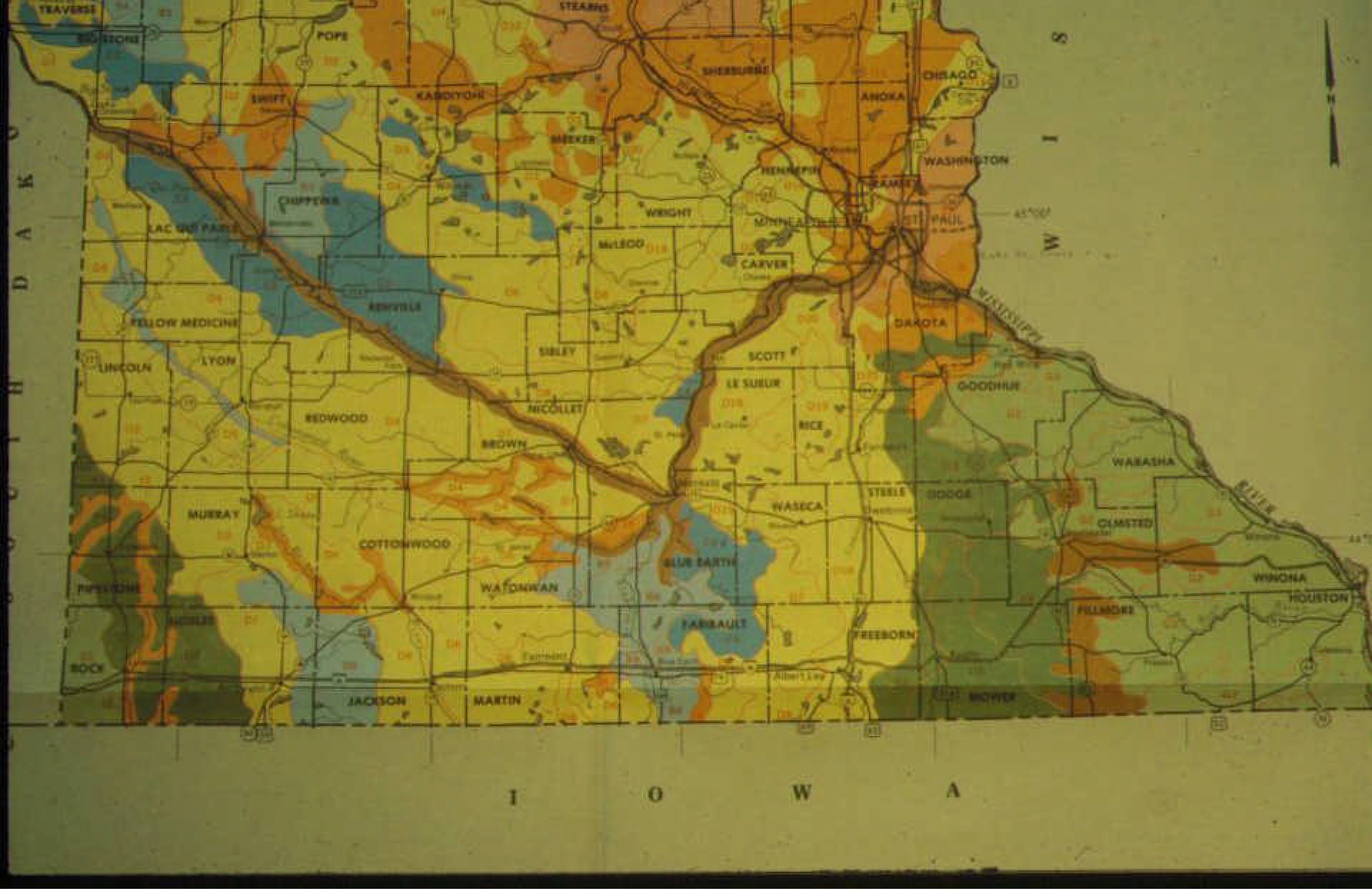
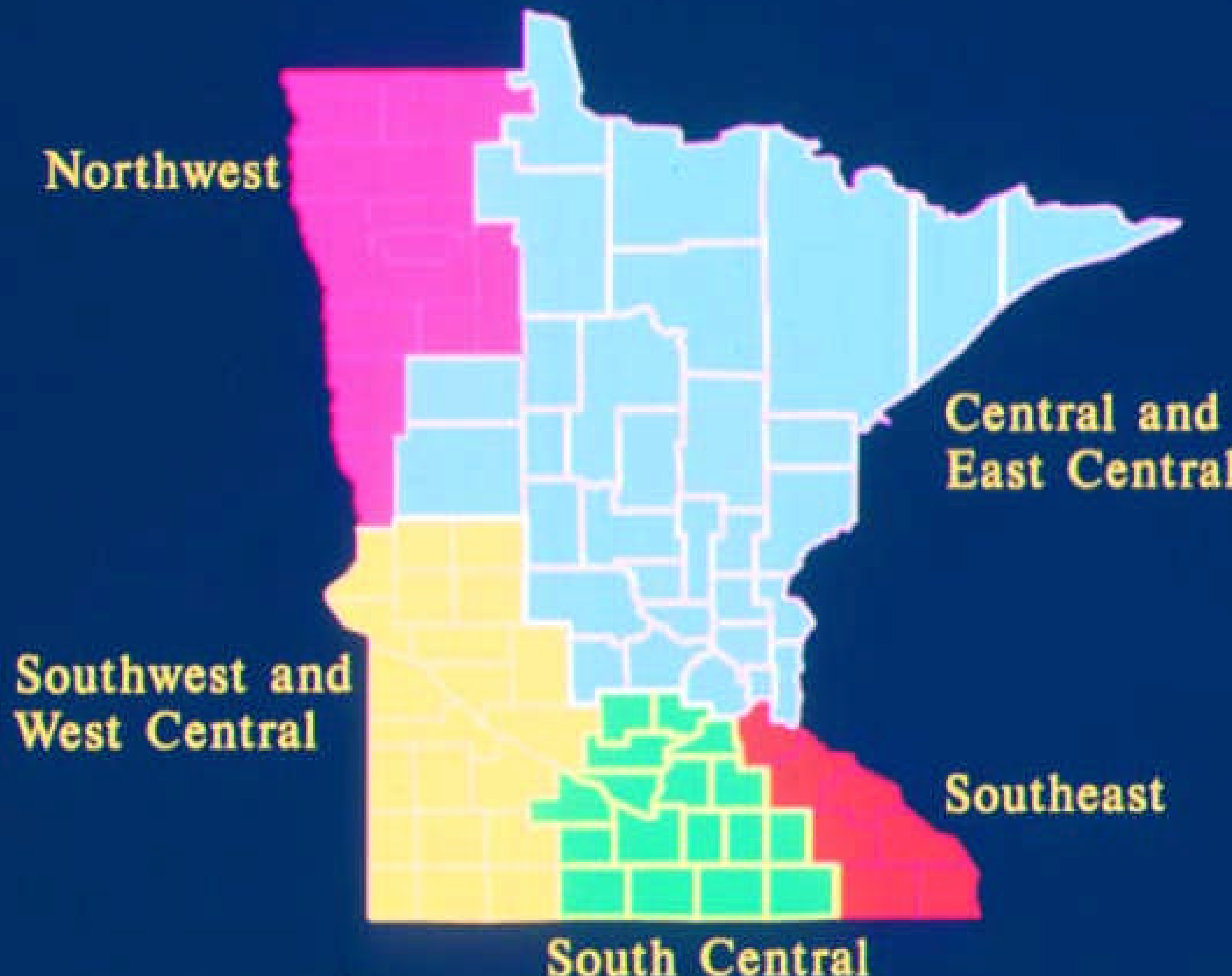
Controlling Factors

- Geology and soil properties
  - Surface or ground water
- Climate
  - Precipitation (time, intensity, and amount)
- Landscape use
  - Row crops, perennials, trees, wetlands, etc.


TRAVERSE
POPE
STEARNS
SHERBURNE
CHISAGO
ANOKA
SWIFT
KANDIYOHI
MEEKER
WASHINGTON
HENNEPIN
RAMSEY
CHIPPEWA
WRIGHT
MINNEAPOLIS
ST. PAUL
45°00'
LAC QUI PARLE
McLEOD
CARVER
RENVILLE
YELLOW MEDICINE
DAKOTA
MISSISSIPPI
SIBLEY
SCOTT
LINCOLN
LYON
LE SUEUR
GOODHUE
NICOLLET
REDWOOD
RICE
BROWN
WABASHA
RIVER
STEELE
DODGE
MURRAY
WASECA
OLMSTED
COTTONWOOD
BLUE EARTH
WINONA
PIPESTONE
WATONWAN
HOUSTON
FILLMORE
NOBLES
FARIBAULT
FREEBORN
ROCK
JACKSON
MARTIN
MOWER
I O W A


Lynn Betts, NRCS

Region Specific BMPs for N



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Primary contaminants impairing water quality

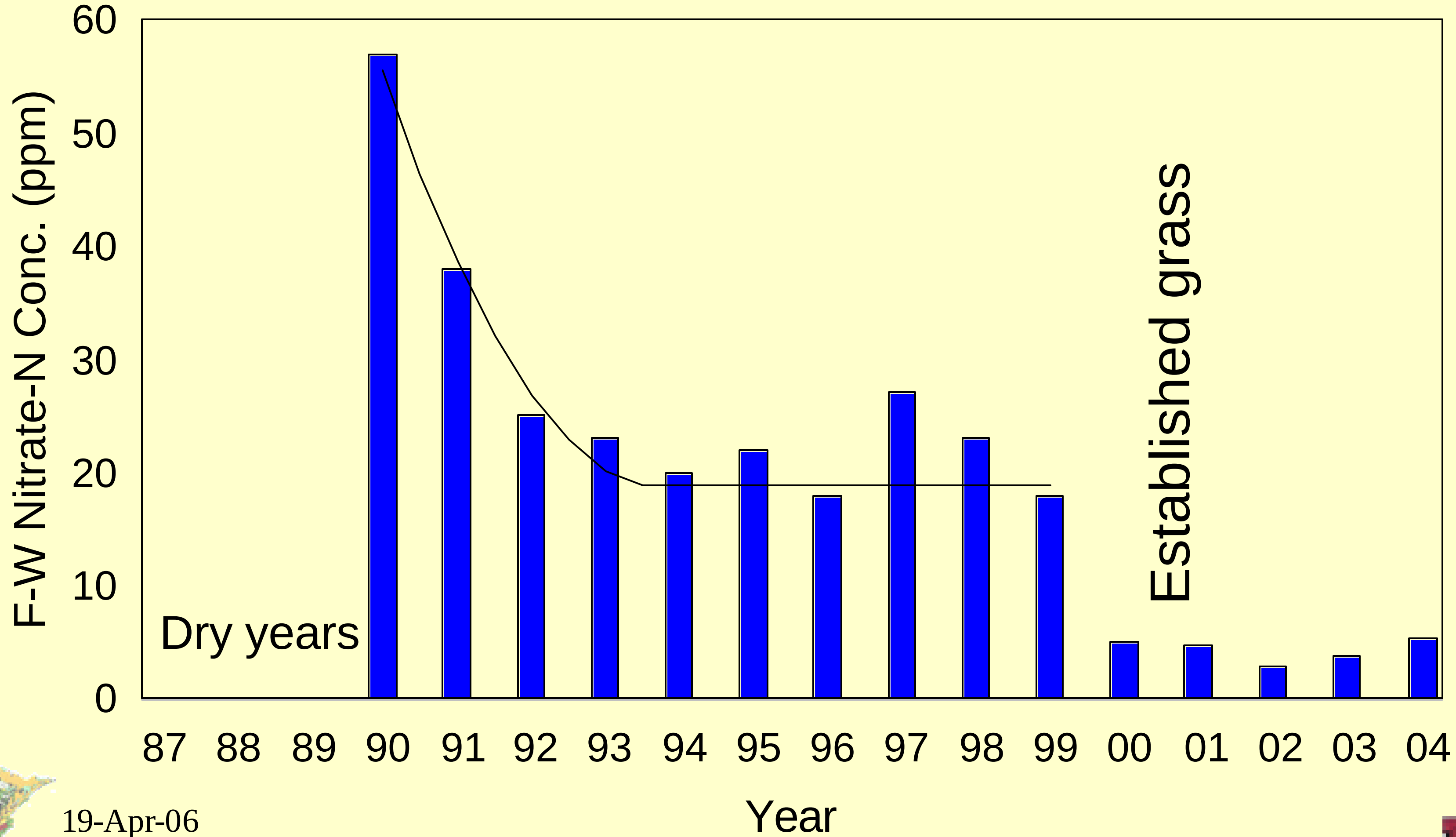
- Sediments
- Nutrients (N and P)
- Pathogens
- Excess water

CROPPING SYSTEMS

Effect of CROPPING SYSTEM on drainage volume, NO_3-N concentration, and N loss in subsurface tile drainage during a 4-yr period (1990-93) in MN.

Cropping System	Total discharge	Nitrate-N Conc.	Nitrate-N Loss
	Inches	ppm	lb/A
Cont. Corn	30.4	28	194
Corn – Soybean	35.5	23	182
Soybean – C	35.4	22	180
Alfalfa	16.4	1.6	6
CRP	25.2	0.7	4

Nitrate losses in tile drainage water from soil mineralization.



CONCLUSION

- Cropping system has greater effect on hydrology and nitrate losses than any other management factor!

“Preventive Management”

Nutrients

- N (rate, time of application, source, and inhibitors)
  - Leaching to ground and surface water
- P (rate, placement, tillage, soil test, source, and transport)
  - Surface runoff

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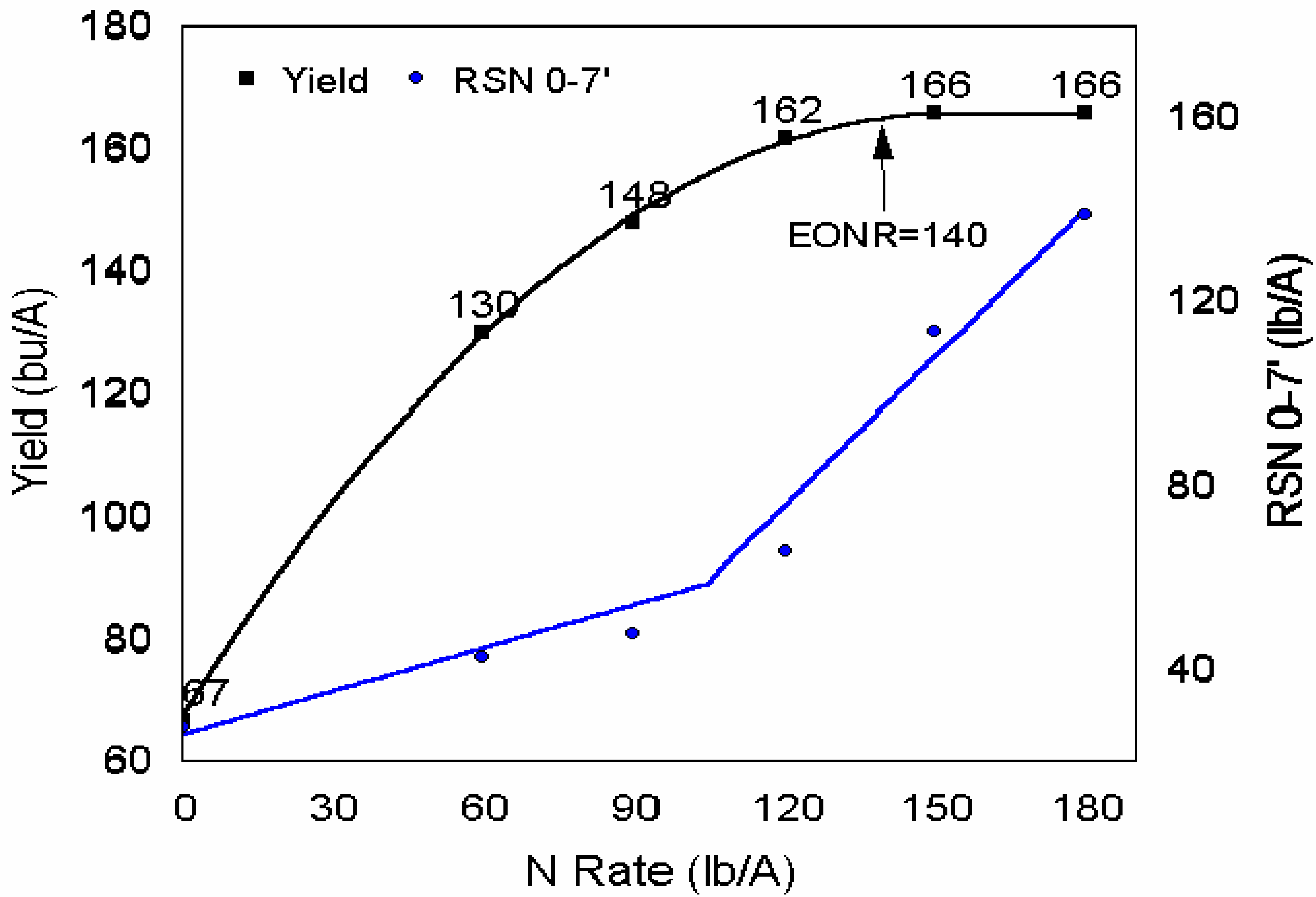
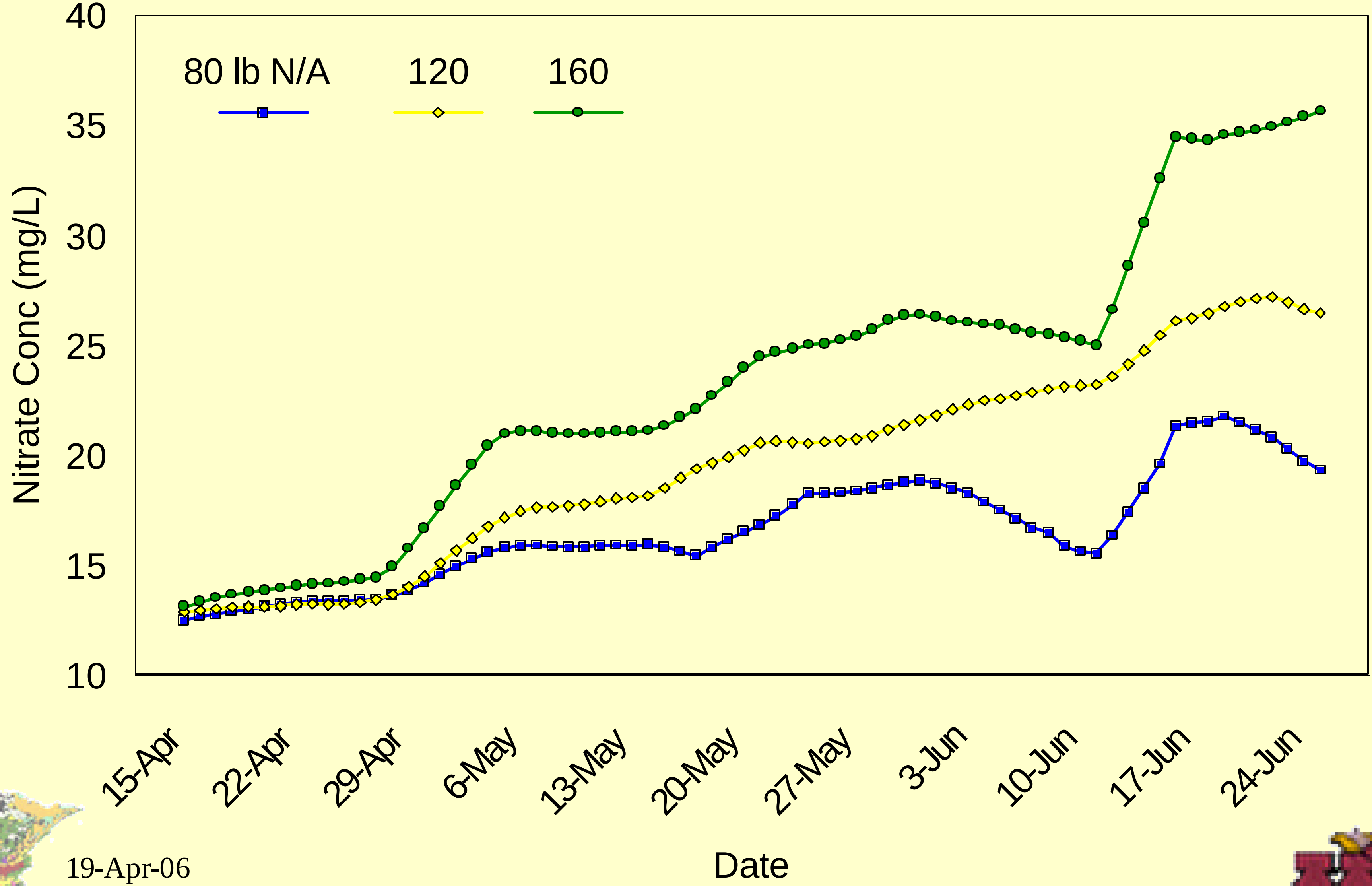
RATE OF APPLICATION

Continuous Corn, 2001–03 Olmsted Co.



Effect of N rate for corn after soybean on NO_3-N concentrations in tile drainage water in 2001.



Effect of N rate on yield of corn after soybean, net return to fertilizer N, and nitrate-N concentration in tile drainage at Waseca (2000–2003).

N Treatment			4-Yr Yield	Net	4-Yr FW
Time	Rate	N-Serve	Avg.	Return	NO_3-N conc.
	lb /A		bu/A	$/A/Yr	mg/L
---	0	---	111	---	---
Fall	80	Yes	144	30	12
“	120	“	166	70	13
“	160	“	172	78	18
Spr.	120	No	180	105	14

Effect of N rate applied for corn in 2003 on nitrate-N concentration and loss in tile drainage during May–September 2004 from soybeans at Waseca.

N Rate.	FW Nitrate-N Concentration	Nitrate-N Loss
lb/A	mg/L	lb/A
80	9	36
120	12	52
160	20	81

TIME OF N APPLICATION
and
Nitrification Inhibitors
“N–Serve”

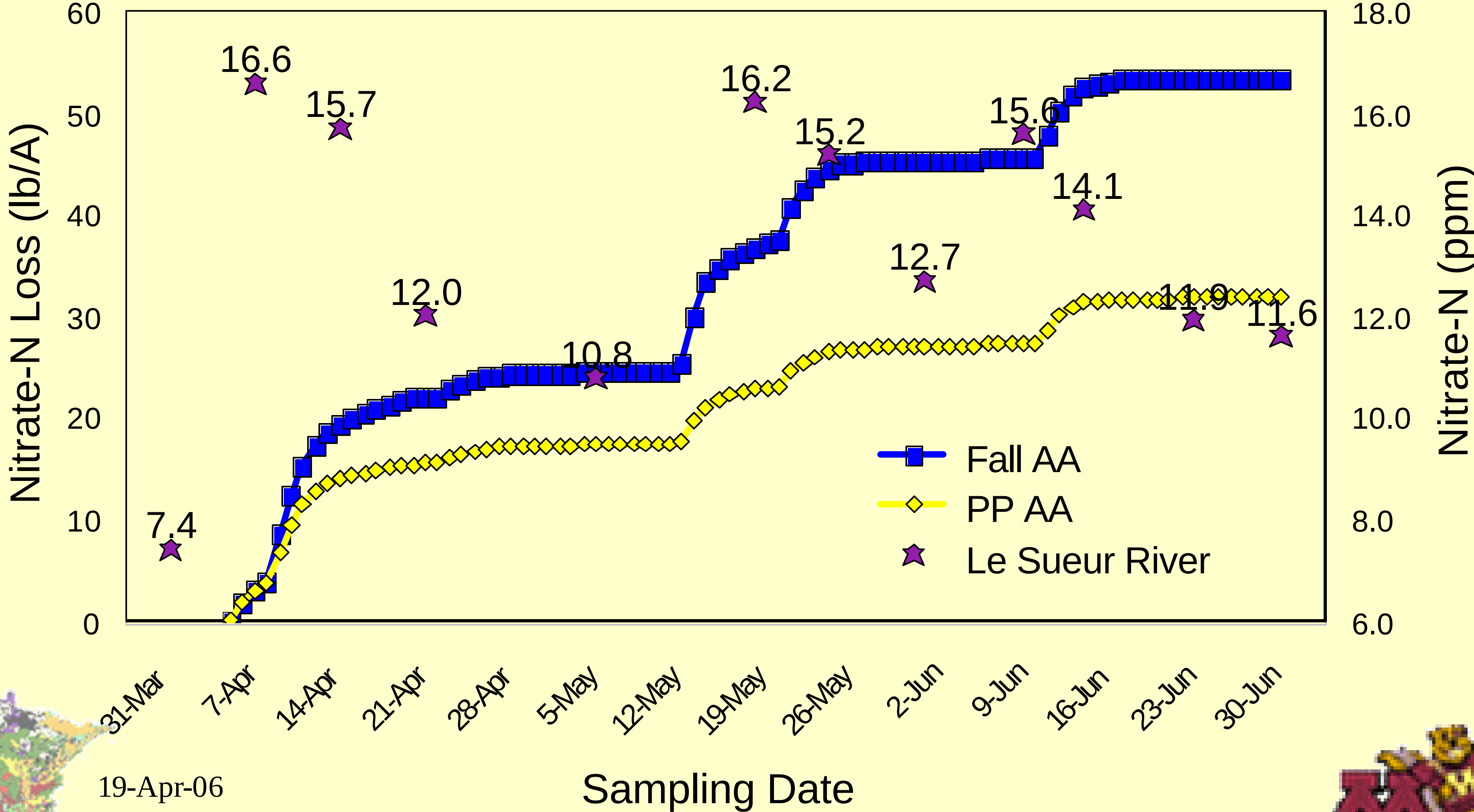
Effect of time of N application and N-Serve on corn yields after soybean from 1987–2001 at Waseca.

Parameter	Time of N Application		
	Fall	Fall+N-Serve	Spring
15-Yr Avg. Yield (bu/A)	144	153	156
15-Yr Avg. Economic return over fall N ($/A/yr) *	---	$9.30	$18.80
15-Yr Avg. FW NO_3-N Conc. (mg/L)	14.1	12.2	12.0
7-Yr Avg. Yield (bu/A) **	131	146	158
7-Yr Avg. Economic return over fall N ($/A/yr) *	---	$22.50	$51.00

* Corn = $2.00/bu; N = $0.25/lb N (fall) & $0.275/lb (spring).

** Seven years when statistically significant differences occurred.

1999 tile water NO_3-N loading at Waseca vs. NO_3-N concentrations in the Le Sueur River 2.3 miles from Mankato.



Corn production and nitrate loss as affected by time of N application and N-Serve at Waseca, 1987-93.

N treatment		7-Yr Average		FW NO_3-N
		Corn	Economic	conc. in tile
Time	N-Serve	yield	return to N	Drainage *
		bu/A	$/A	- mg/L -
Fall	No	131	34	16.8
"	Yes	139	43	13.7
Spring	No	139	47	13.7
Split	No	145	56	14.6
	LSD (0.10):	4		

* Across the 4-cycle corn (1990-93) – soybean (1991-94) rotation.

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Sediment

- Erosion
- Tillage
  - Surface residues
- Row crops vs. perennials

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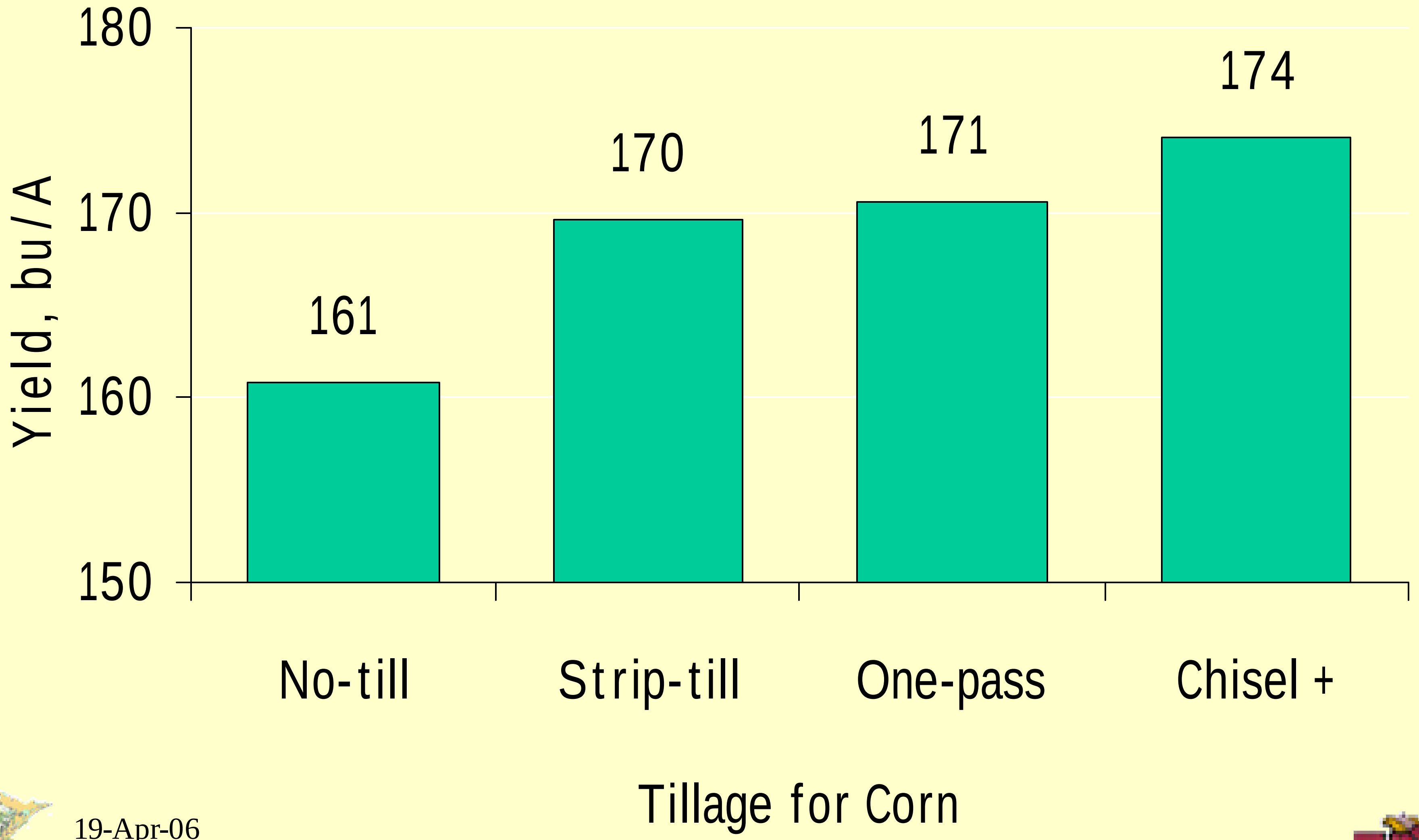
Corn yield as affected by tillage system in southeastern Minn. (1997–2000)

Tillage System	Crop Rotation			
	Cont. corn		Corn-soybean	
	Yield	Residue	Yield	Residue
	bu/A	%	bu/A	%
CP+	166	26	182	23
ST	162	64	183	57
DZT	163	54	186	41
NT	155	87	182	67
LSD (0.10):	3	10	NS	6

Corn yield following soybean as affected by tillage at Waseca (31 Site-Yr Avg.)



Livestock

- Manure nutrients
  - Challenges and uncertainties
    - Nutrient contents, spreading, storage, value, land area, etc.
  - Scale perceptions
  - Pathogens
  - Antibiotic resistance

THANKS