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Consider soil drainage class when making N application timing decision for corn

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Wisconsin Agribusiness Classic

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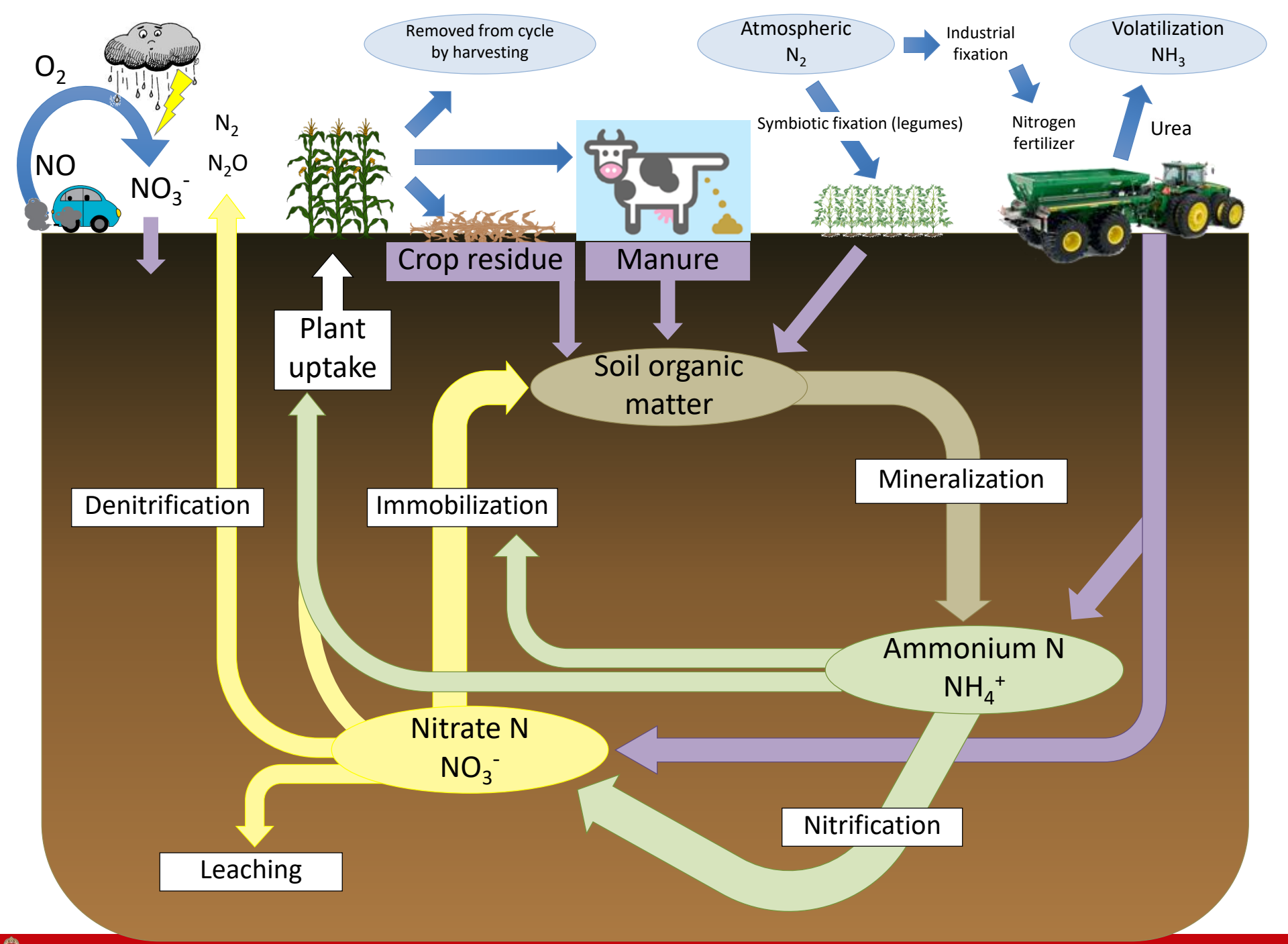
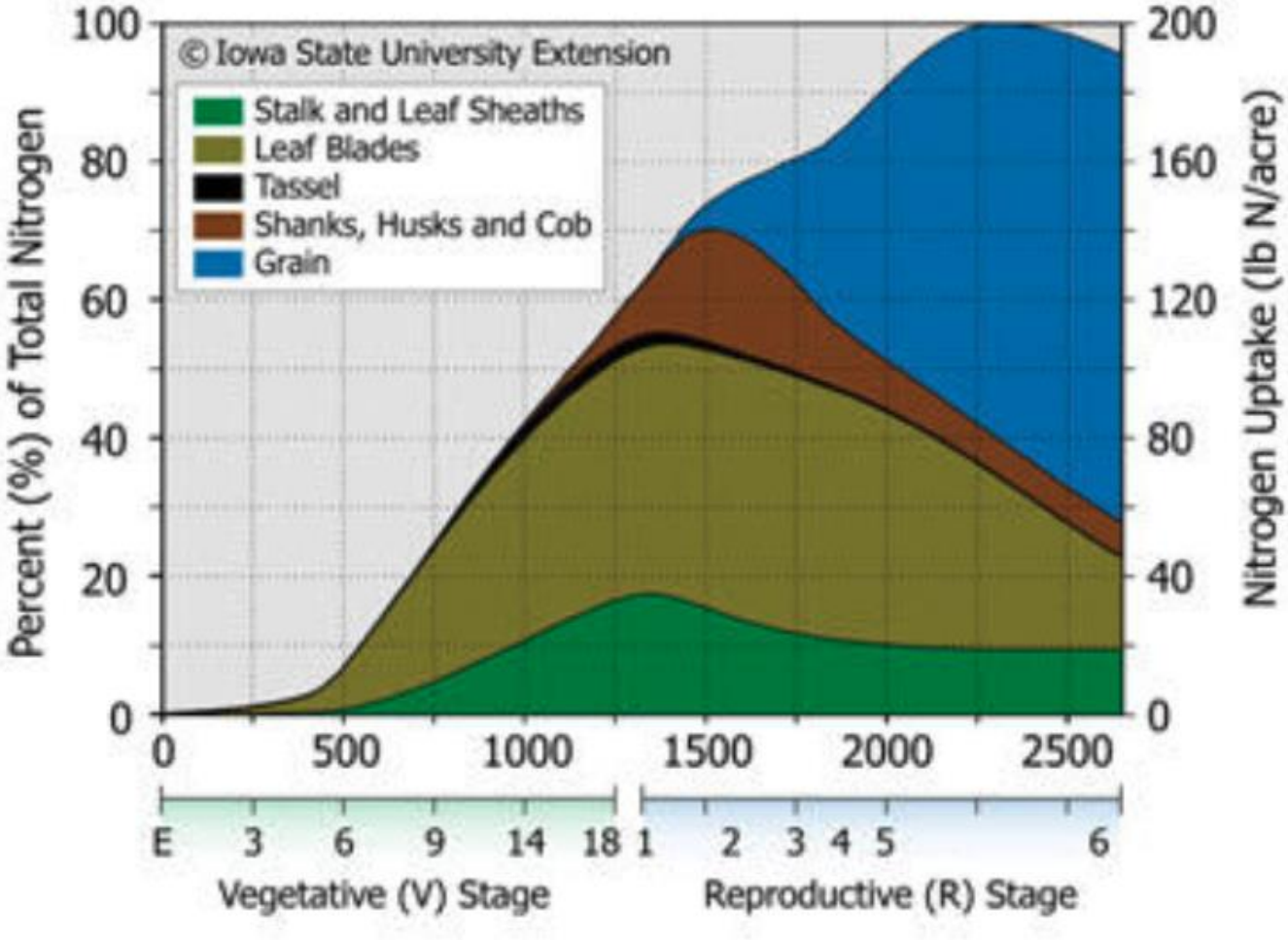

O_2
NO
NO_3^-
N_2
N_2O
Removed from cycle by harvesting
Atmospheric N_2
Industrial fixation
Volatilization NH_3
Symbiotic fixation (legumes)
Nitrogen fertilizer
Urea
Crop residue
Manure
Plant uptake
Soil organic matter
Denitrification
Immobilization
Mineralization
Ammonium N NH_4^+
Nitrate N NO_3^-
Nitrification
Leaching

Corn N uptake



N Timing Study in Lancaster & Marshfield, 2014-2016

N Timing

- Preplant: PP
- Sidedress: SD
  - V6, ~18”
- Split: PP_{40} + SD
- Preplant + Late: PP + LV_{40}
  - Late = 10 d before VT
- Triple split: PP_{40} + SD + LV_{40}

Previous crop = corn

N Sources

- Preplant: urea broadcast, incorporated
- Sidedress: UAN sub-surface band between rows
- Late: UAN with Agrotain surface band between rows

Soil Drainage

- Lancaster, well-drained
- Marshfield, somewhat poorly drained

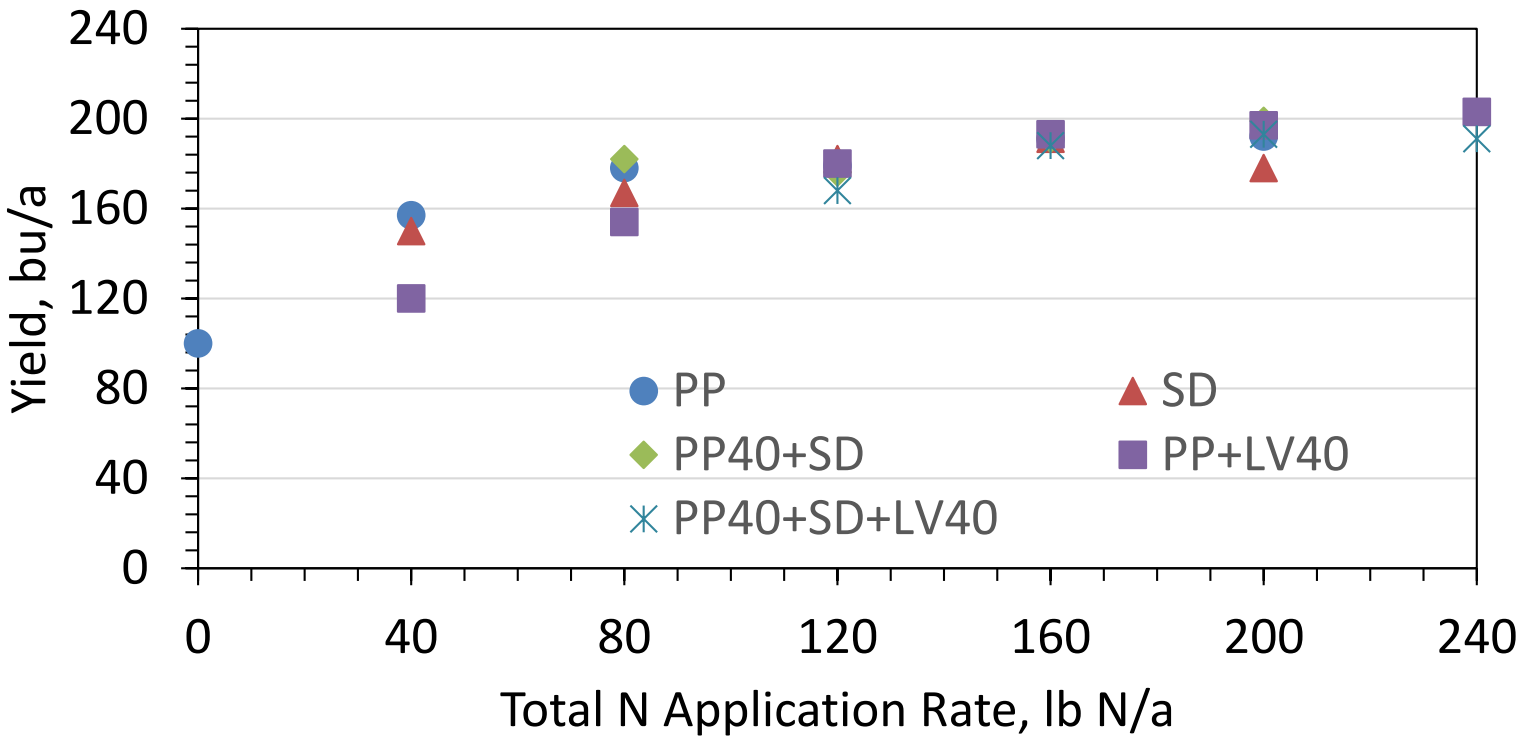
Research funded by WI Fertilizer Research Program

Growing season precipitation

Location	Year	PP to V6	V6 to LV	2-wk following LV	PP to 2-wk following LV
		------ precipitation (departure from normal), inches ------			
Lancaster	2014	6.34 (-0.16)	3.07 (0.24)	0.08 (-1.77)	9.49 (-1.69)
	2015	8.11 (1.54)	2.36 (-1.38)	0.79 (-1.38)	11.26 (-1.22)
	2016	5.20 (0.31)	6.18 (2.17)	7.24 (5.31)	18.62 (7.79)
Marshfield	2014*	5.83 (1.89)	2.28 (-1.30)	1.46 (-0.91)	9.57 (-0.32)
	2015	8.74 (2.48)	3.07 (0.00)	2.01 (0.00)	13.82 (2.48)
	2016	5.98 (1.34)	4.06 (0.43)	2.60 (0.63)	12.64 (2.40)

*slightly better drainage than other years

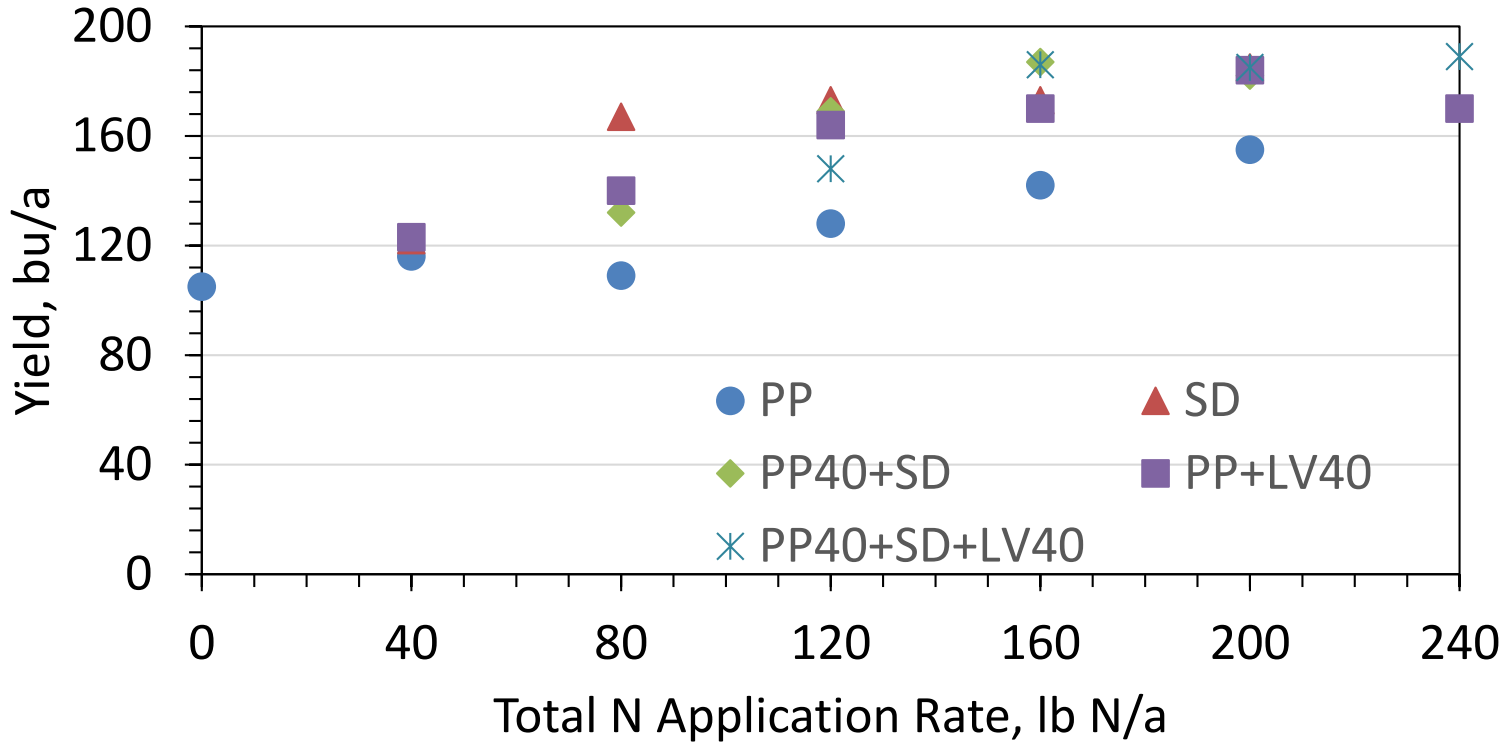
Lancaster, 2015



- Waiting too long to apply N, reduces yield.
- No effect of timing on well drained soil

$MRTN_{0.10}$ = 165 lb N/a, 155-180 lb/a
$EONR_{0.10}$= 2014: 181 lb/a, 203 bu/a
2015: 112 lb/a, 185 bu/a
2016: 162 lb/a, 219 bu/a

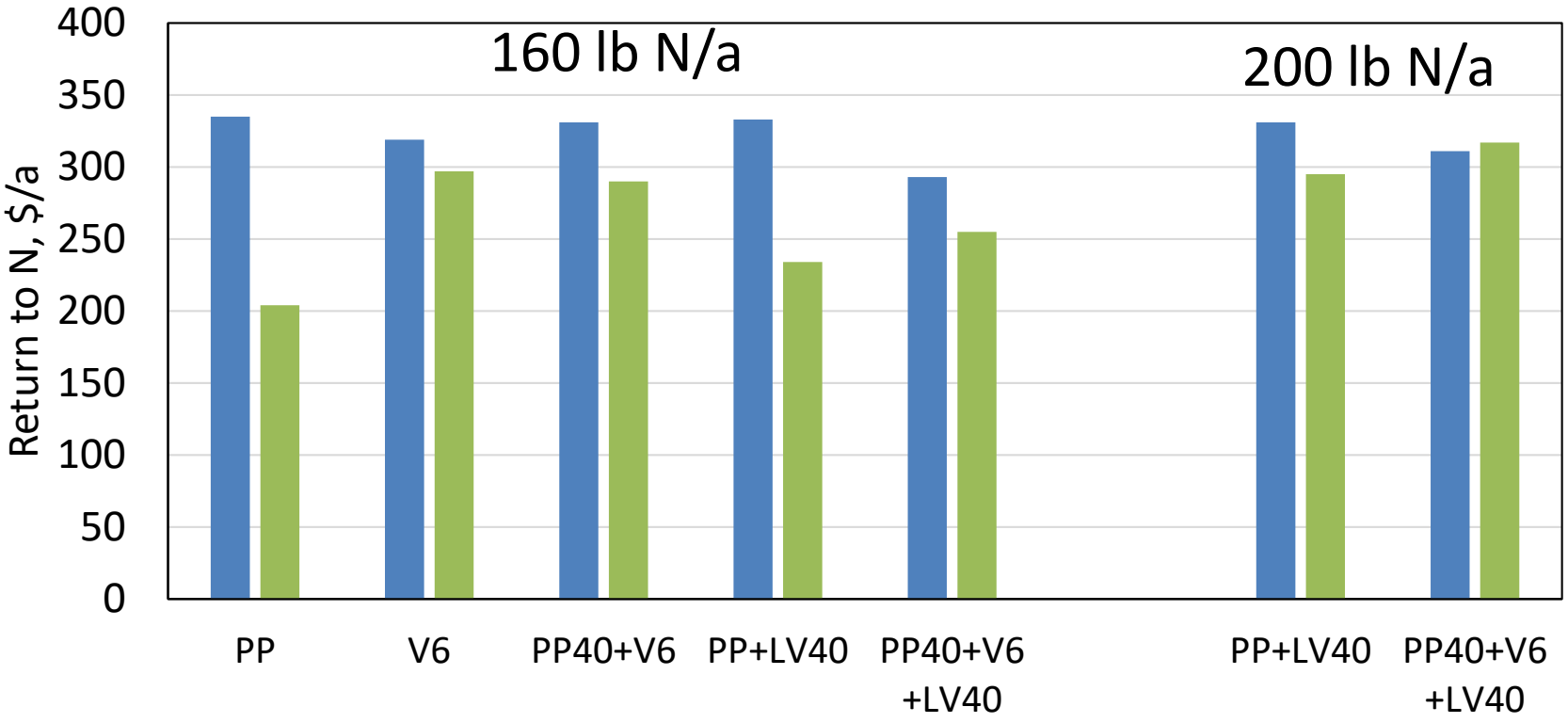
Marshfield, 2015



- In-season applications are preferred on somewhat poorly drained and wetter soils.
- Rescue N applications at late vegetative were effective at recouping yield from early season N loss.

$MRTN_{0.10}$ = 165 lb/a, 155-180 lb/a (High YP)
= 125 lb/a, 115-140 lb/a (Med YP)
$EONR_{0.10}$= 2014: 184 lb/a, 185 bu/a
2015: 109-210 lb/a, 177-151 bu/a
2016: 210 lb/a, 154-191 bu/a

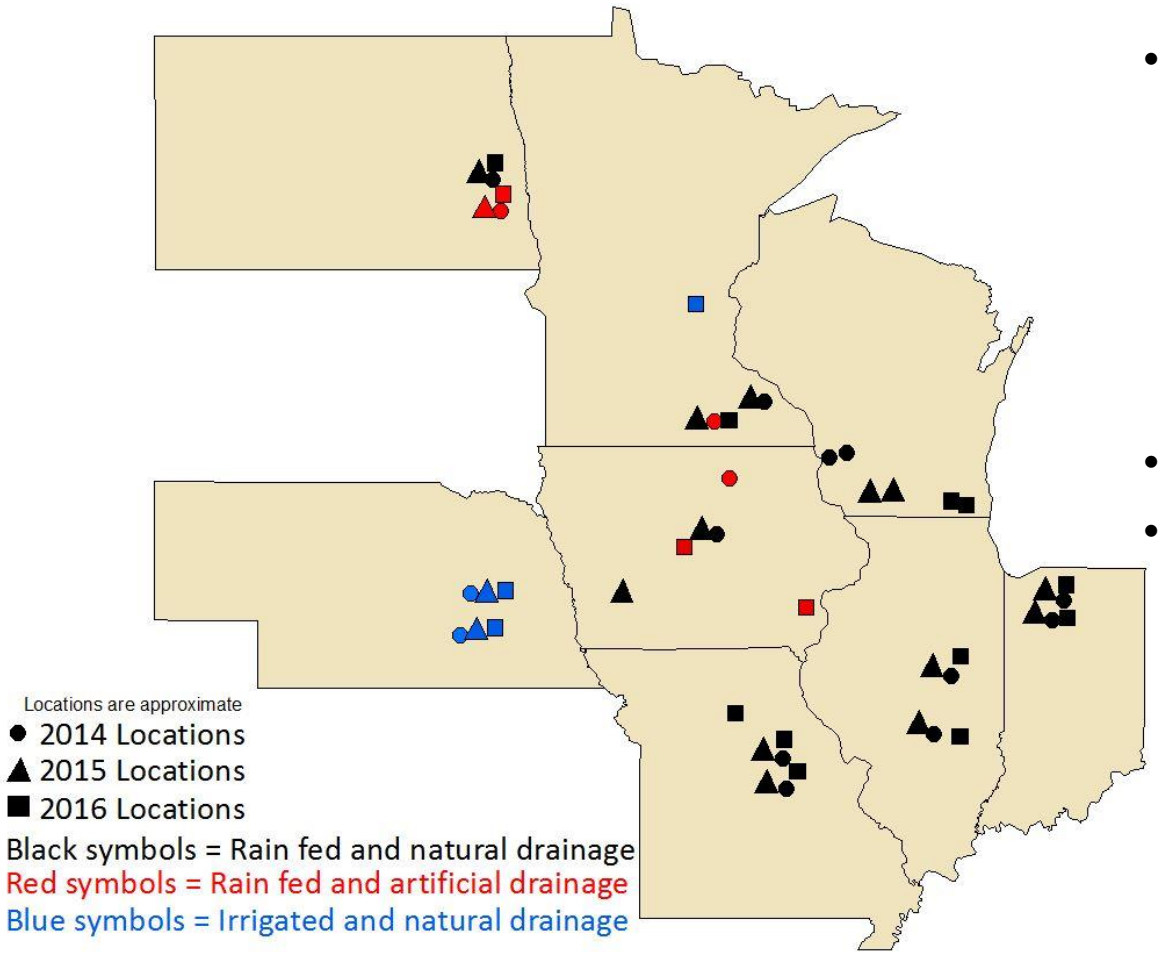
3-year average return to N



$4/bu
$0.40/lb N
$10/a for each application >1

No effect of timing at Lancaster
Sidedressing N paid at Marshfield

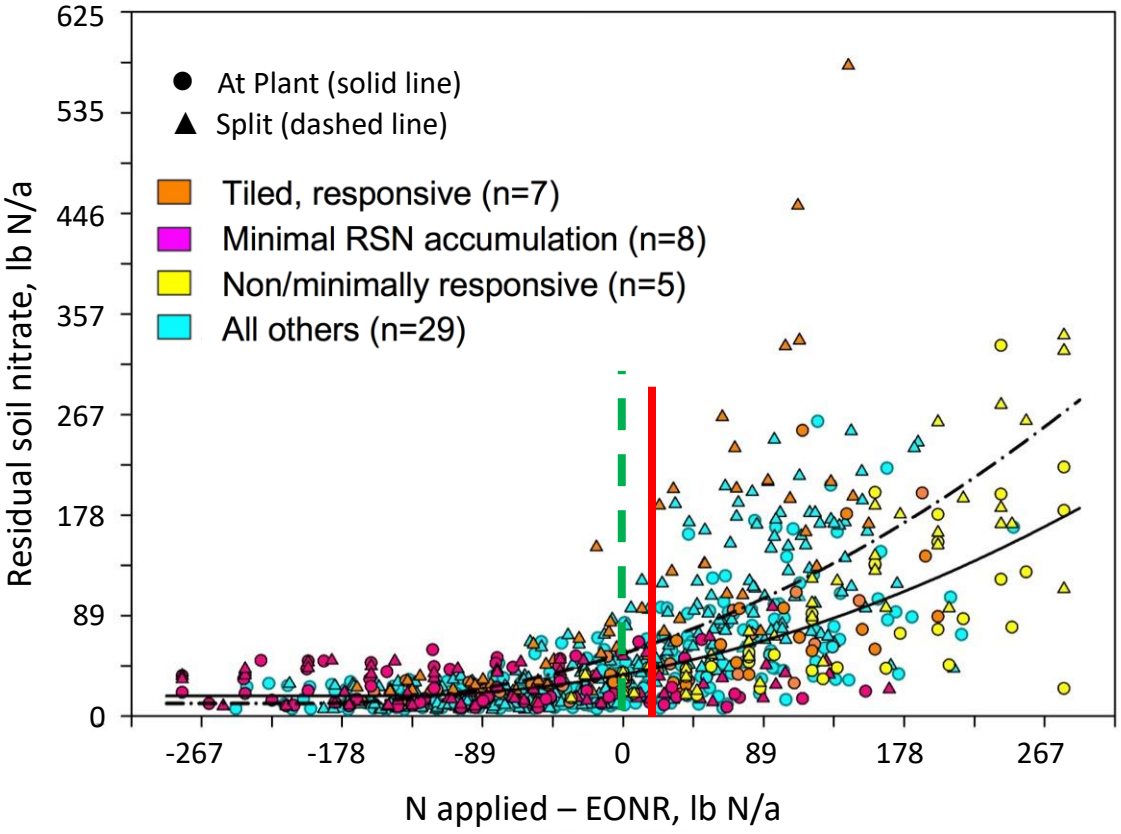
Midwestern N Timing Study, 2014-2016



- 49 site-years
- Site selection
  - Site productivity
  - Prev. crop soybean, except for 5 corn, 1 sunflower
  - No recent manure history
  - Tillage: no-till and reduced
- Standardized protocol
- Treatments
  - 0-280 lb N/a
    - At plant
    - Split = 40 lb N/a at plant + V9 sidedress

Research funded by Pioneer

Timing of N application influences timing of potential N loss

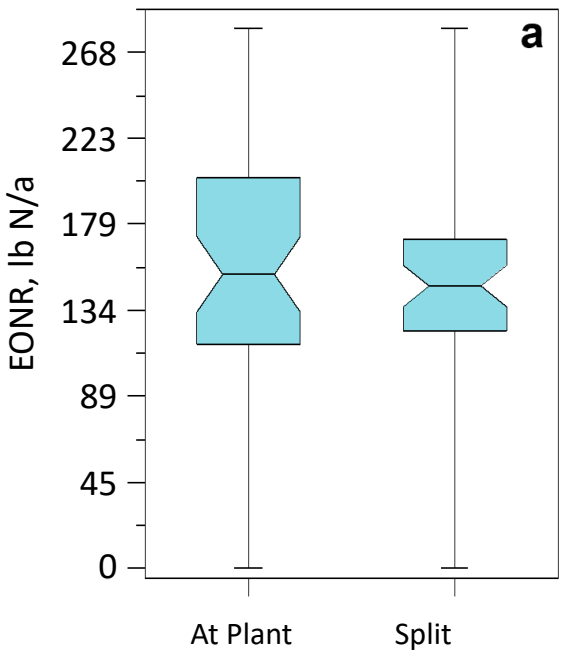


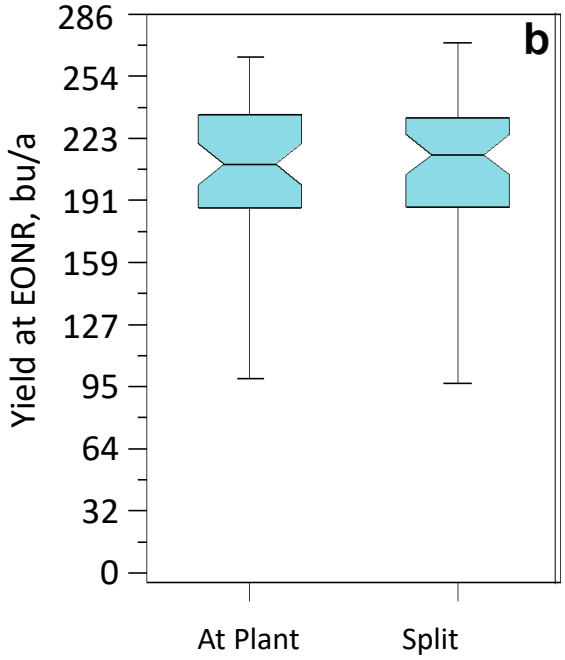
Split applications leave more N in the soil profile after harvest (55 vs 37 lb N/a at $EONR_{0.10}$) compared to at plant applications

Potential N losses at $EONR_{0.10}$ are similar to lower N rates

$EONR_{0.10}$ = economic optimum N rate at N:corn price ratio of 0.10
eg. \$0.30/lb N and \$3.00/bu or
\$0.40/lb N and \$4.00/bu

Effect of N timing on EONR & yield

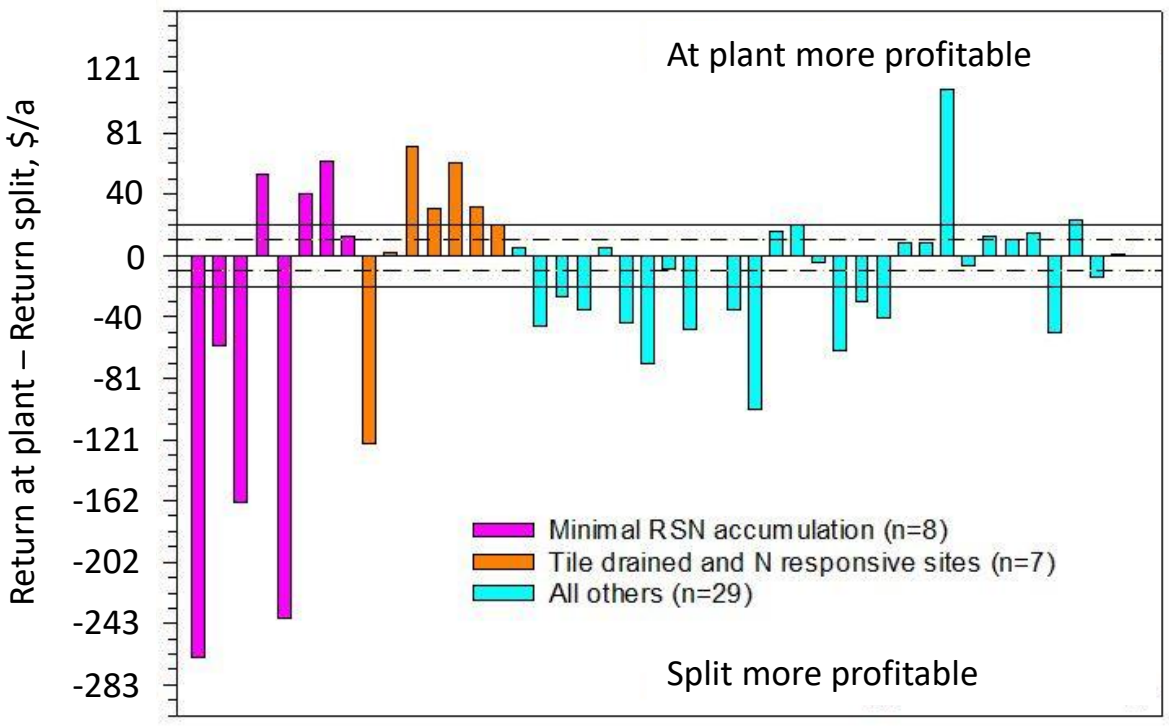




- Study average EONR:
  - AP: 151 lb N/a
  - Split: 142 lb N/a

- Differences > 18 lb N/a in EONR:
  - $EONR_{AP} > EONR_{split}$ (n=19, 39%)
  - $EONR_{AP} < EONR_{split}$ (n=11, 22%)
  - $EONR_{AP} = EONR_{split}$ (n=19, 39%)

Profitability of N timing is based on soil/site conditions



- Study average return to N:
  - AP: $323/a
  - Split: $343/a
- Differences >$10/a in return to N at EONR:
  - AP > Split (n=16, 36%)
  - AP < Split (n=18, 41%)
  - AP = Split (n=10, 23%)

Improve N use efficiency and profitability by considering soil drainage class

- Time of N application influences time of potential N loss
  - N application rates > $MRTN_{0.10}$ have greatest loss potential
- On well-drained soils, N application timing doesn't typically influence yield
  - Consider costs associated with multiple applications
  - When no N is applied prior to planting, late N applications can result in early season crop stress
- On a somewhat poorly drained soil where there is a high probability of early season denitrification loss
  - Apply a majority of N in season
  - 40 lb N/a at late vegetative can rescue the crop
- On excessively drained and sandy soils where leaching is a concern, in-season applications are preferable

STOP SOIL EROSION SAVE OUR FUTURE

World Soil Day

5 DECEMBER 2019

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