# Proceedings of the 5th Annual Nitrogen: Minnesota's Grand Challenge & Compelling Opportunity Conference

Extension
UNIVERSITY OF WISCONSIN–MADISON

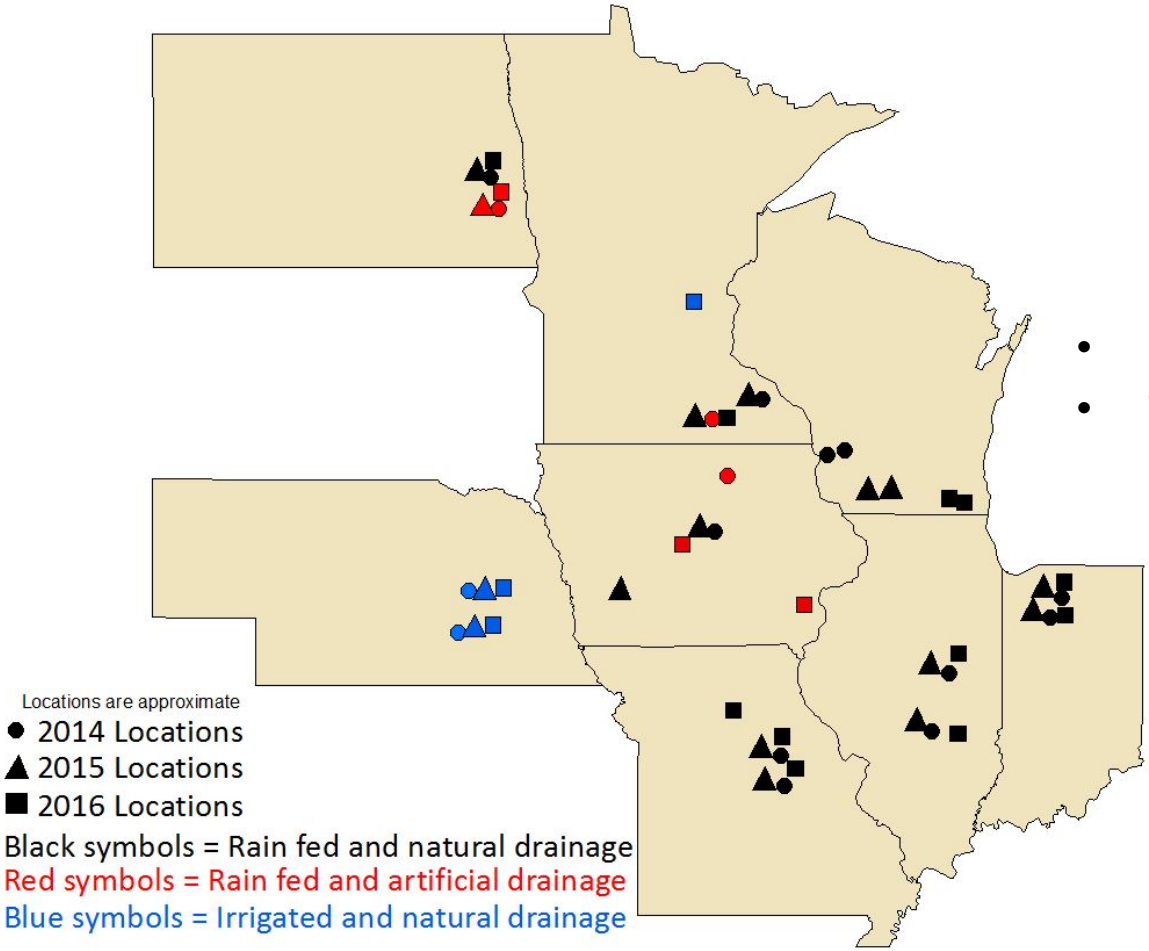
# NUE and potential environmental outcomes associated with N application timing for corn

Carrie Laboski, Chris Bandura,
J. Camberato, P. Carter, R. Ferguson, F. Fernendez,
D. Franzen, N. Kitchen, E. Nafziger, J. Sawyer, J. Shanahan

Nitrogen: Minnesota's Grand Challenge and Compelling Opportunity Conference
February 5, 2019

Carrie Laboski, Professor & Extension Soil Scientist
College of Ag and Life Sciences, Department of Soil Science
laboski@wisc.edu
www.NPKetc.wisc.edu

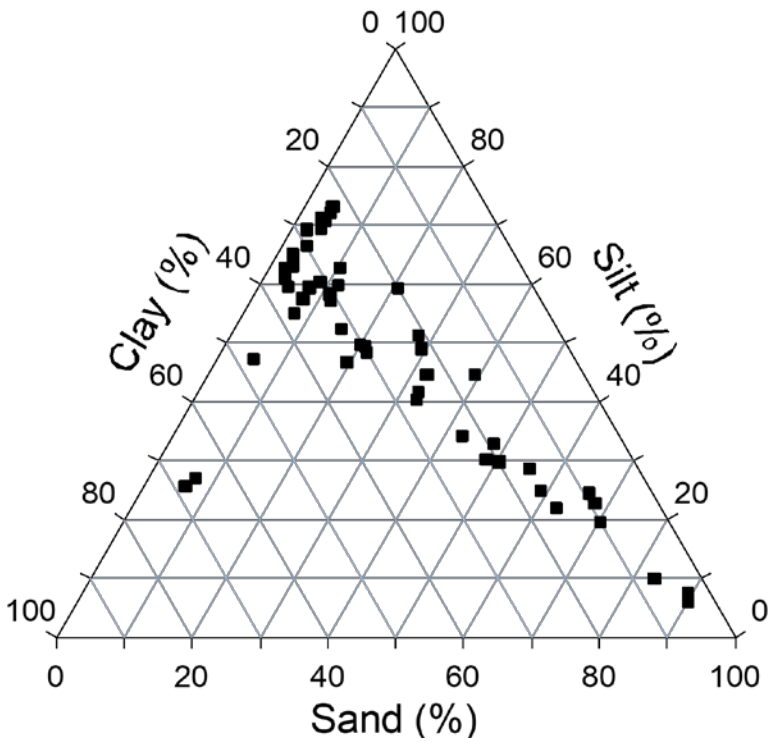
# Research Sites

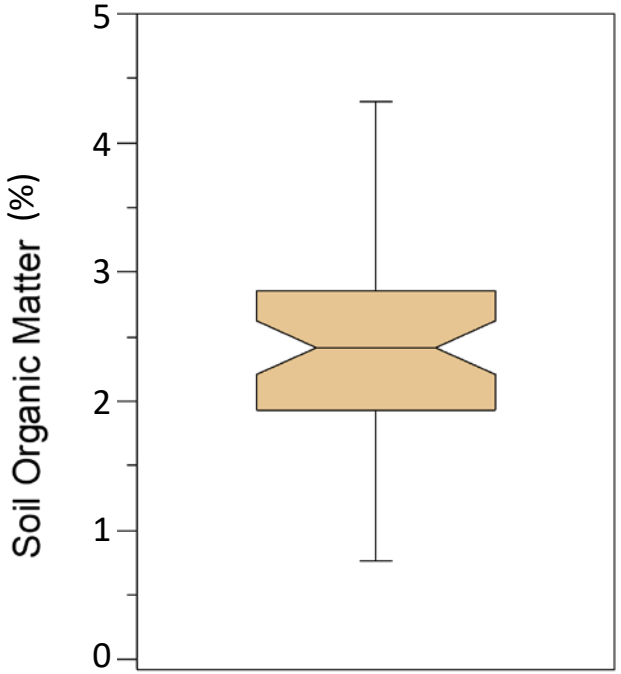



- 49 site-years
- Site selection
  - Site productivity
  - Prev. crop soybean, except for 5 corn, 1 sunflower
  - No recent manure history
  - Tillage: no-till and reduced
- Standardized protocol
- Treatments
  - 0-280 lb N/a
    - At plant
    - Split = 40 lb N/a at plant + V9 sidedress

Research funded by Pioneer

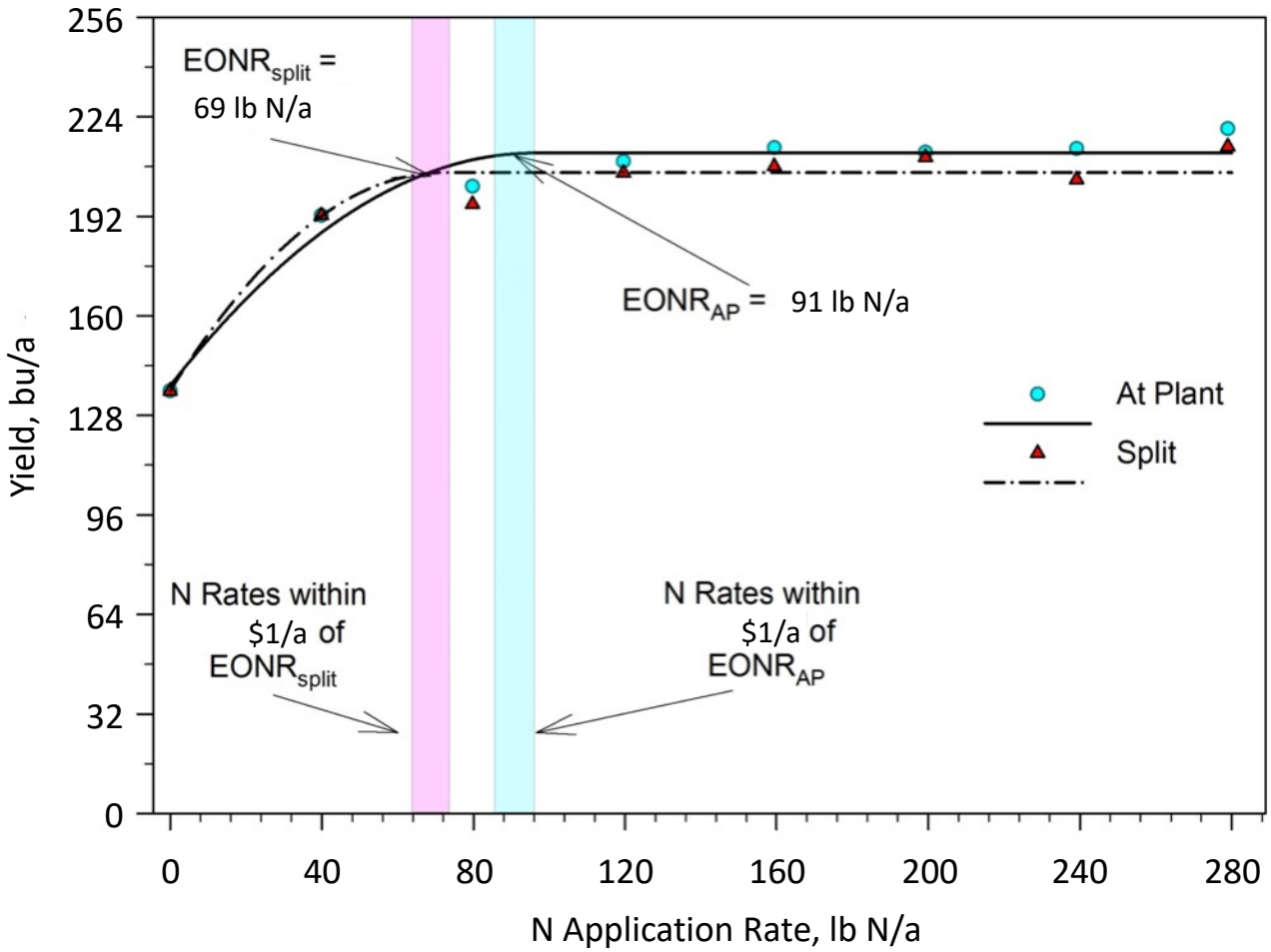
# Very brief summary of soil characteristics




Natural drainage class ranged from poorly to excessively drained

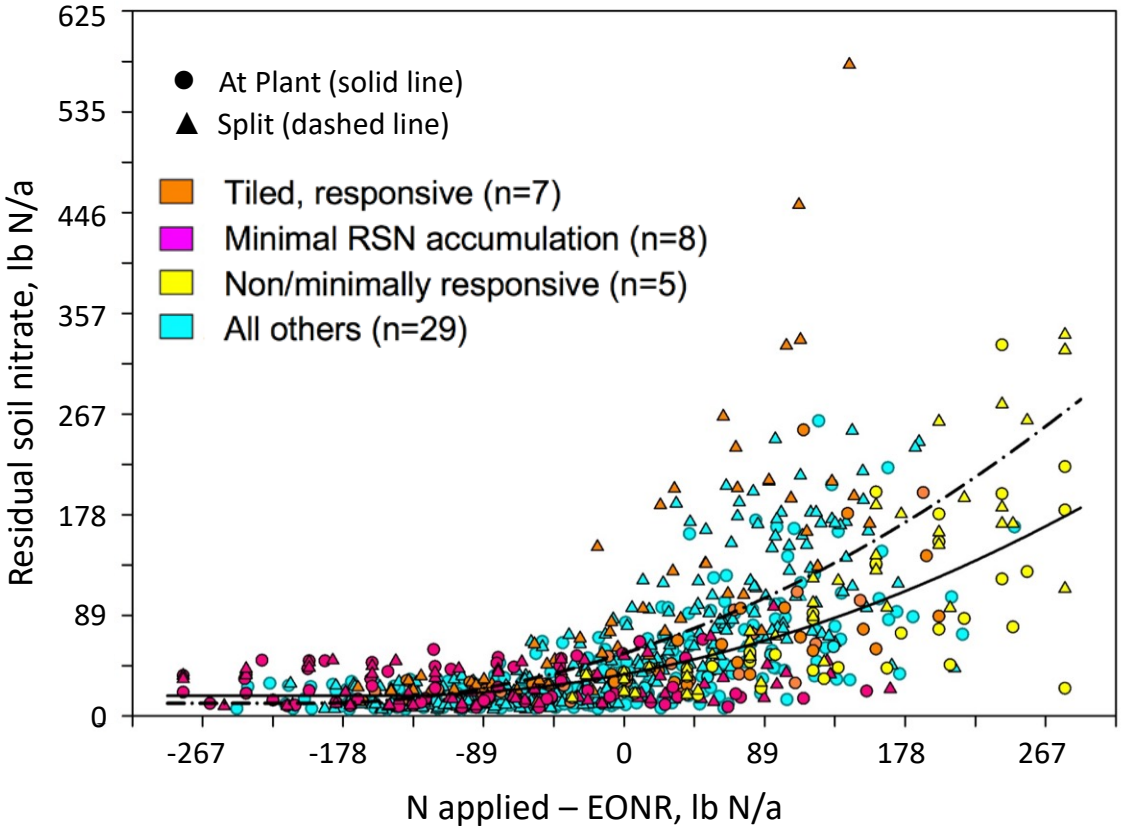
# Yield Response to N and EONR




Study average: Profitability within $1/a of EONR = EONR $\pm$ 9 lb N/a

# How does N application timing effect RSN?

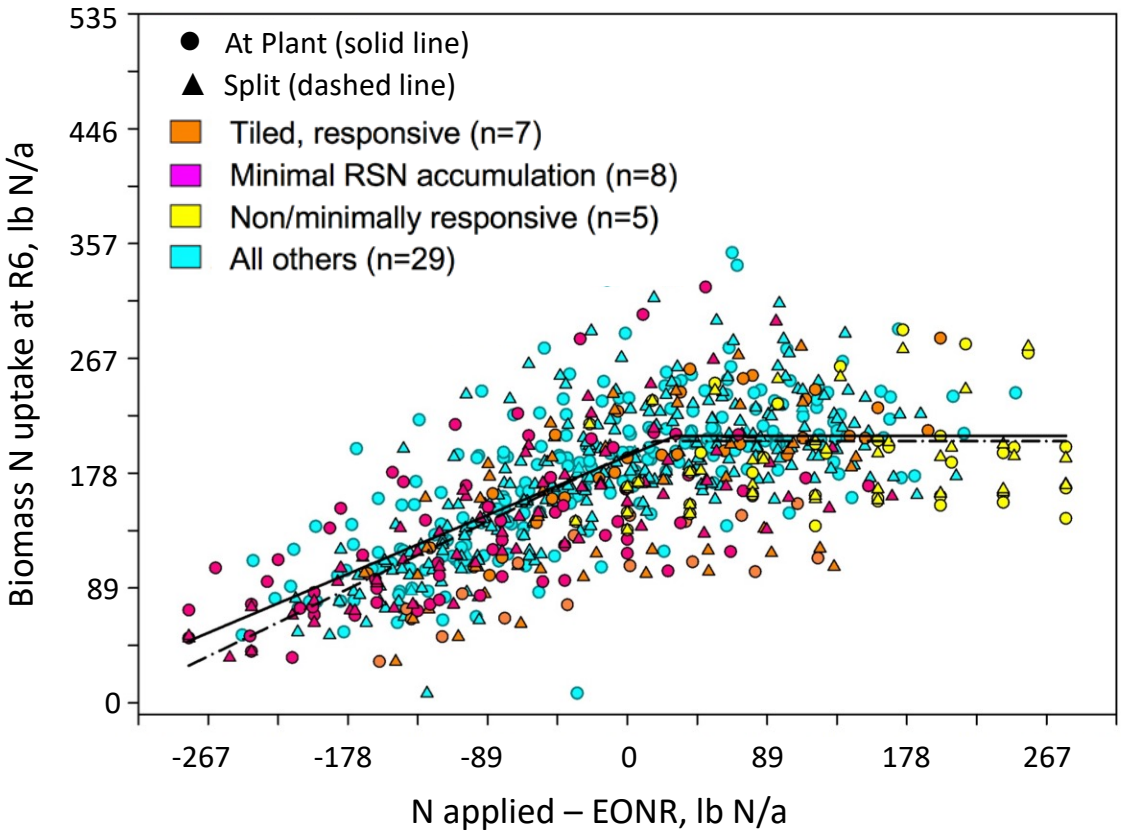
# At N rates ≥ EONR, split applications leave more N in the soil profile after harvest




At EONR, estimated RSN was 18 lb N/a greater for split application
(55 vs 37 lb N/a)

PPNT background = 50 lb/a

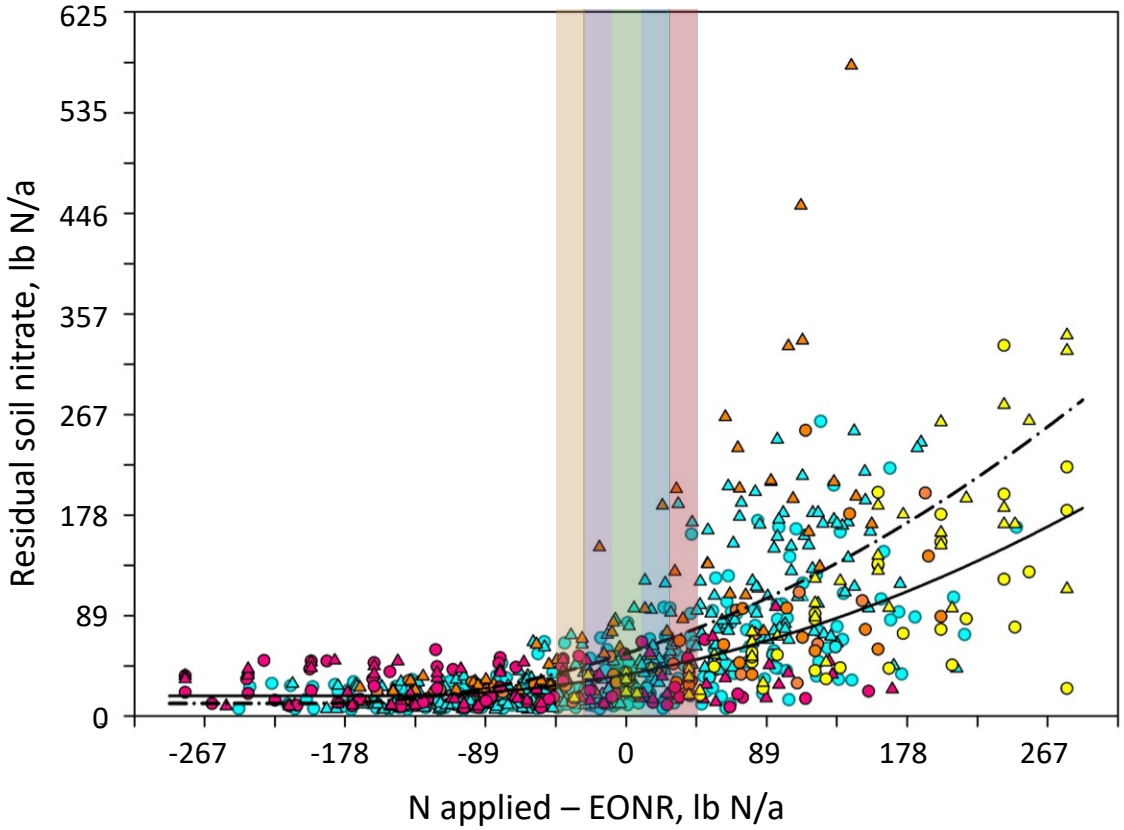
# No difference in biomass N uptake at EONR



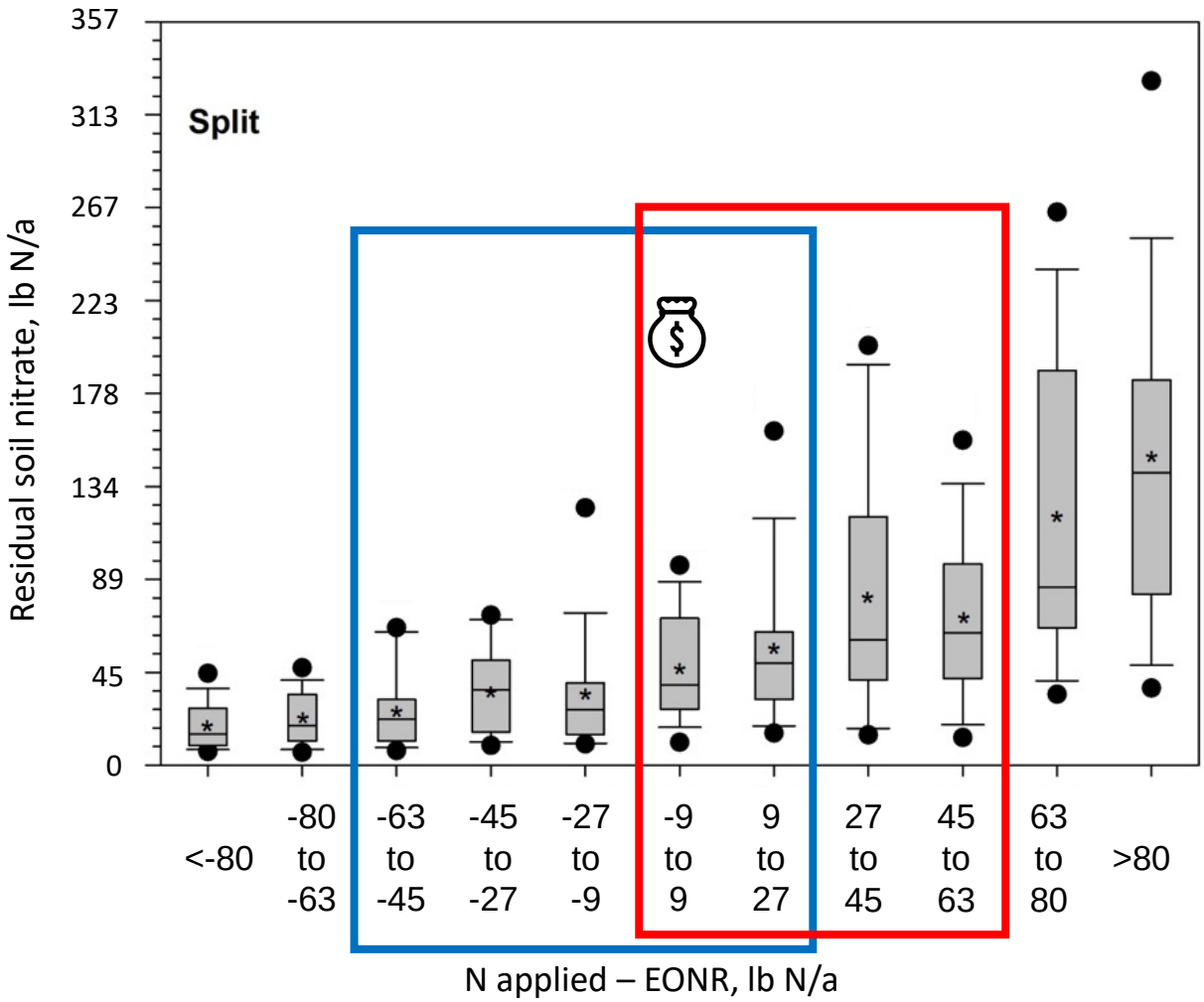

At EONR, No difference in est. N uptake between N application timings

Therefore, it is not *if* N is being lost, but rather *when*

# How high does N application have to be before RSN starts to increase substantially?



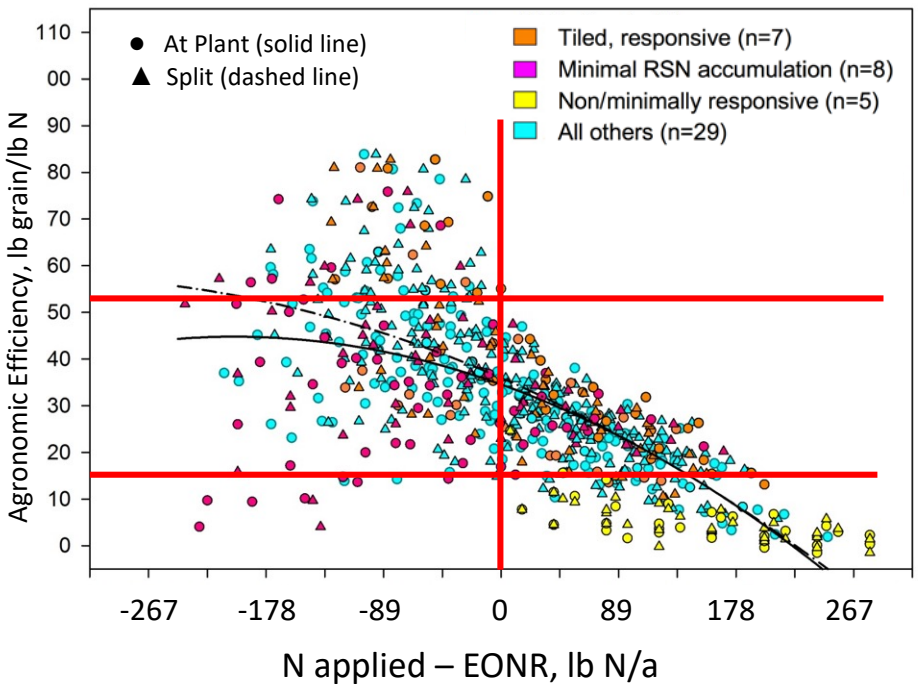
# If N rate is >27 lb N/a over EONR, then RSN is significantly greater than under application

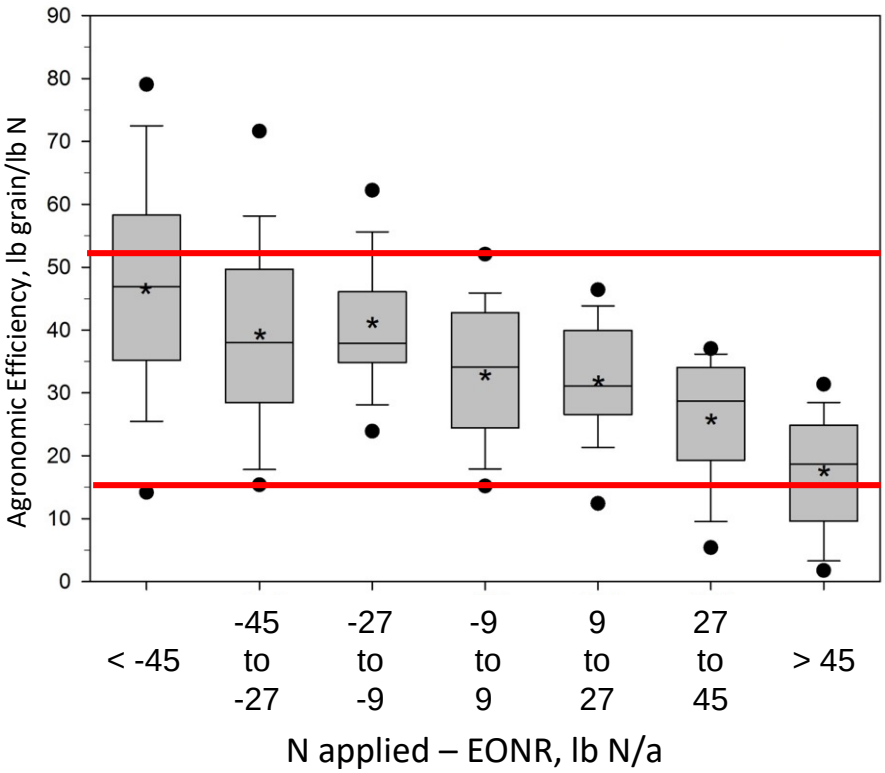


# How does N timing effect N use efficiency?

$$\text{Agronomic Efficiency} = \frac{Increase\ in\ grain\ yield\ over\ 0\ N\ rate}{N\ Application\ Rate}$$

# Timing does not effect NUE at the EONR
# NUE highly variable

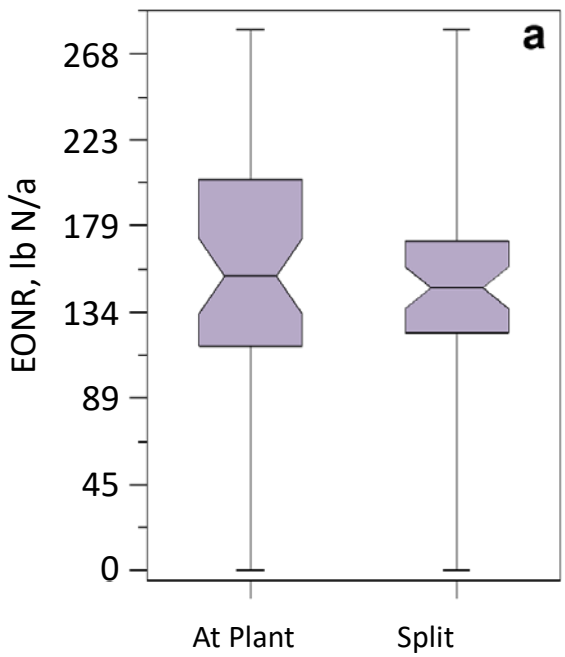


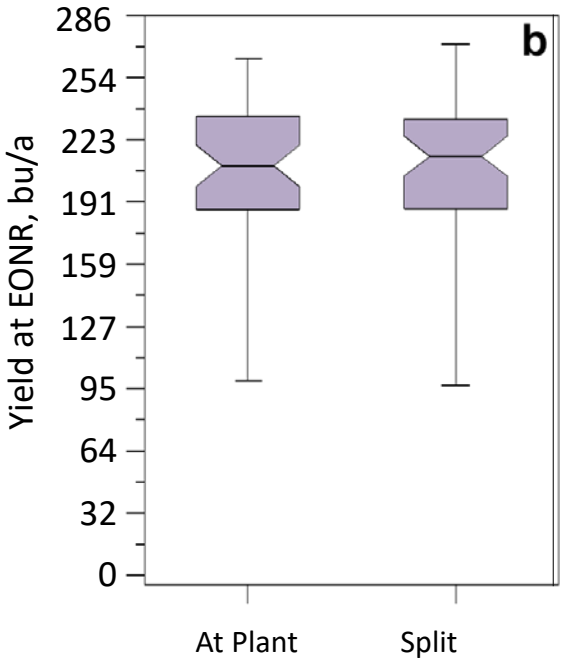




- 100% of AE ≥ 52 lb grain per lb N, under applied
- 90% of AE ≤ 15 lb grain per lb N, over applied

# How does N timing influence profitability?

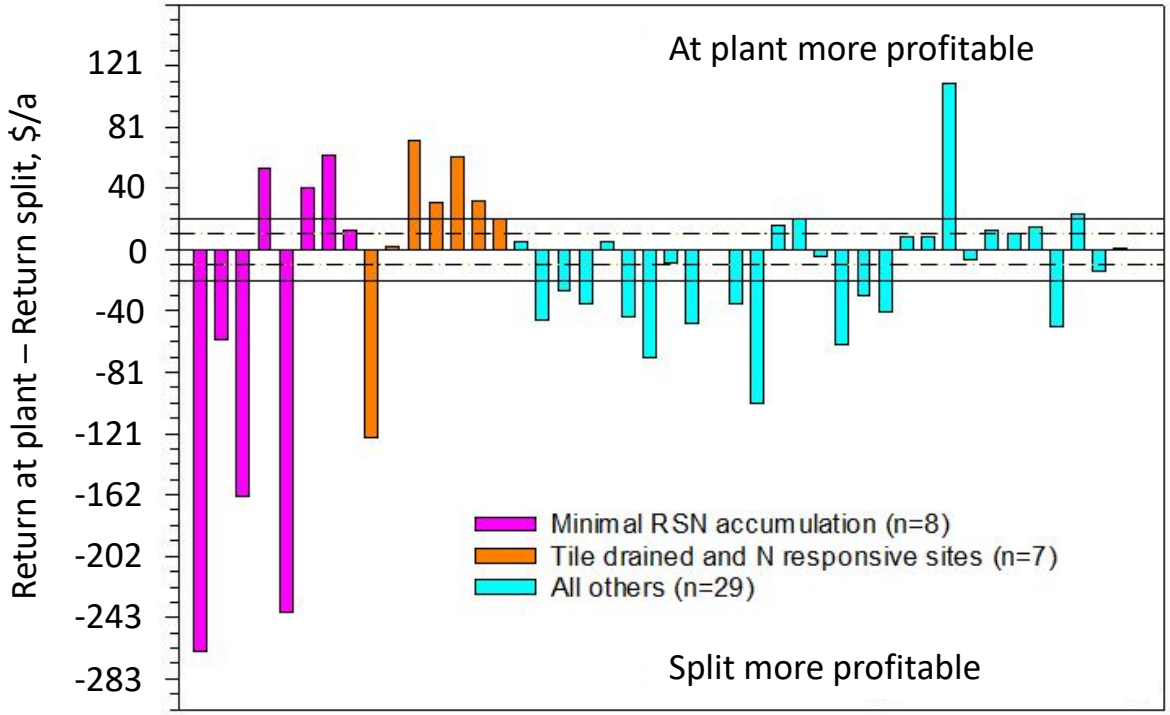
# Split application has slightly lower EONR




- 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)
  - $EONR_{AP} < EONR_{split}$ (n=11)
  - $EONR_{AP} = EONR_{split}$ (n=19)

# 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)
  - AP < Split (n=18)
  - AP = Split (n=10)

# Take Home Points

- Split applications do not necessarily result in less potential N loss
  - Time of application influences *when* N loss may occur
- Profitable production resulted in low potential for N loss, regardless of application timing
  - Split applications may be more profitable on poorly drained and excessively drained soils
  - At plant applications were more profitable on tile drained soils
- NUE can vary substantially at the EONR
  - NUE may be useful to compare management practices in a field, but should not be used to target a value that would be considered a nutrient management success
- Continued efforts to refine N rate decision making tools and increase grower adoption are necessary to improve water quality
  - N management tools should be considered successful if they limit over application by ~25 lb N/a

Department of Soil Science
UNIVERSITY OF WISCONSIN–MADISON

# Thank you!

**Carrie Laboski**
laboski@wisc.edu
608-263-2795 @NPKetc

www.NPKetc.soils.wisc.edu
http://ipcm.wisc.edu/
https://youtube.com/user/uwipm