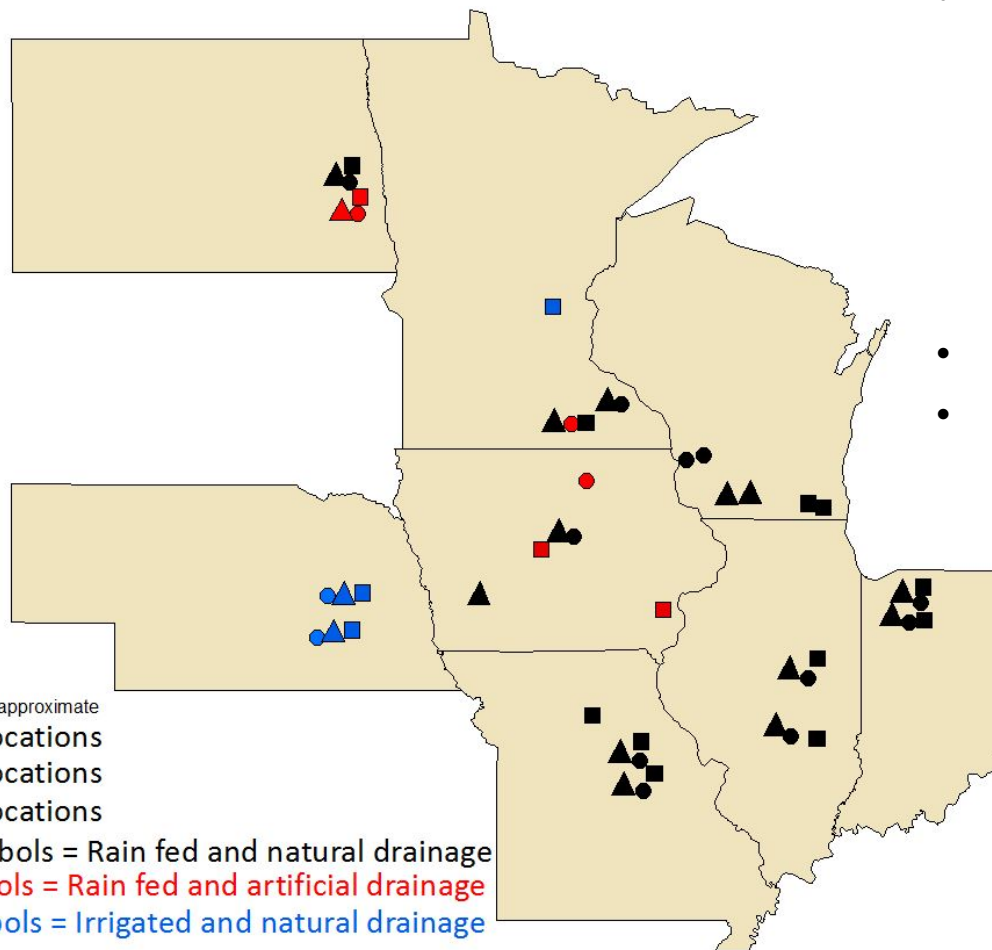# NUE and potential environmental outcomes associated with N application timing for corn

Carrie Laboski, Chris Bandura,

J. Camberato, P. Carter, R. Ferguson, F. Fernendez,

D. Franzen, N. Kitchen, E. Nafziger, J. Sawyer, J. Shanahan

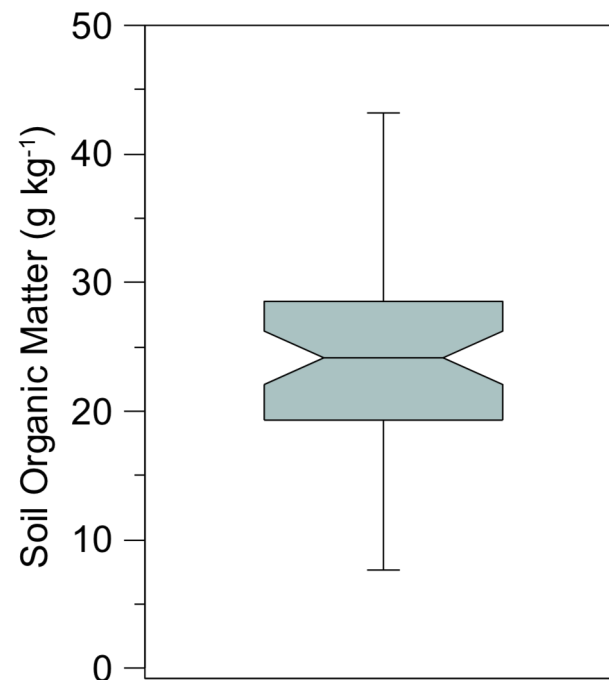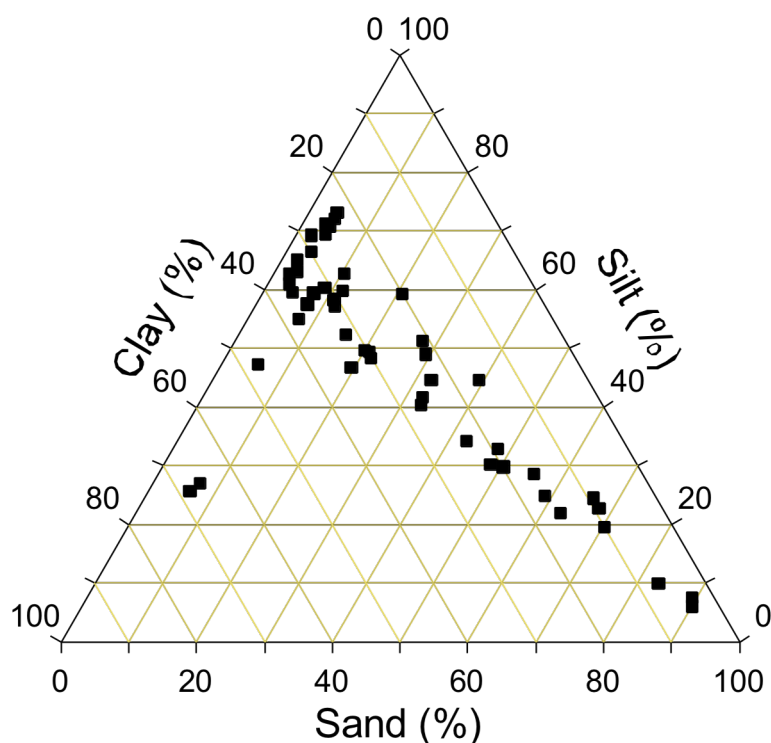Wisconsin Agribusiness Classic, 1/17/19

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

Locations are approximate
- ● 2014 Locations
- ▲ 2015 Locations
- ■ 2016 Locations

Black symbols = Rain fed and natural drainage
Red symbols = Rain fed and artificial drainage
Blue symbols = Irrigated and natural drainage

Research funded by Pioneer

Very brief summary of soil characteristics

Natural drainage class ranged from poorly to excessively drained
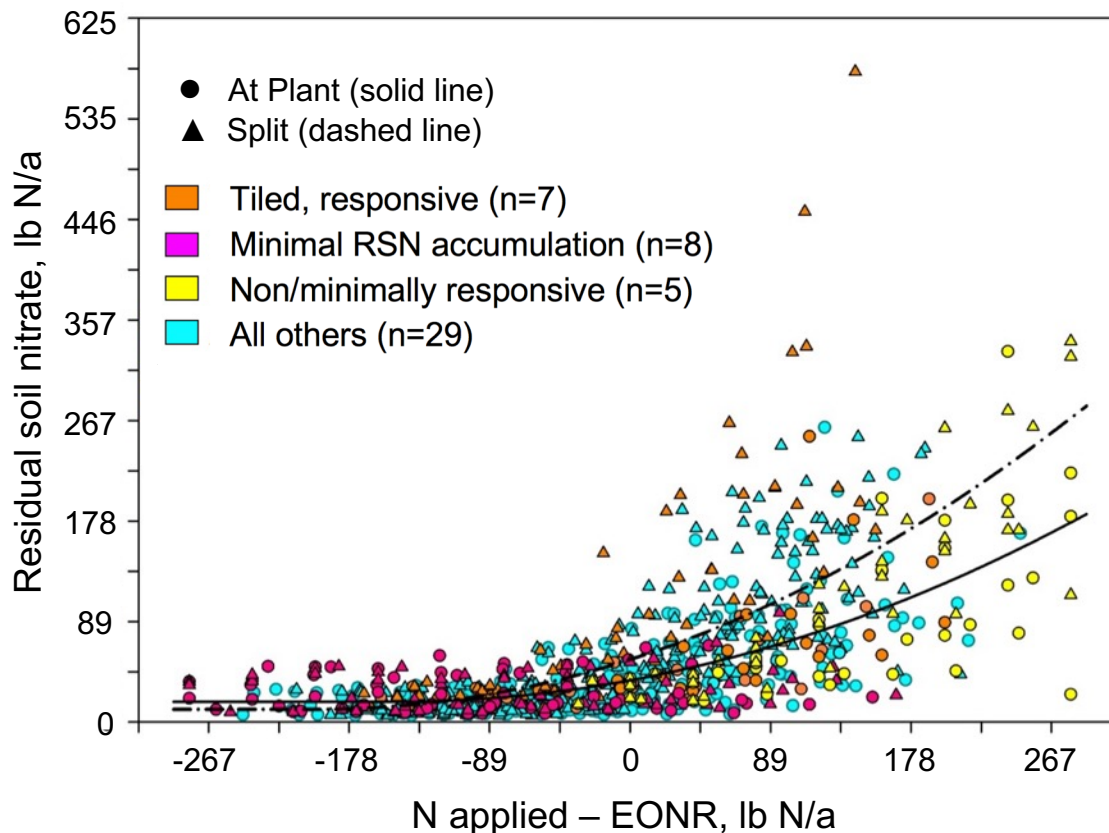
Yield Response to N and EONR
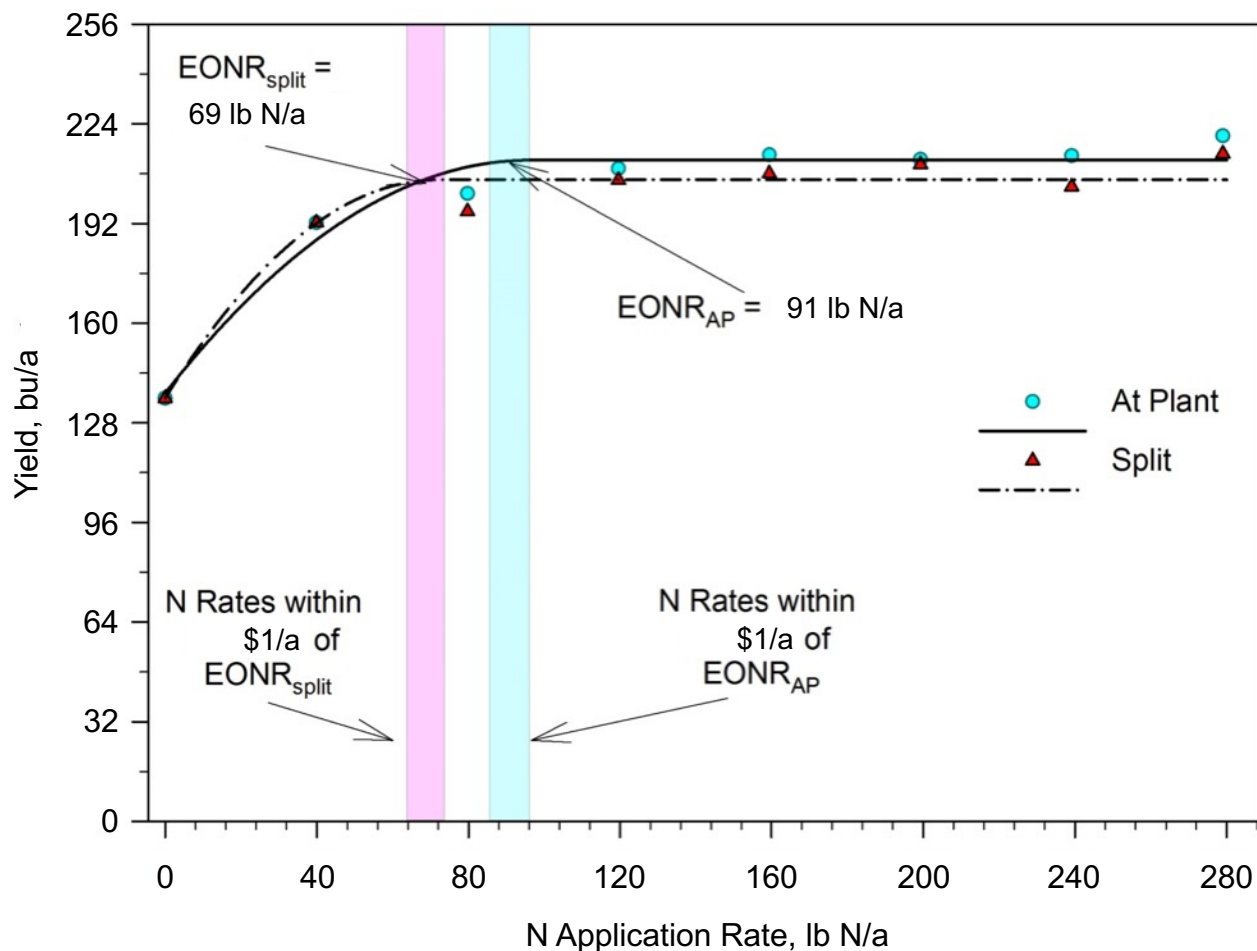
Study average: Profitability within \$1/a of EONR = EONR $\pm$ 9 lb N/a
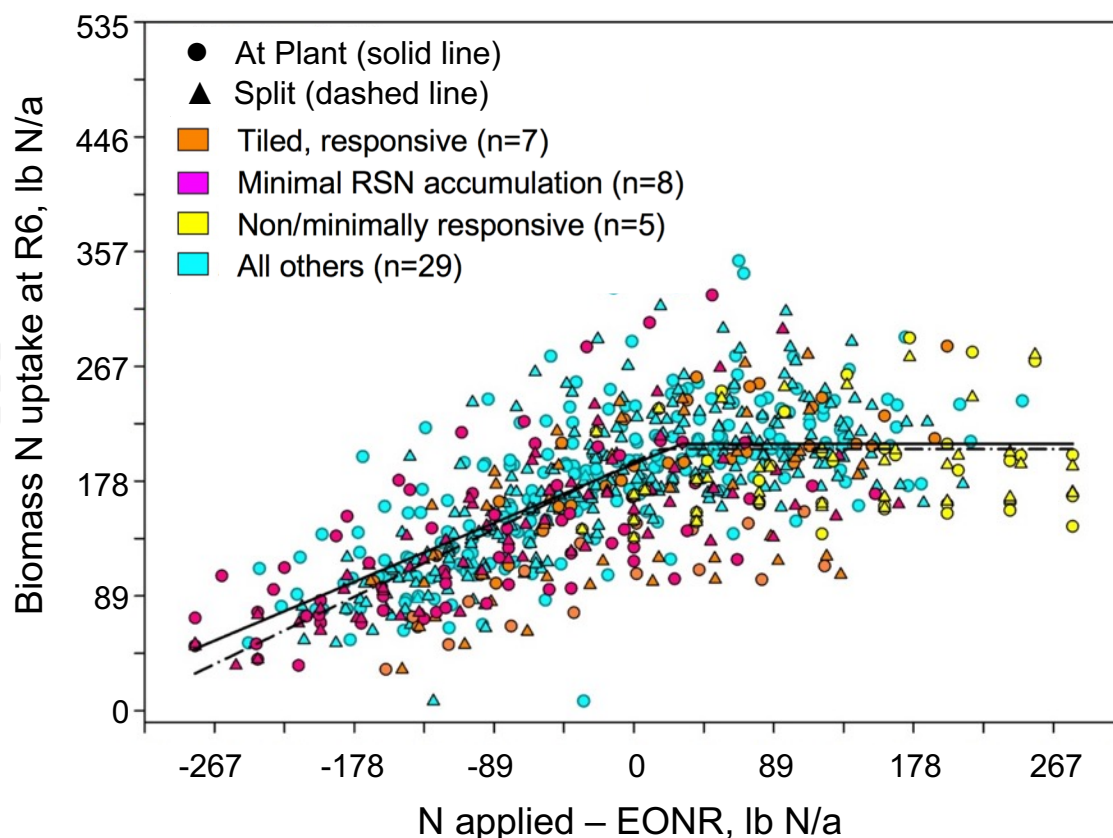
How does N application timing effect RSN?

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)
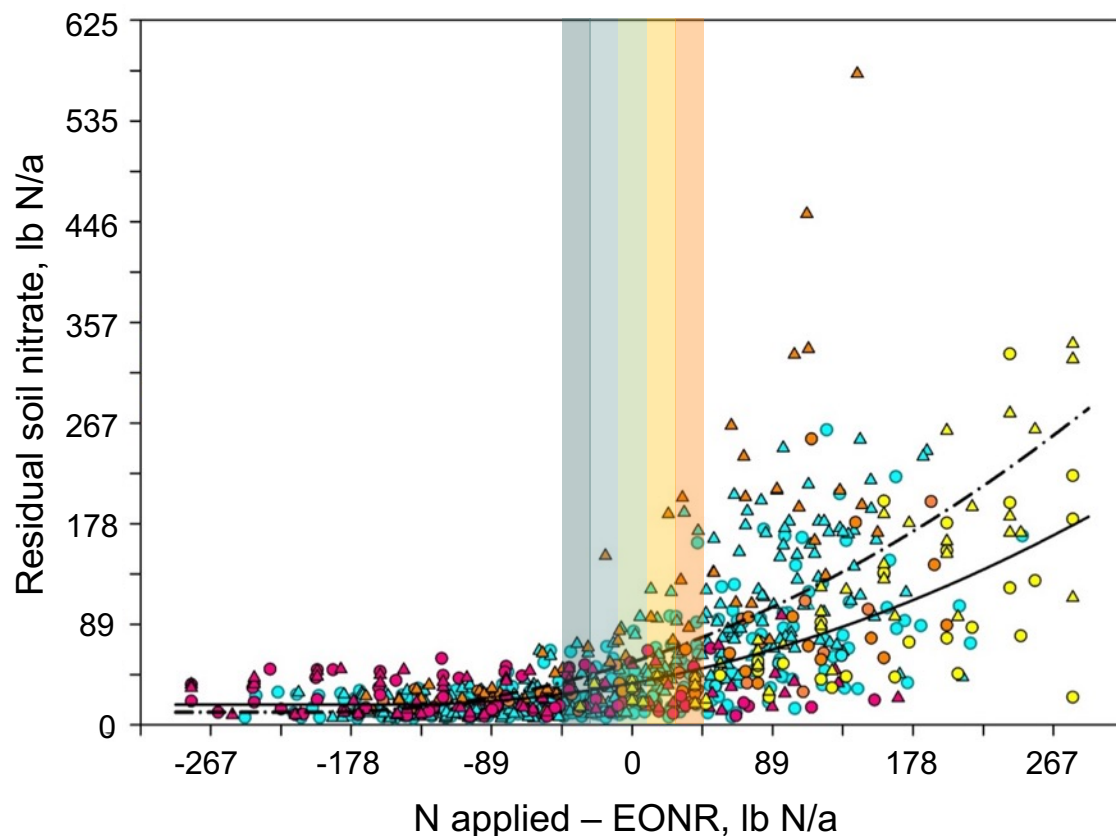
PPNT background = 50 lb/a
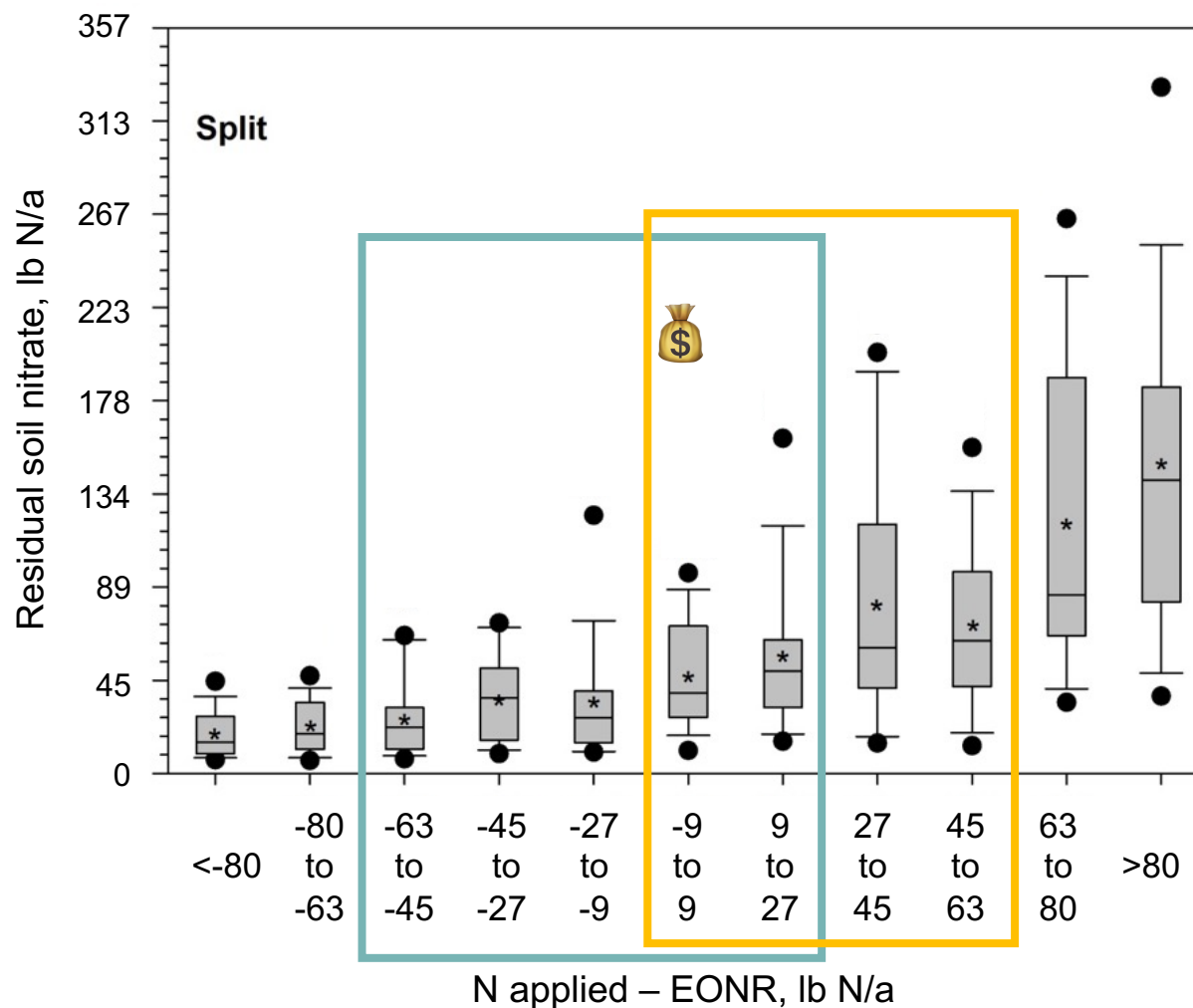
No difference in biomass N uptake at EONR

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
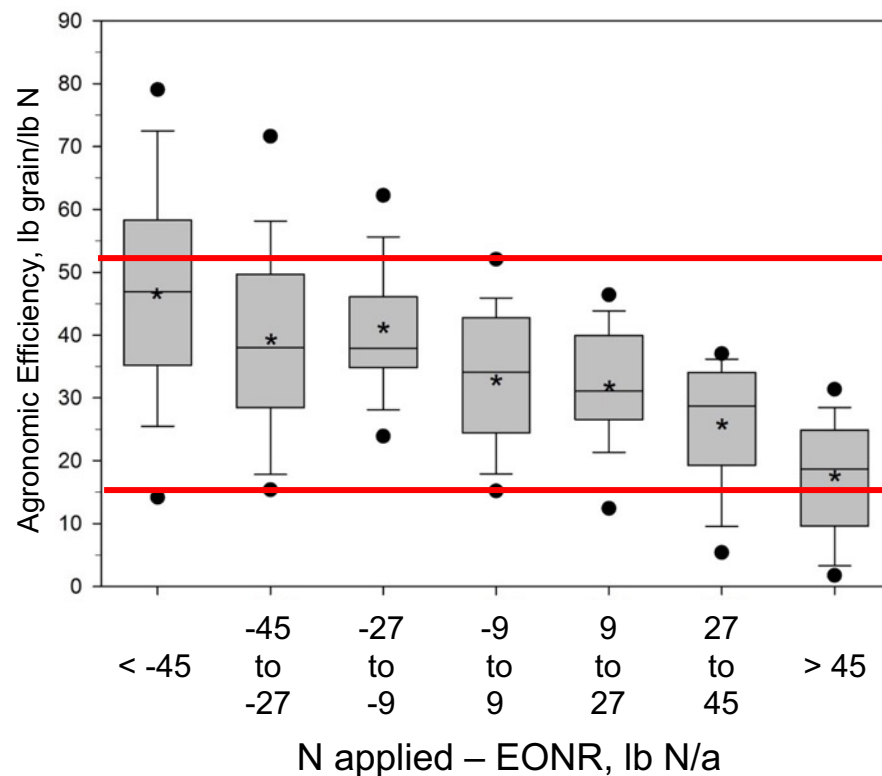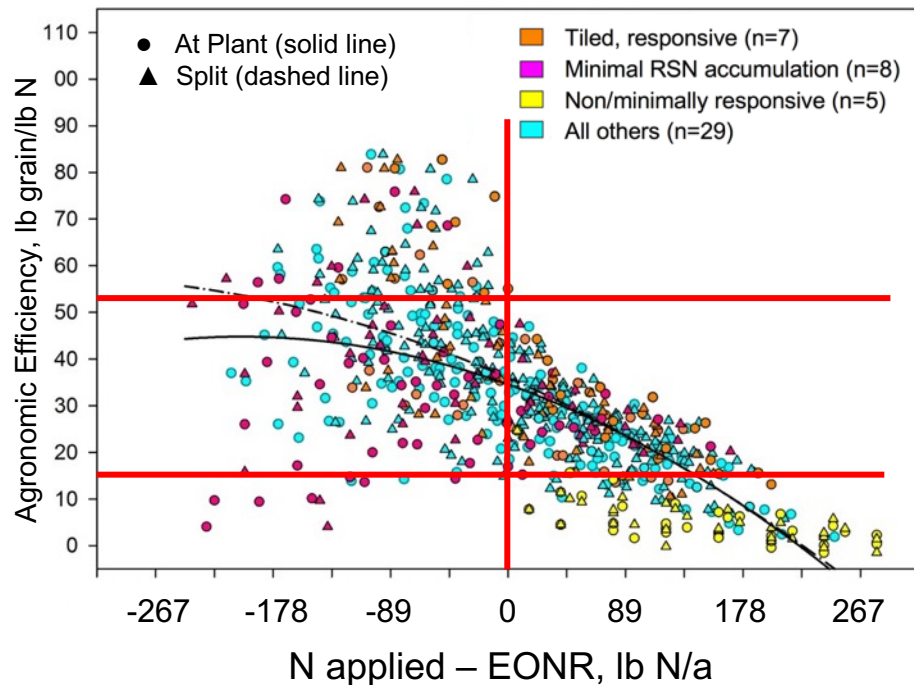
How does N timing effect N use efficiency?

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

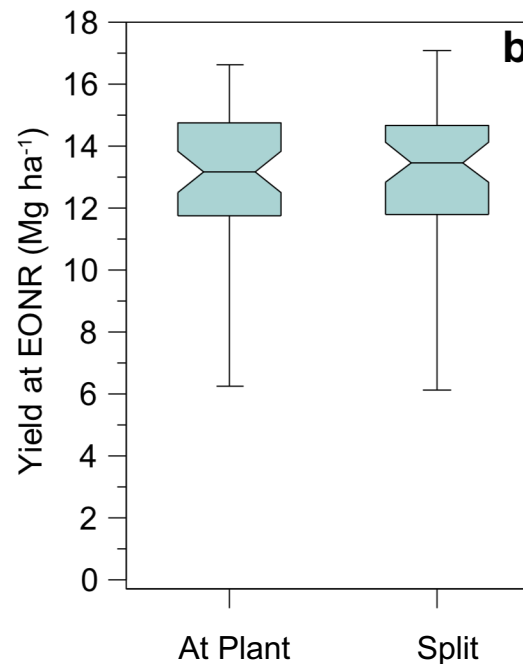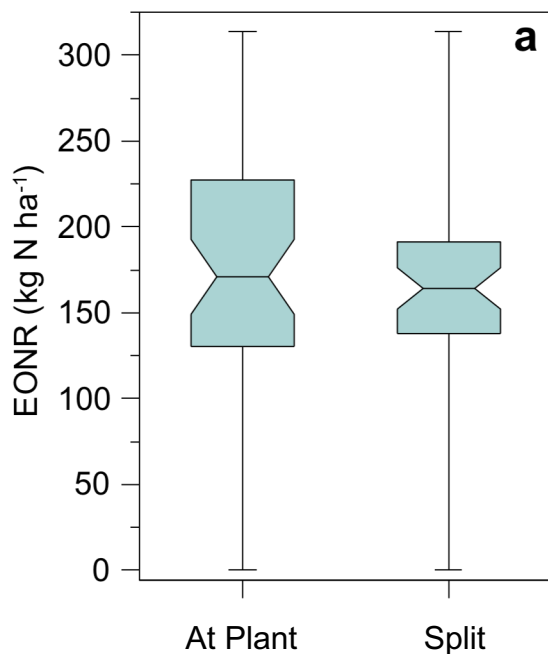# Timing does not effect NUE at the EONR NUE highly variable

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

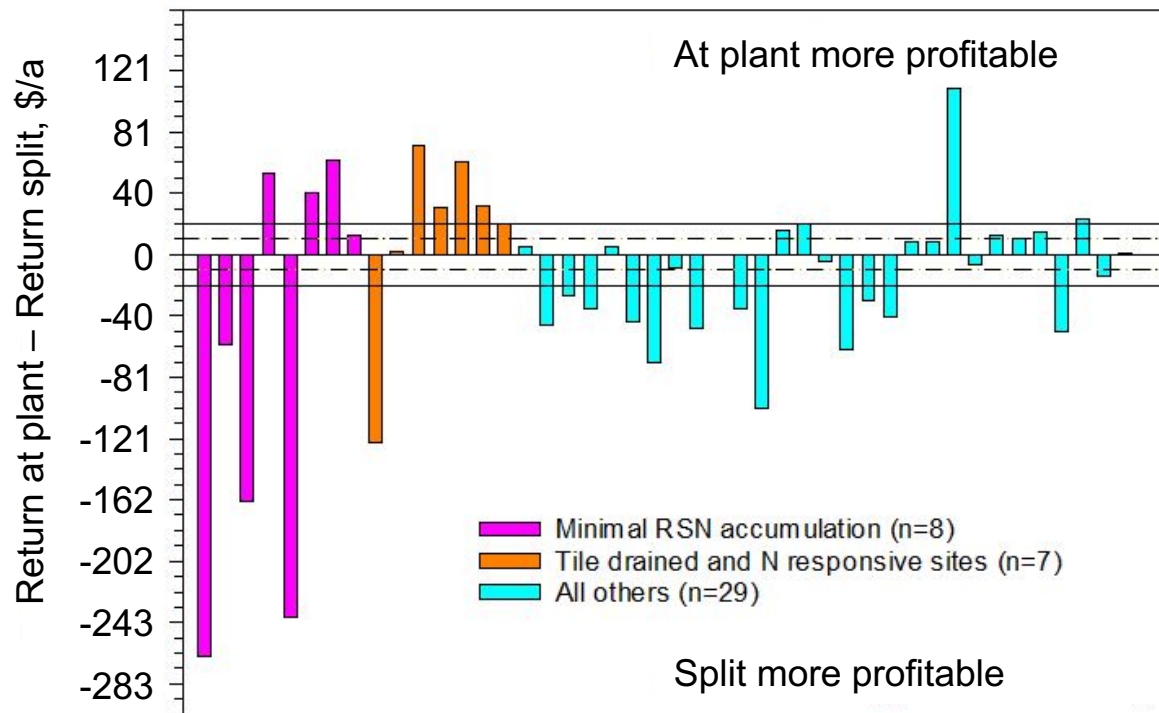# How does N timing influence profitability?

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

Thank you!

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