

# **In-Situ Soil Nitrogen Mineralization in Response to Nitrogen Management for Corn and Soybean in Poorly Drained Soils With and Without Tile-Drainage**

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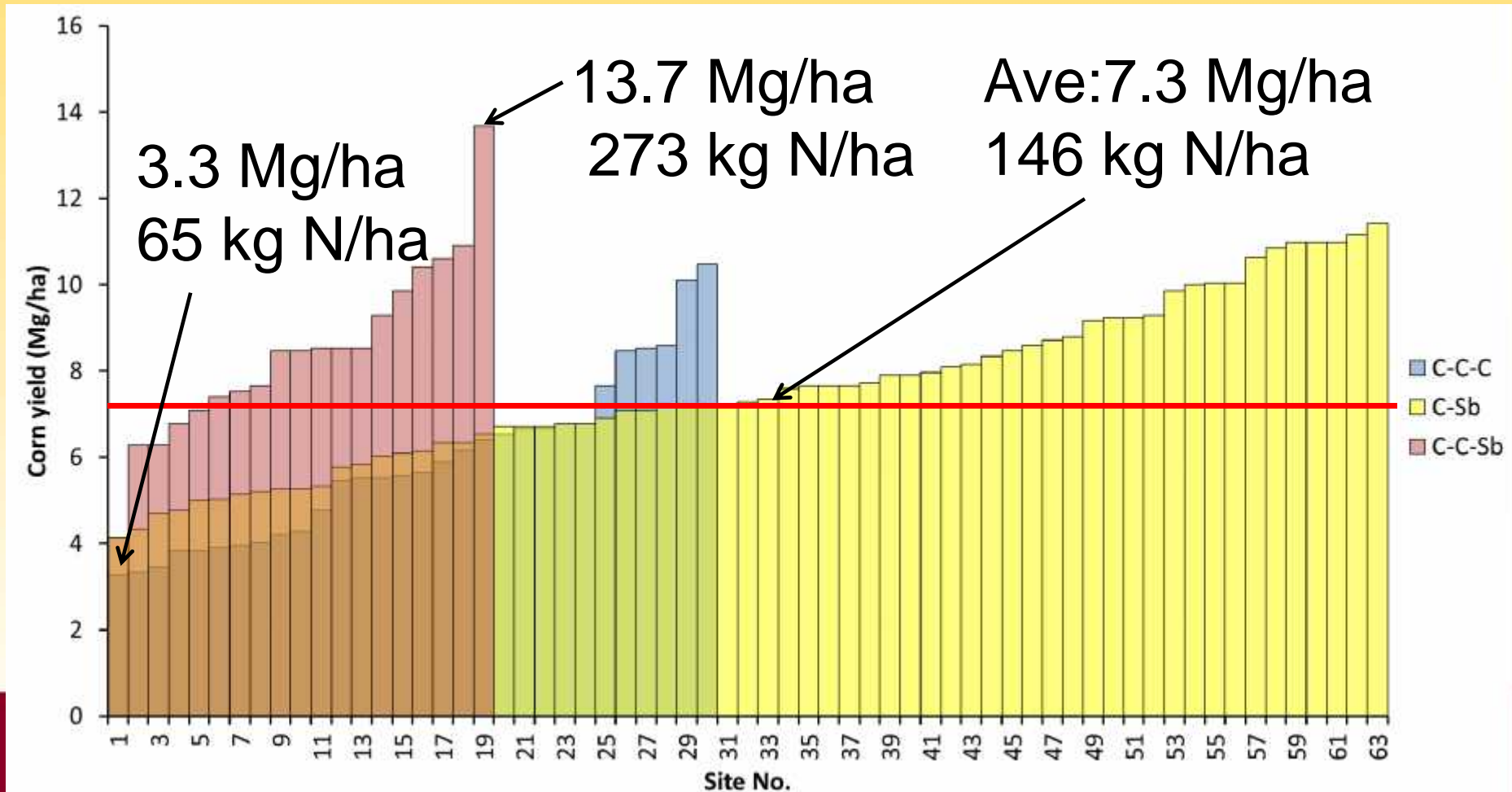


**UNIVERSITY OF MINNESOTA**

**Driven to Discover<sup>SM</sup>**

# How Much Yield Can We Get Through Mineralization in MN?

Percent of Corn Yield at EONR Obtained from the 0-N Check 53% C-C, 71% C-S



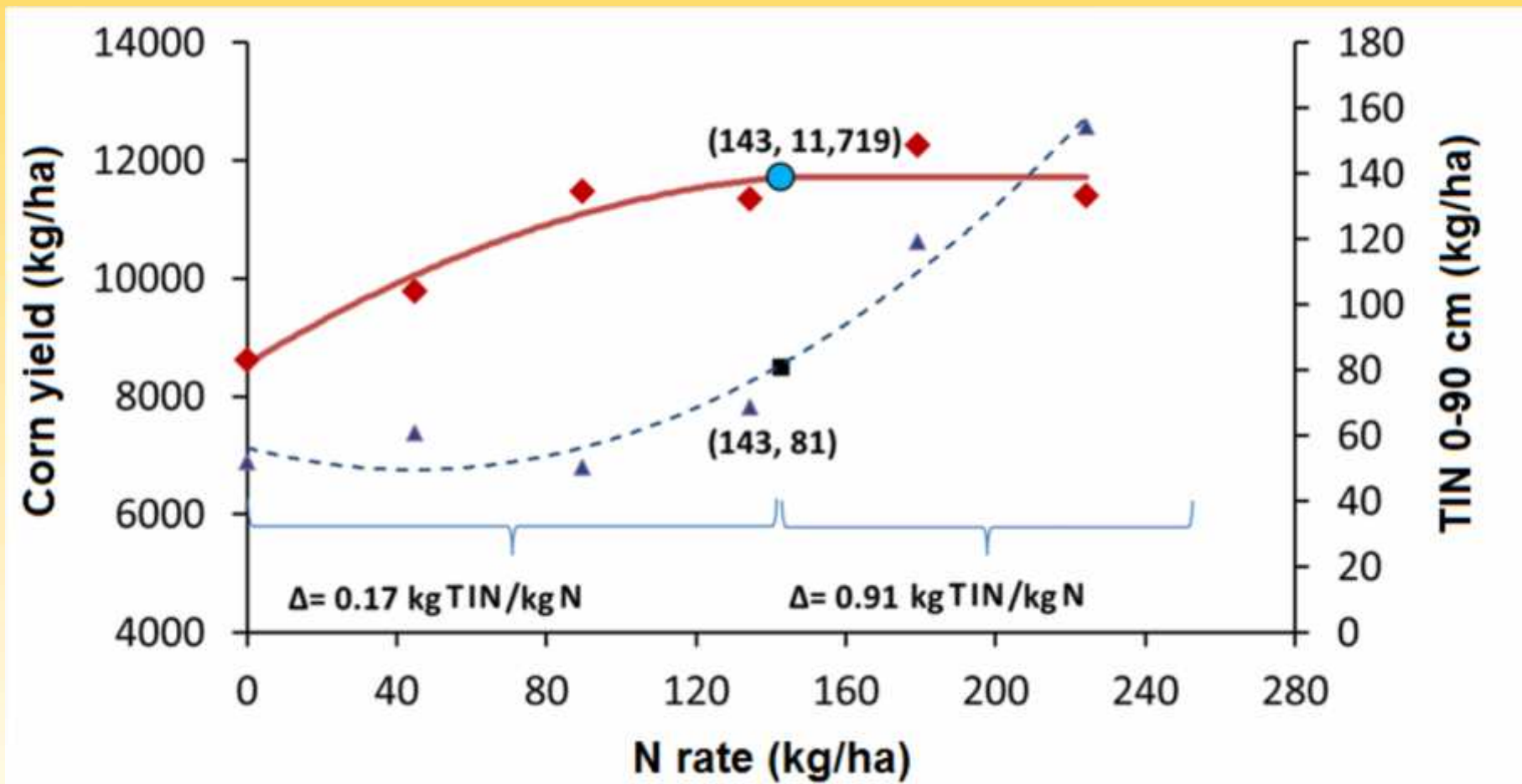
# After 4 Years of Constant Management in a Sandy Loam with 4.6% SOM



| N rate<br>kg ha <sup>-1</sup> | Corn-Corn  | Corn-Soybean | Soybean-Corn |
|-------------------------------|--|--------------|--------------|
|                               | mg NO <sub>3</sub> <sup>-</sup> -N L <sup>-1</sup> |              |              |
| <b>0</b>                      | <b>8.8d</b>  | <b>19.7d</b> | <b>10.6c</b> |
| <b>135</b>                    | 28.2c  | 42.9c        | 10.9c        |
| <b>180</b>                    | 37.2b  | 46.6bc       | 15.6b        |
| <b>225</b>                    | 42.7ab   | 55.8a        | 25.0a        |
| <b>270</b>                    | 44.3a  | 53.6ab       | 15.8b        |
| <b>Mean</b>                   | 32.2   | 43.7         | 15.6         |

| N rate<br>kg ha <sup>-1</sup> | Corn-Corn   | Corn-Soybean | Soybean-Corn |
|-------------------------------|---|--------------|--------------|
|                               | kg NO <sub>3</sub> <sup>-</sup> -N ha <sup>-1</sup> |              |              |
| <b>0</b>                      | <b>21b</b>  | <b>50c</b>   | <b>26</b>    |
| <b>135</b>                    | 64ab  | 84b          | 25           |
| <b>180</b>                    | 83a   | 92ab         | 39           |
| <b>225</b>                    | 93a   | 113a         | 62           |
| <b>270</b>                    | 100a  | 112a         | 41           |
| <b>Mean</b>                   | 72A   | 91A          | 38B          |

# Optimum N Rate and Residual N





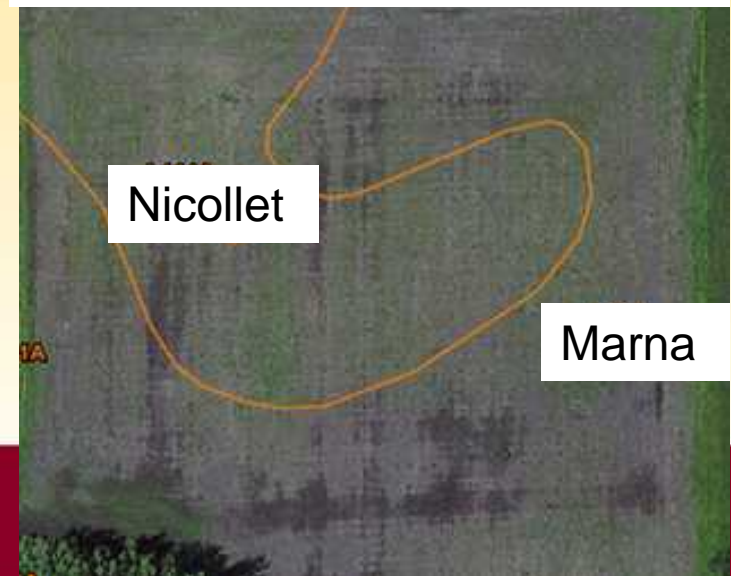
Control  
drainage  
structure

In undrained soil:

- 19% greater TOC (41 vs 35 Mg/ha)
- 18% greater TN (2.9 vs 2.4 Mg/ha)

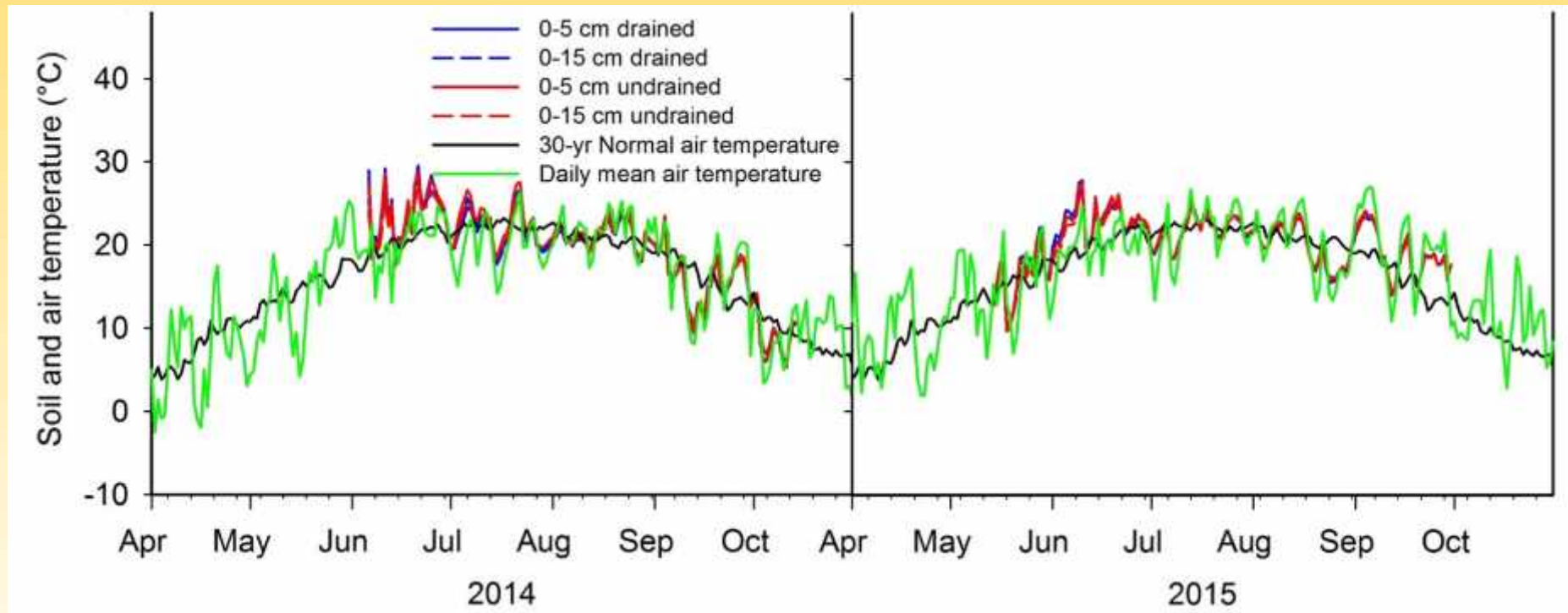


Silty clay loam; 5.3% OM

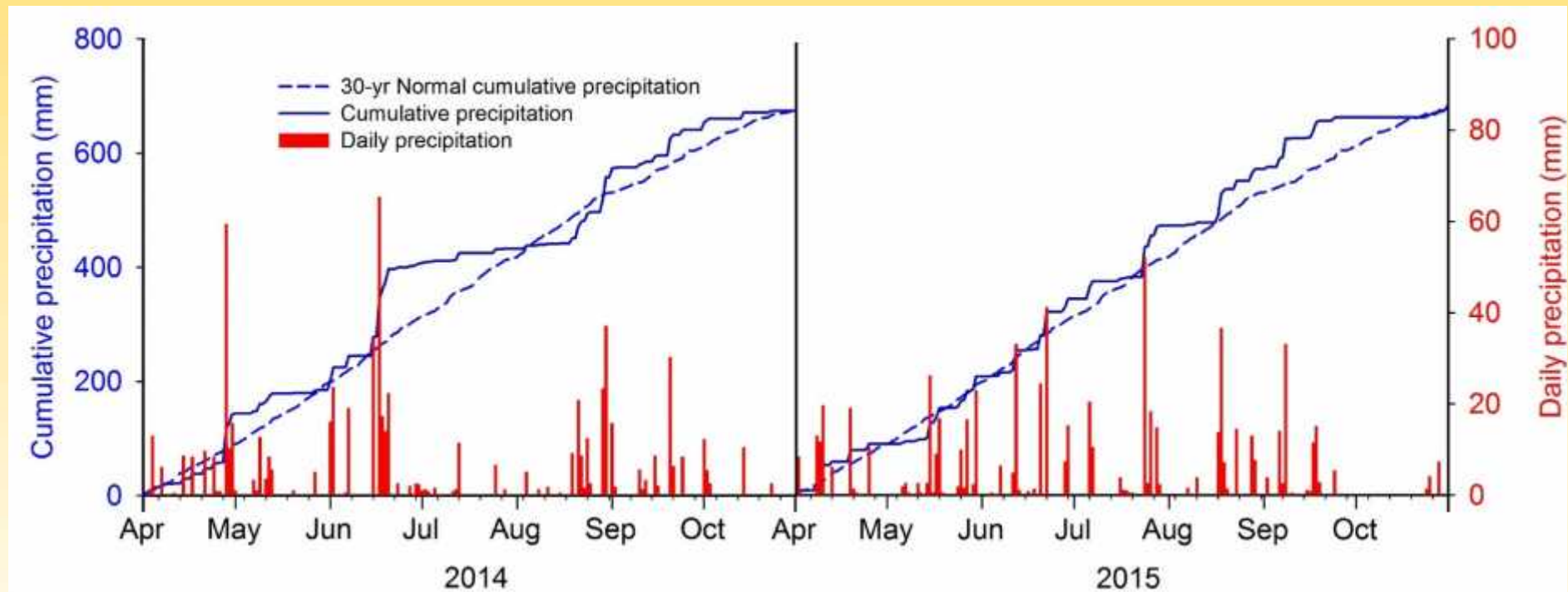




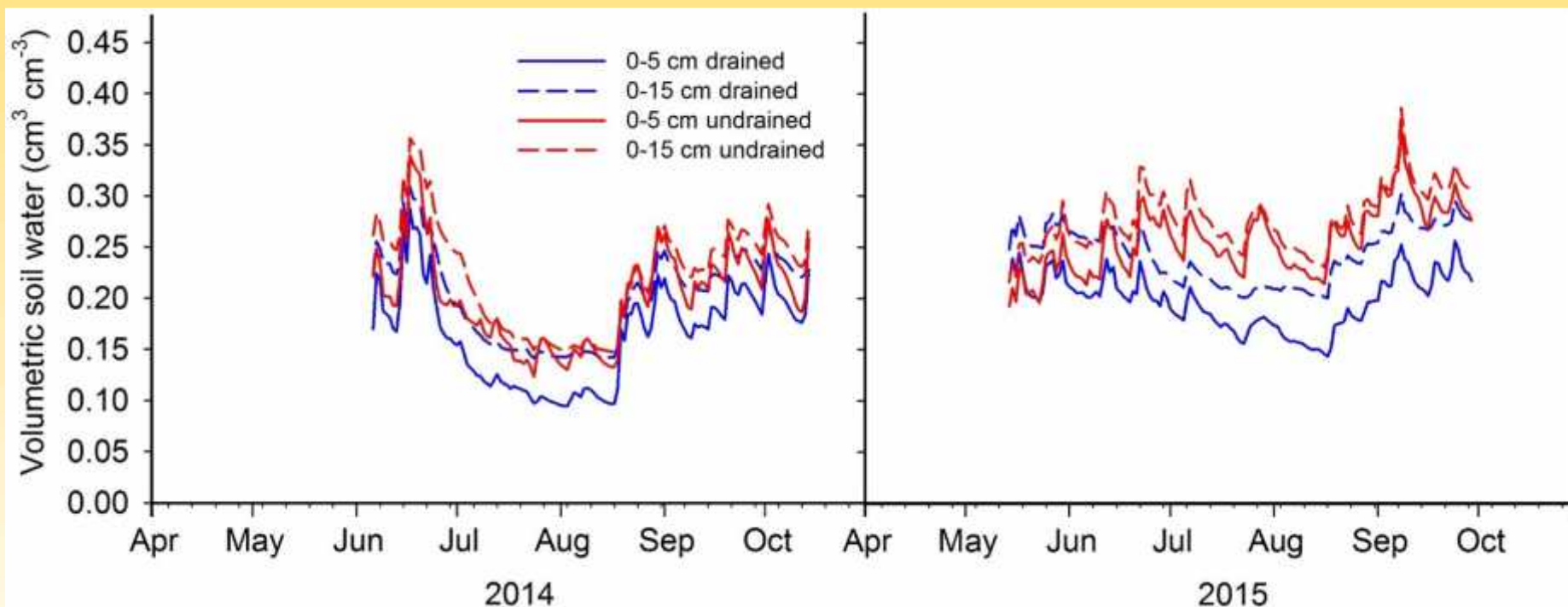
# Soil and Air Temperature at 0-5 and 0-15 cm Soil Depth



# Daily and Cumulative Precipitation and 30-yr Normal Cumulative Precipitation



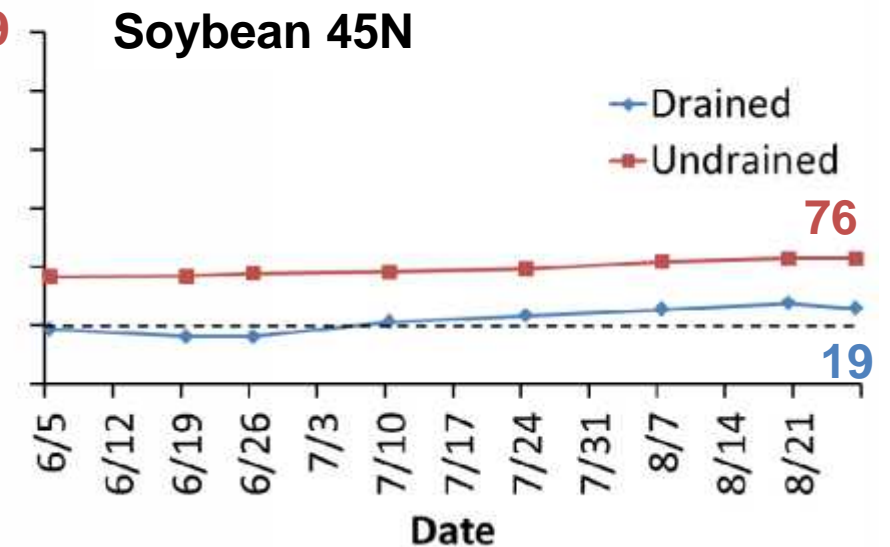
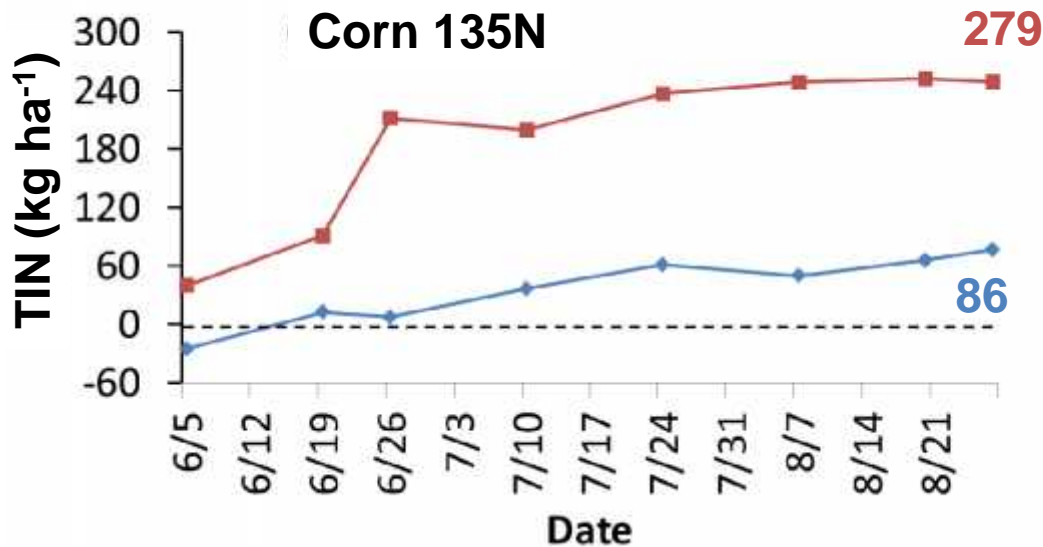
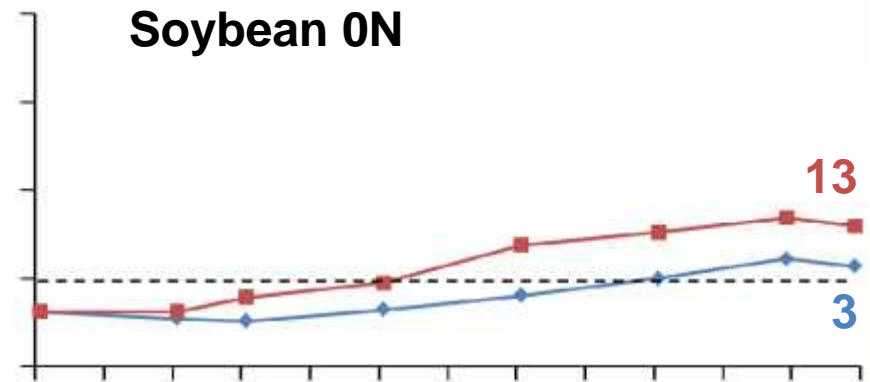
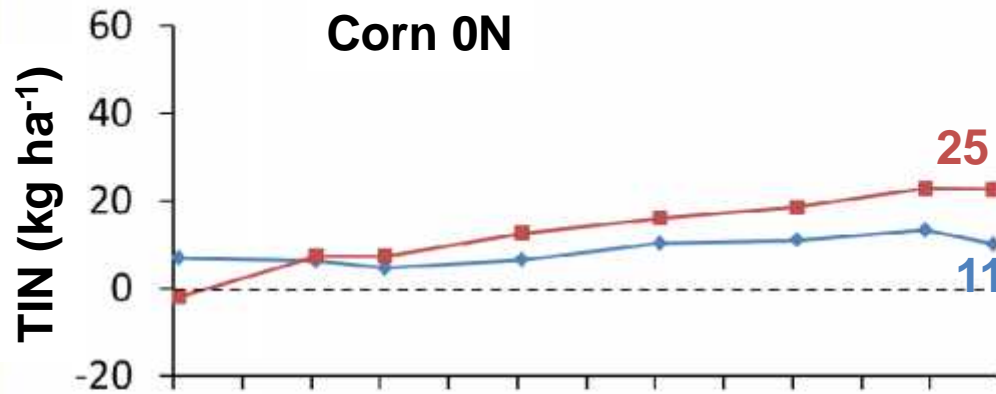
# Volumetric Soil Water Content at 0-5 and 0-15 cm Soil Depth for Drained and Undrained Soils





# 2014

|                              |     |
|------------------------------|-----|
| Adding N in D increase Nmin  | Yes |
| Adding N in UD decrease Nmin | No  |
| Soybean less Nmin than corn  | Yes |
| D greater Nmin than UD       | No  |



# 2015

Adding N in D increase Nmin

Yes

Adding N in UD decrease Nmin

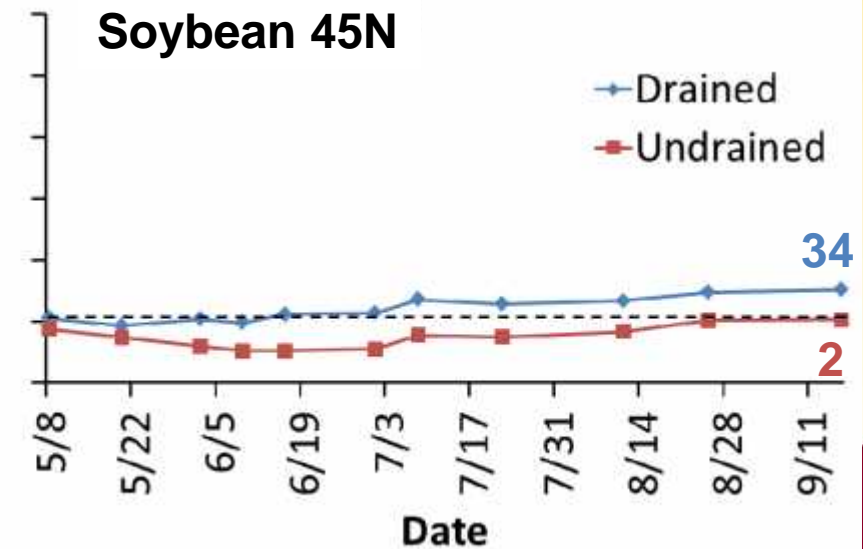
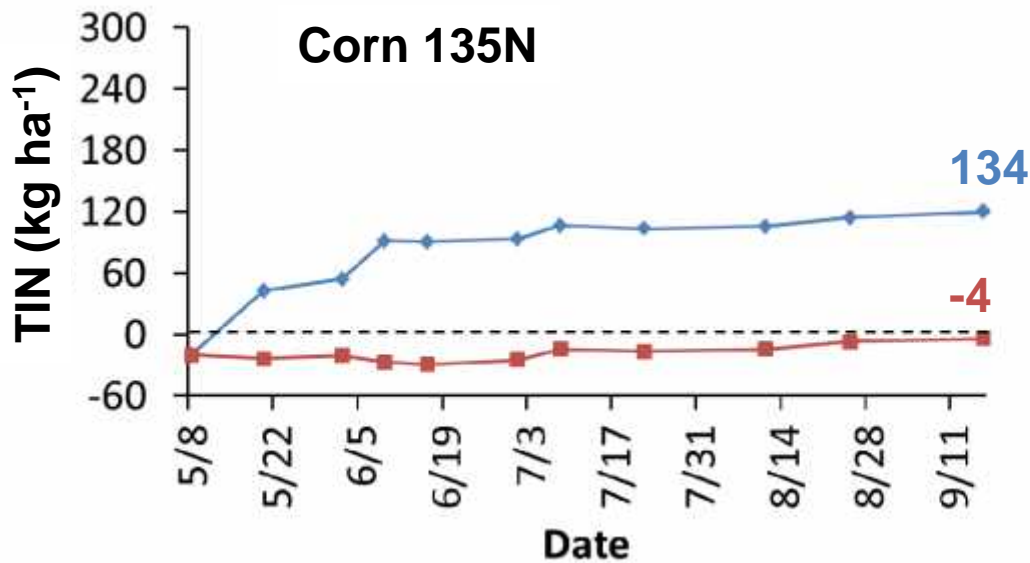
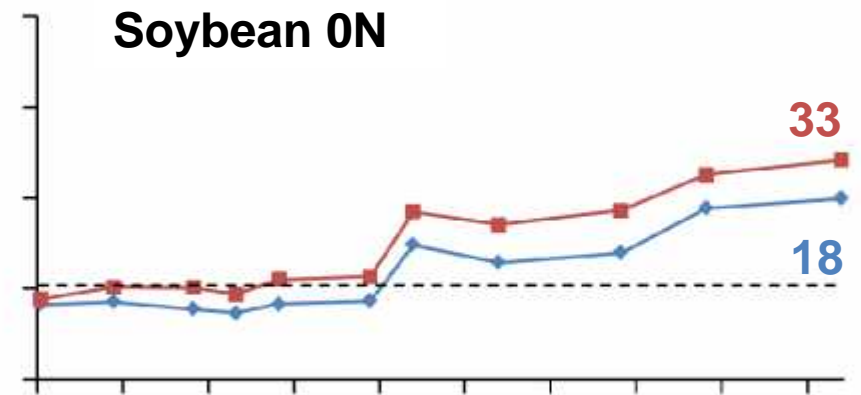
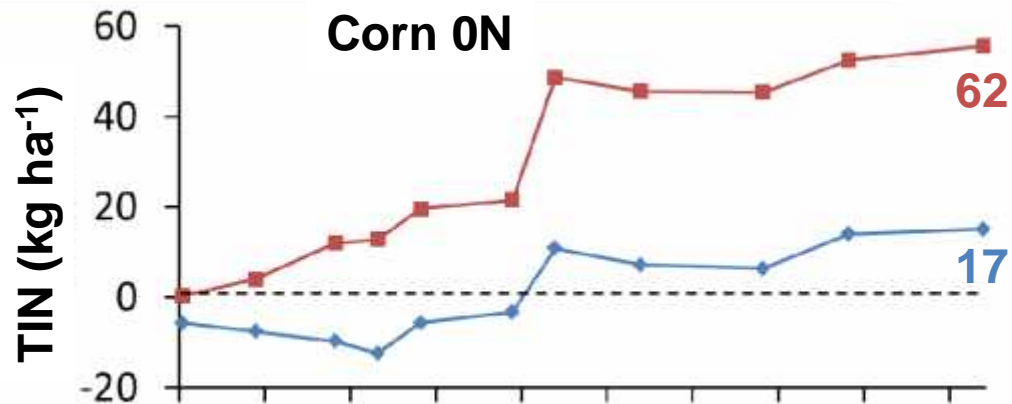
Yes

Soybean less Nmin than corn

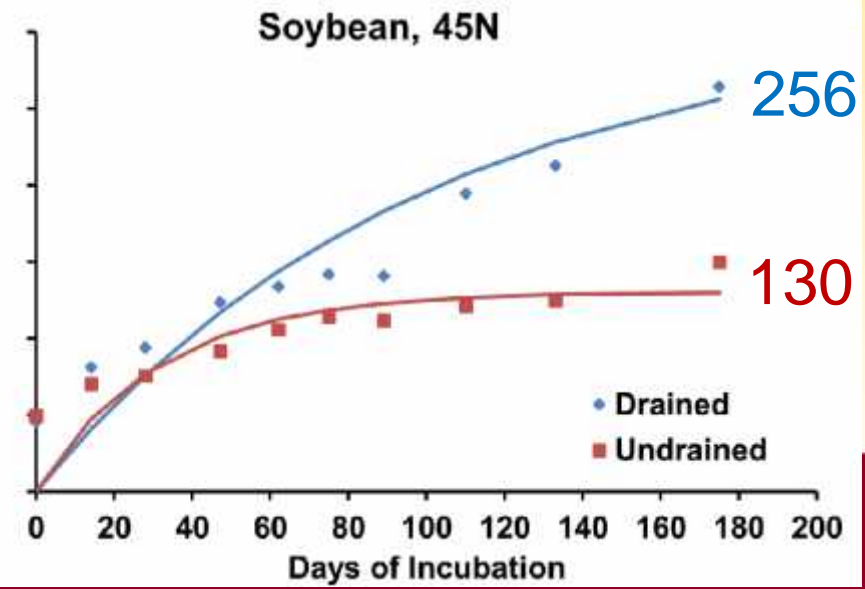
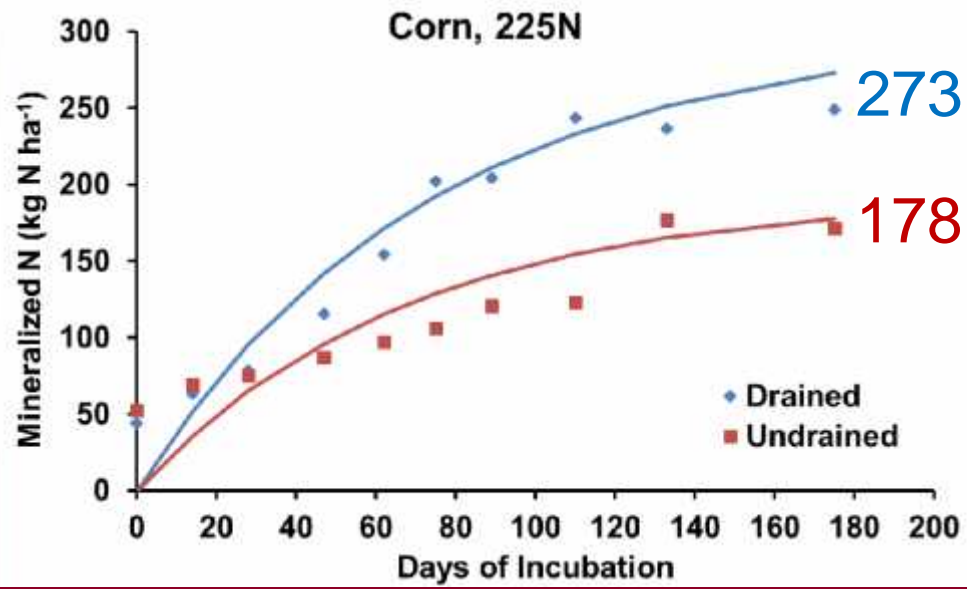
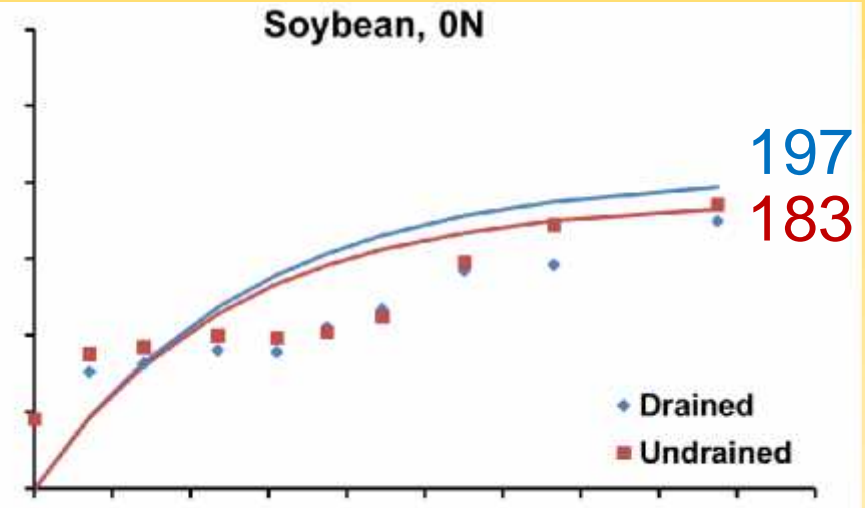
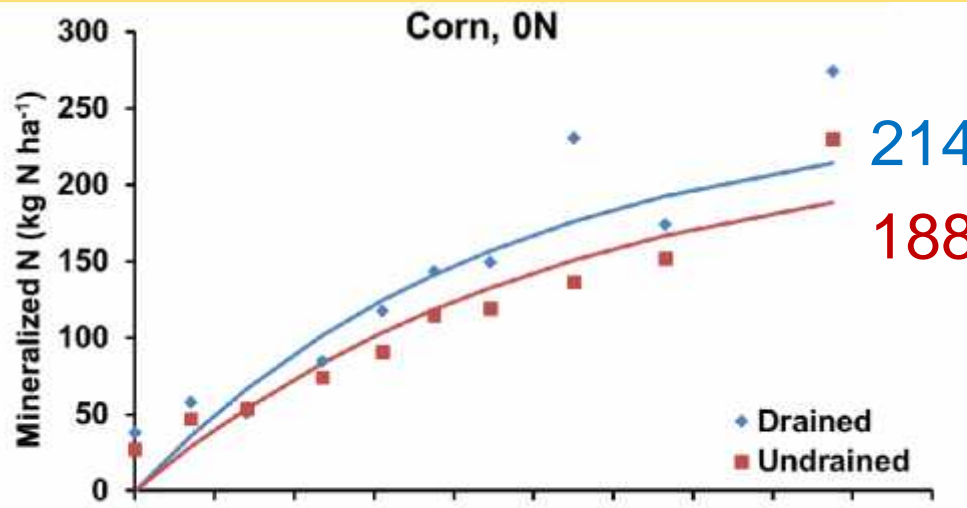
Yes

D greater Nmin than UD

Yes for fert. trt only



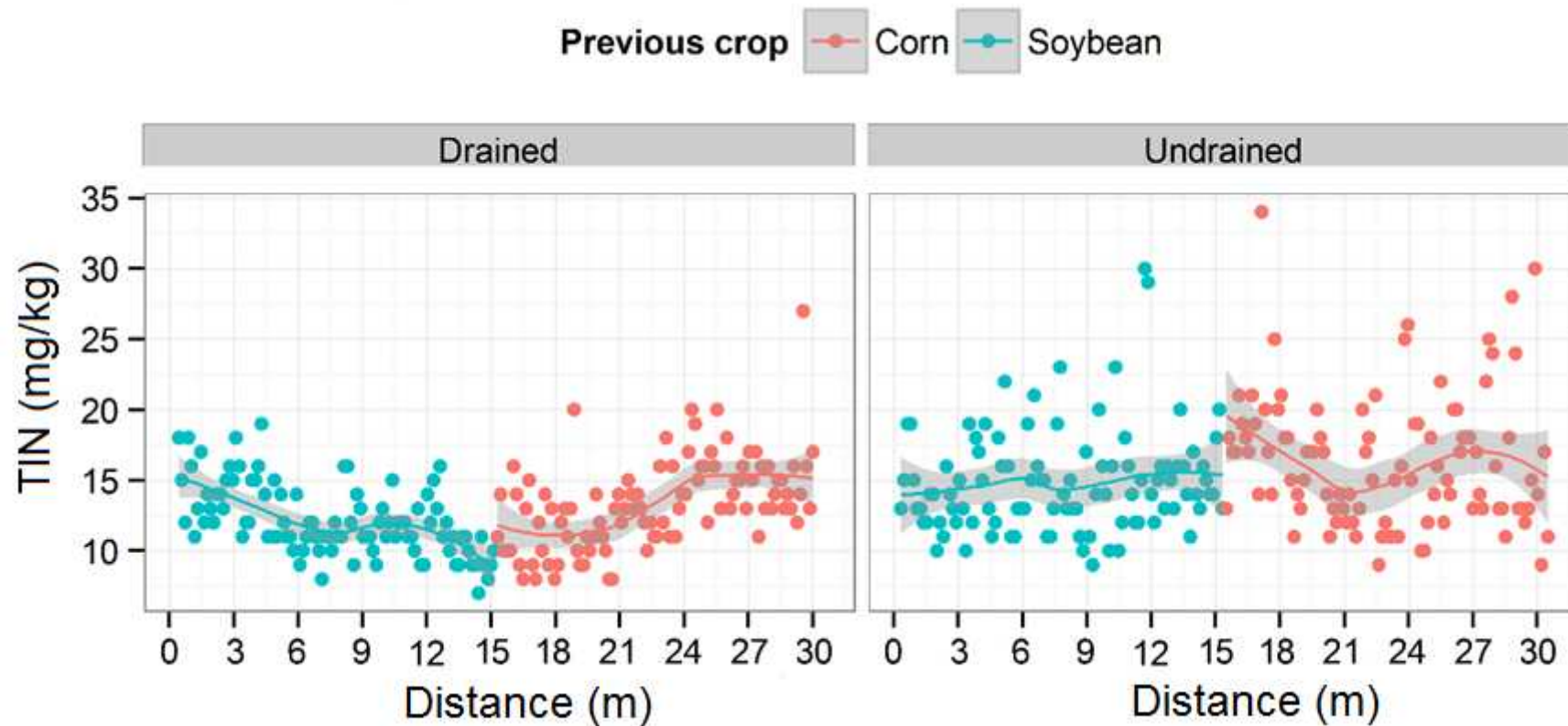
|                              |     |
|------------------------------|-----|
| Adding N in D increase Nmin  | Yes |
| Adding N in UD decrease Nmin | Yes |
| Soybean less Nmin than corn  | Yes |
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## Lab Measurements of Ideal (Potential) May Not Translate Well to Field Conditions

| Crop    | Drainage  | Nitrogen | Lab                            | 2014 | 2015 |
|---------|-----------|----------|--------------------------------|------|------|
|         |           |          | —————kg ha <sup>-1</sup> ————— |      |      |
| Corn    | Drained   | No       | 214                            | 11   | 17   |
|         |           | Fert.    | 273                            | 86   | 134  |
|         | Undrained | No       | 188                            | 25   | 62   |
|         |           | Fert.    | 178                            | 279  | -4   |
| Soybean | Drained   | No       | 197                            | 3    | 18   |
|         |           | Fert.    | 256                            | 19   | 34   |
|         | Undrained | No       | 183                            | 13   | 33   |
|         |           | Fert.    | 130                            | 76   | 2    |





- 400 samples 0-30 cm deep every 15 cm over a 30 m linear transect
- 180 point samples (0-15, 15-30, 30-60 cm) 10-core composite

Overall, 20 samples per hectare are needed to achieve a TIN estimate with 10% error margin at 0.05 significance level



# Summary

- There are many challenges and opportunities around N management
- Quantifying soil N mineralization is not an easy endeavor
- Critically important to improve our understanding of the mineralization process to enhance N management



# Questions?

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