

# Spring Timing and Method of Cereal Rye Termination Influence Soil Nitrate

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## Introduction

Nitrate lost from agricultural fields is costly to farmers, aquatic wildlife, and drinking and recreational water. Cereal rye, a cold-tolerant cover crop, can uptake nitrate from the soil between harvest and crop establishment, when most leaching occurs in Iowa. Farmers can choose from a variety of herbicides and times at which to terminate their cereal rye before the later-planted soybeans; management suites may affect the potential for nitrate retention.

This study aims to determine 1) effects of two types of herbicides and 2) effects of termination timing on soil nitrate-N and yield.

## Materials & Methods

### Two herbicides used for rye termination

- Glyphosate (RoundUp), a systemic herbicide
- Paraquat (Gramoxone), a contact herbicide

### Two timings of rye termination

- Early termination: coincides with termination before corn (at least 10 days before corn seeding), and ~30 days before soybean seeding
- Late termination: several days before soybean is seeded

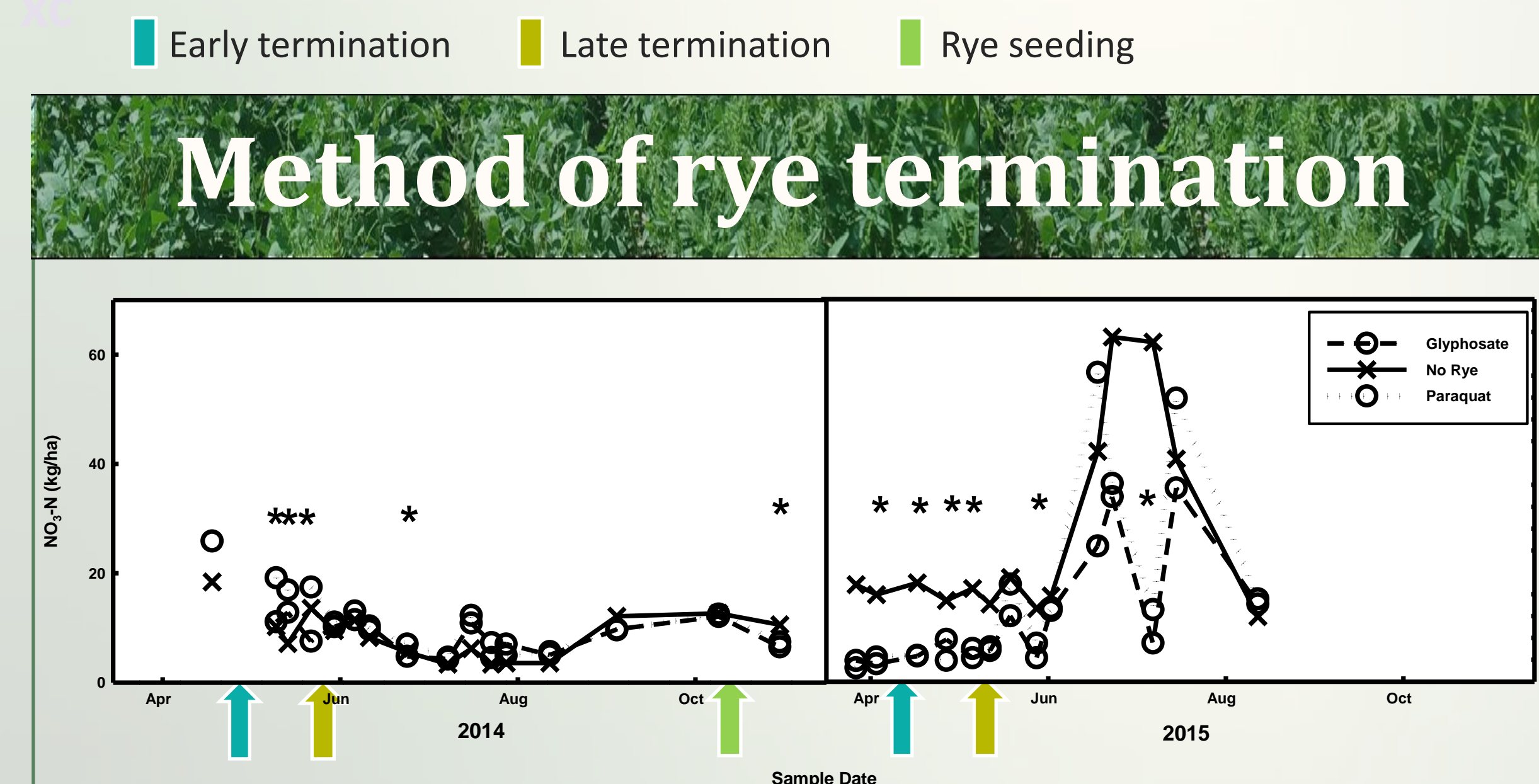
### Soil sampling

- Soil cores were taken to 30-cm depth for soil nitrate-N concentrations

### Rye litter decomposition

- Cereal rye decomposition and loss of total nitrogen was measured with the treatments used in this study
- Rye shoots were placed in mesh bags on the field surface to simulate decomposing litter
- Rye roots were sampled with a wide-core probe to 20 cm

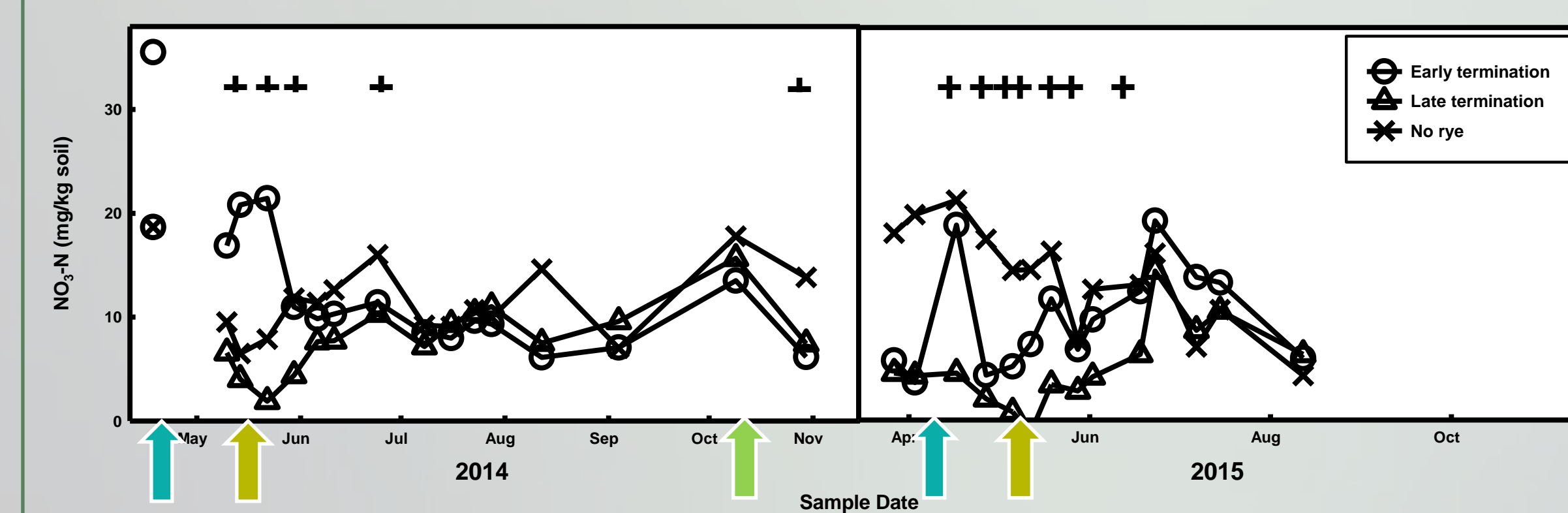
## Results



**Figure 1.** Soil nitrate-N as a function of herbicide type in a continuous corn system. Significant differences: asterisks (\*), effect of herbicide.

- In 2014, Paraquat-terminated rye increased soil nitrate after termination in both soy and corn plots, but this trend did not continue in 2015.
- Well-established rye decreased soil nitrate in 2015 compared to bare plots.
- Crops following corn had overall lower nitrate concentrations than crops following soybean, despite higher fertilization

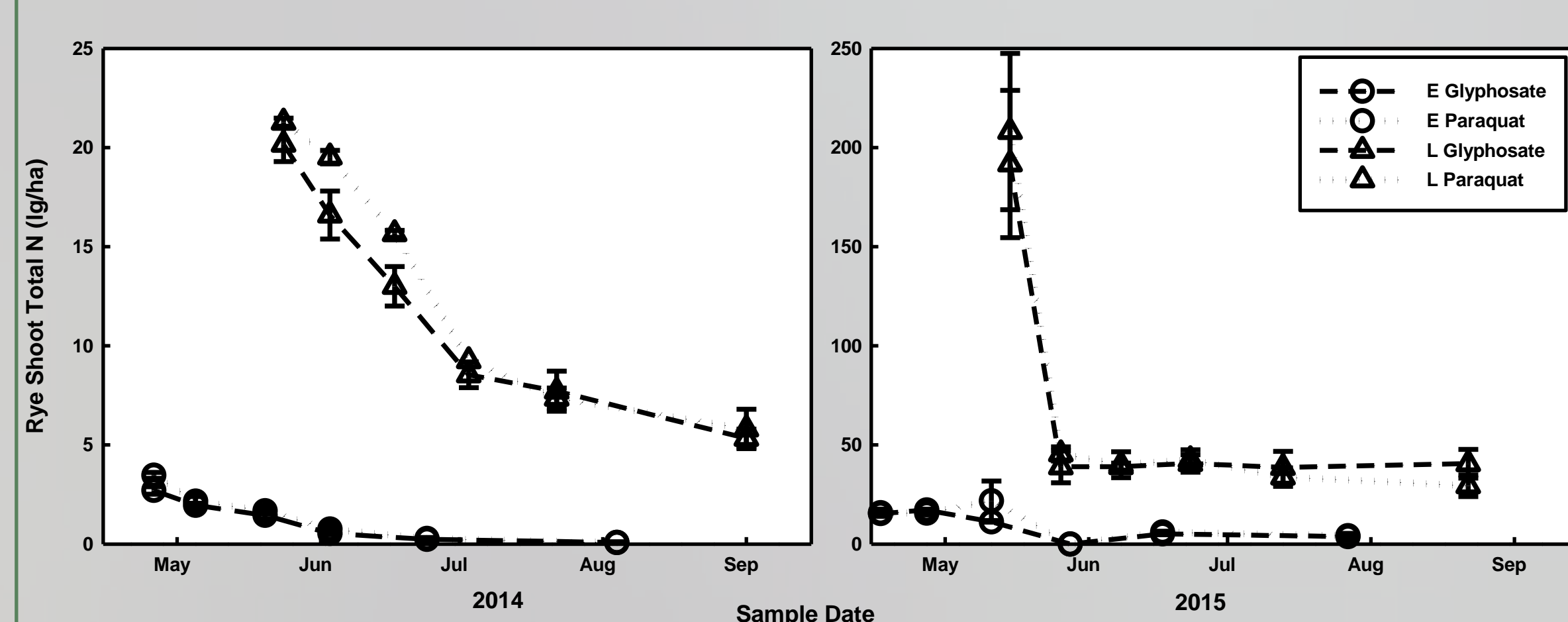
## Timing of rye termination



**Figure 3.** Soil nitrate-N as a function of time of termination and herbicide in soy. Significant differences: crosses (+), effect of termination timing.

- Successful establishment of rye in the Fall of 2014 likely lead to significantly lower nitrate levels in rye plots in 2015
- Late-terminated rye significantly reduced soil nitrate both years following termination
- In 2014, paraquat heightened the effects of timing on nitrate, but did not affect timing in 2015

## Rye Decomposition



**Figure 4.** Shoot total nitrogen as a function of herbicide type and termination time in soy.

- Rye biomass and nitrogen uptake was significantly higher at the late termination date, and decomposed more slowly
- Herbicide treatment did not affect shoot nitrogen loss

## Discussion

Differences in soil nitrate between early-, late-terminated rye, and bare plots are greatest in the spring, when most nitrate is lost from fields in Iowa. Terminating rye at a later date before soybean slows the movement of nitrogen from decomposing rye back to the soil.

In 2014, paraquat induced a speedier release of nitrogen from decomposing rye, and heightened a faster rate of nitrogen loss from early terminated rye plots. This trend was not seen in 2015, possibly because large rye biomass increased variation.

Rye was not well-established at the beginning of 2014, which may have led to plots without rye having low nitrate concentrations. Well-established rye in fall 2014 reduced soil nitrate in rye plots at that time, and the trend continued in the following spring. The greater rye grew before termination, the more nitrogen retained was retained by decomposing rye after 100 days.

Both corn and soybean yields were well below the county average in 2014, and may have been due to no-till being established in plots only one year prior to initiation of the experiment.

## Future Analysis

Kristina Craft is conducting a concurrent study exploring nitrate leaching as a function of soil moisture and rye cover.

## Acknowledgements

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