

# **Cover crop N uptake and decomposition**

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## Implementation of cover crops in no-till corn and soybean systems in Nebraska

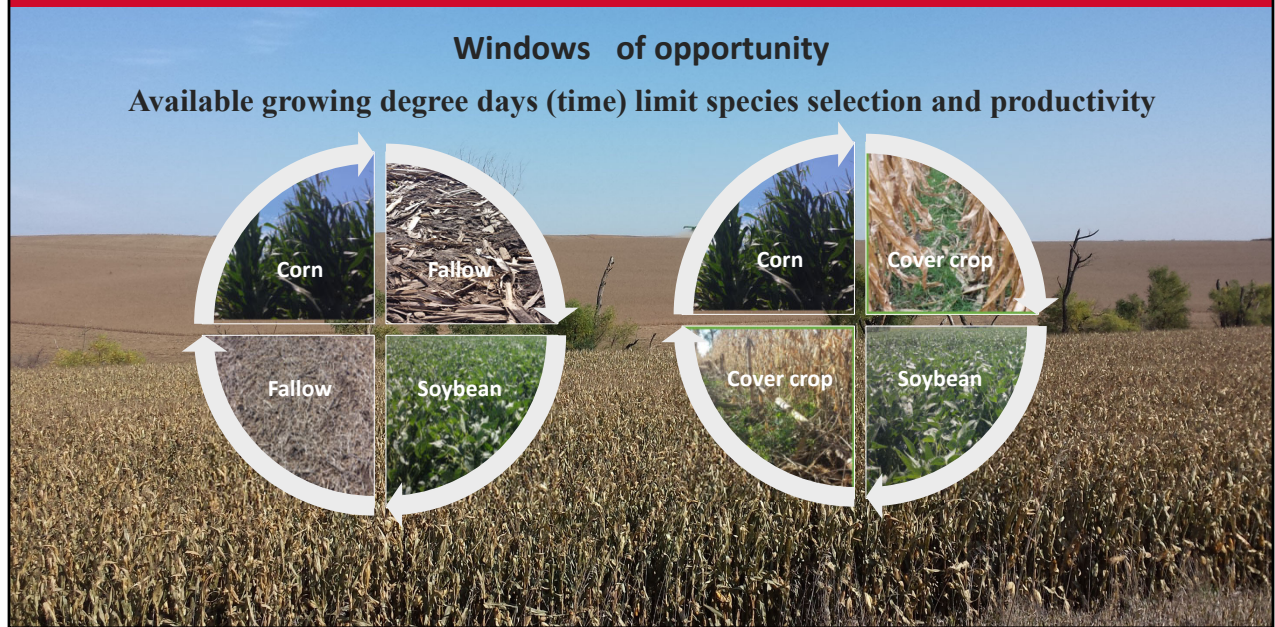
- Project developed in cooperation with NE Corn and Soybean Boards
- Assessed cover crop productivity, soil health parameters, crop yields
- Cover crop N uptake, C:N ratio affect its ability to retain and cycle nutrients (N)



Interest in cover crops is increasing in Nebraska

# Crop Production Clinics

**N** EXTENSION



In terms of yields, profitability, ecosystem services. Without changes to corn-soybean system. Start by briefly explaining our methods, then sharing what we found and how our findings could improve corn production efficiency and add value to corn production. Lastly, we'll address how the objectives in our new proposal can help with

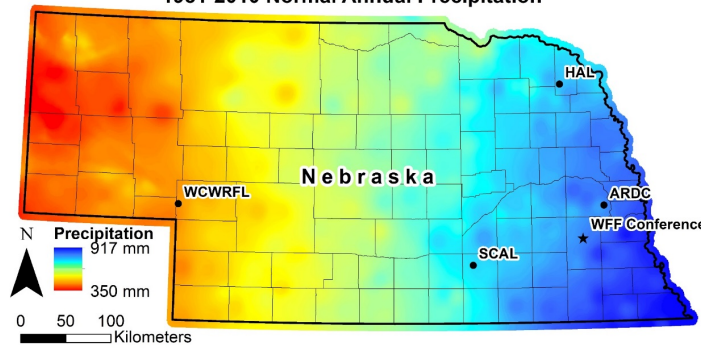
# Crop Production Clinics

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## Locations

North-east: Concord  
**Rainfed**

1981-2010 Normal Annual Precipitation



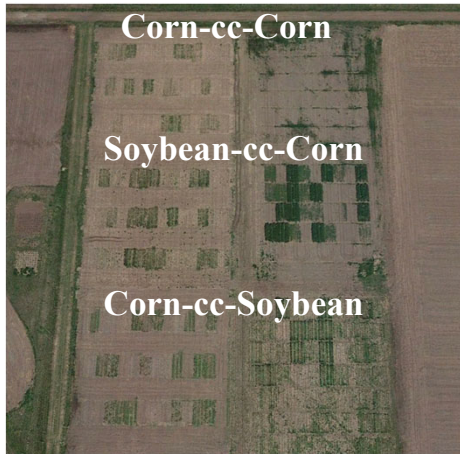
East: Mead  
**Rainfed**

South-central: Clay Center  
**Irrigated**

Graph by Burdette Barker, PhD, 2017  
Nebraska map source: USDA-NRCS. (2009). *Processed TIGER 2002 Counties plus NRCS additions and Processed TIGER 2002 Counties plus NRCS additions dissolve*. Retrieved from: <http://datagateway.nrcs.usda.gov/>

PRISM precipitation from: USDA-NRCS (2012). *Precipitation rasters for each month plus yearly*. U.S. Department of Agriculture, Natural Resources Conservation Service, National Geospatial Management Center. Fort Worth, Texas.

## Experimental design



- RCBD with 4 reps (3 at Mead), same cover crop in same plot for 4 years (2014/2015 – 2017/2018)
- No-till
- 3 cropping sequences
  - Continuous corn with cover crops (cc)
  - Soybean-cover crops-corn
  - Corn-cover crops-soybean

Cover crops planted into corn, followed by corn. Cover crops planted into soybean, followed by corn. Cover crops planted into corn, followed by soybean

## Cover crops for specific goals

**N scavenger, erosion control, organic matter, weed suppression, winter-hardy**

Cereal rye, 60 lb/a

### **N fixation**

Hairy vetch & winter pea, 10 and 25 lb/a

**N scavenger and N fixation, erosion control, organic matter, weed suppression**

4-species mix (rye 30, pea 10, vetch 4, radish 3 lb/a)

7-species mix (rye 20, pea 8, vetch 3, radish 2, oats 15, clover 3, collards 1 lb/a)

Control (no cover crop)

Cover crops planted into corn, followed by corn. Cover crops planted into soybean, followed by corn. Cover crops planted into corn, followed by soybean

# Crop Production Clinics



Early planted cover crops (broadcast into corn and soybean in mid-September)



Late-planted cover crops (drilled after harvest)

Biomass production is crucial to achieving cover crop goals.



This is what 1,000 lb/ac of rye biomass looks like.

Nitrate leaching is loss for farmer, contaminant in environment, bad in drinking water. We have to keep the N in the soil where crops can reach it. Rye is great because it has many small fine roots that suck up N. May bring it up from deeper in profile – we don't know. Rye mulch decomposes slowly while corn and beans are growing and can take up N.



<1,000 lb/a



- In cont. corn
- Legumes
- Planted after harvest

## Average biomass of cover crops

1,000 – 2,000 lb/a  
(erosion control, reducing N loss)



- Before soybean
- Rye in soybean-corn

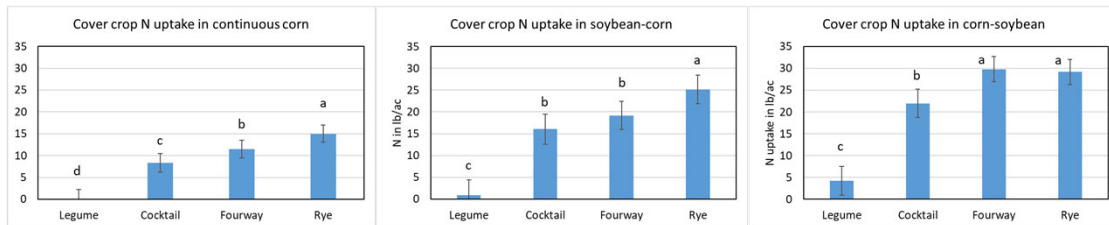
4,000 lb/a\* for weed control



- \*Rye before soybean in 2016

Cover crops NRCS: 6 to 8 inches of growth for erosion control

## Cover crop N uptake



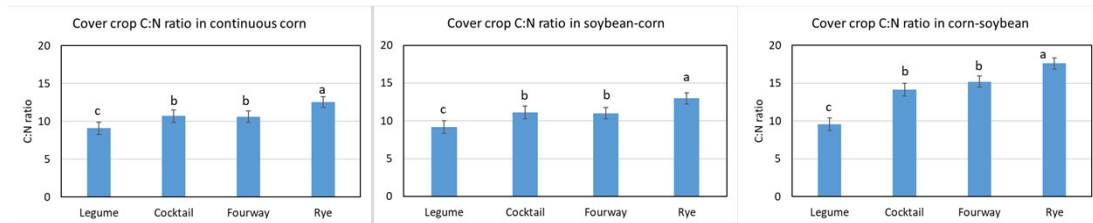
Legume=vetch+pea    cocktail=rye+oat+legume+brassicas    fourway=rye+legume+brassica    rye=cereal rye

## Cover crop N uptake

- Rye is good N scavenger
- Greatest N uptake before soybean
- Period before soybean planting has highest N loss
- N retention versus N release
- C:N ratio (physiological stage, biomass, species) determines N release

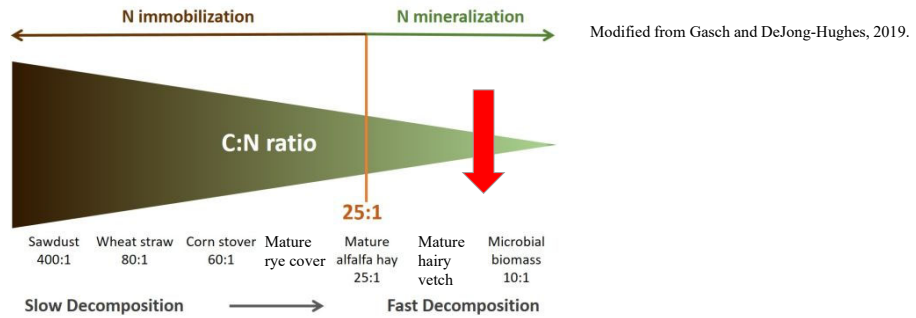
(Castello, 2016; Syswerda et al., 2012)

## Cover crop C:N



Legume=vetch+pea    cocktail=rye+oat+legume+brassicas    fourway=rye+legume+brassica    rye=cereal rye

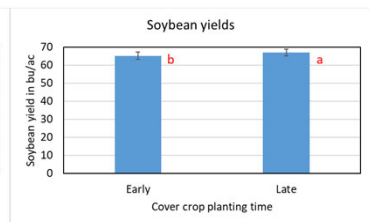
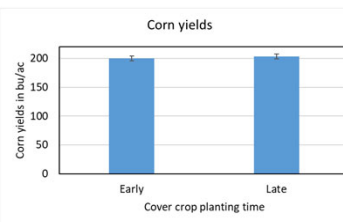
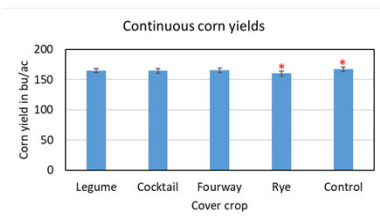
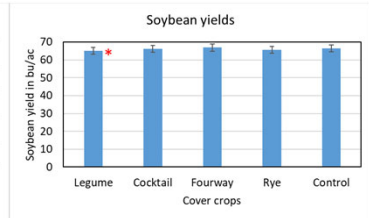
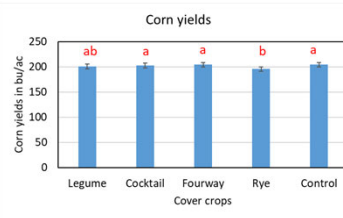
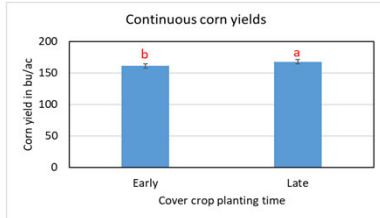
## Cover crop decomposition



Rye released 33% N, legume 75% N by corn V6 (Ruffo and Bollero 2003)

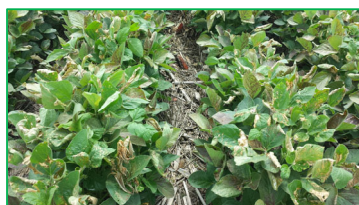
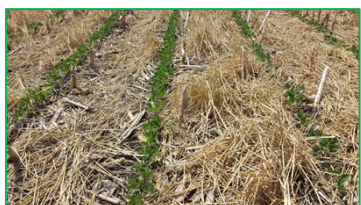
This is a study with similar C:N ratios than ours

# Crop Production Clinics



Legume=vetch+pea    cocktail=rye+oat+legume+brassicas    fourway=rye+legume+brassica    rye=cereal rye

## Corn and soybean in cover crop residue



Soybean



Rotation corn



Cont. corn



Some cover crops can become weeds

## Take-home message

- Cover crop productivity and N uptake were relatively low
- Rye and mixes with rye may be used for retaining more N in these systems
  - Rye is cheapest
- Cover crop biomass N is unlikely to cause N immobilization
  - Except in years with high biomass production
  - Starter N is recommended
- Soybean yields were not impacted by cover crops
- Rye reduced corn yields by 4%, other cover crops had no impact
  - Water, pathogens, allelopathy



# Crop Production Clinics

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## Thank you

George Biliarski	Caleb Wilford	Roger Elmore	Sabrina Ruis
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## References

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