Cover crop N uptake and decomposition
Katja Koehler-Cole
Interest in cover crops is increasing in Nebraska
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
Graph by Burdette Barker, PhD, 2017
Crop Production Clinics

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)

- Cereal rye
- Legume (vetch and pea)
- Cocktail mix (rye, vetch, pea, radish, collards, clover)
- Four-species mix (rye, vetch, pea, radish)
- Control

Late-planted cover crops (drilled after harvest)

- Rye
- Legume
- Cocktail mix
- Four-way mix
- Control
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.
Crop Production Clinics

Average biomass of cover crops

<1,000 lb/a
1,000 – 2,000 lb/a
4,000 lb/a* for weed control

(erosion control, reducing N loss)

• In cont. corn
• Legumes
• Planted after harvest

• Before soybean
• Rye in soybean-corn

• *Rye before soybean in 2016

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

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
  (Castello, 2016; Syswerda et al., 2012)
- N retention versus N release
- C:N ratio (physiological stage, biomass, species) determines N release
Cover crop C:N

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

## Thank you

<table>
<thead>
<tr>
<th>George Biliarski</th>
<th>Caleb Wilford</th>
<th>Roger Elmore</th>
<th>Sabrina Ruis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mike Schlick</td>
<td>Jeremy Milander</td>
<td>Chuck Francis</td>
<td>Suat Irmak</td>
</tr>
<tr>
<td>Tom Galusha</td>
<td>Jennifer Sherman</td>
<td>Humberto Blanco</td>
<td>Derek Heeren</td>
</tr>
<tr>
<td>Mike Mainz</td>
<td>Glen Slater</td>
<td>Charles Shapiro</td>
<td>Burdette Barker</td>
</tr>
</tbody>
</table>

Funding for the research project was provided by the Nebraska Corn Board and the Nebraska Soybean Board.
References