Nitrogen Fertilizer Needs of Small Grains After Alfalfa

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Three main ideas

Return
On
Investment

Prediction:
Bad
Good
Alfalfa Nitrogen Credits

1. Alfalfa residue
2. N deposition
3. Soil quality improvements

“N credit”
Literature

Lin and Putnam, 2013
Literature

- 2001, Kelling and Speth, Wisconsin - 50 lb N ac\(^{-1}\)
- 1989, Badaruddin and Meyer, North Carolina - 130 lb N ac\(^{-1}\)
- 1987, Bulman and Smith, Eastern Canada - 90 lb N ac\(^{-1}\)
2018

- 18 farms
- 13 forage - Green
- 9 grain - Blue
- Three 2nd year sites
- 15 1st year sites
## Plot design

<table>
<thead>
<tr>
<th></th>
<th>30</th>
<th>120</th>
<th>120</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>150</td>
<td>60</td>
<td>0</td>
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<td>90</td>
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</tbody>
</table>

![Plot Area](image)
Soil Sampling
Fertilizer application

<table>
<thead>
<tr>
<th>AMMONIUM NITRATE</th>
<th>BASED FERTILIZER</th>
</tr>
</thead>
<tbody>
<tr>
<td>34.4% N</td>
<td></td>
</tr>
<tr>
<td>TOTAL NITROGEN (N)</td>
<td>34.4%</td>
</tr>
<tr>
<td>NITRIC NITROGEN (N)</td>
<td>17.2%</td>
</tr>
<tr>
<td>AMMONIACAL NITROGEN (N)</td>
<td>17.2%</td>
</tr>
<tr>
<td>500 KG NET</td>
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</tbody>
</table>
Harvest
Forage yield results

Forage yield

Small grain forage yield (tons DM ac⁻¹) vs. N fertilizer rate (lb N ac⁻¹)

- Farm 1
- Farm 5
- Farm 6
- Farm 7
- Farm 8
- Farm 9
- Farm 10
- Farm 11
- Farm 12
- Farm 13
- Farm 15
- Farm 16
- Farm 17

23%
Grain yield results

Grain Yield

Small grain yield (bu DM ac\(^{-1}\)) vs. N fertilizer rate (lb N ac\(^{-1}\))
Application timing
Is split N worth it?

Extra 30 lbs N in fall

Small grain yield (bu/acre)

Spring fertilizer rate (lb N / acre)
Is split N worth it?

Extra 30 lbs N in fall

No Benefit of fall N application

Small grain yield (bu/acre)

Spring fertilizer rate (lb N / acre)
Is late N application beneficial?

[Bar graph showing grain yield (bu/acre) for 60 and Late 60.]

- 4 Farms
Predicting response to \( N \)
Soil nitrate levels (top 12 inch)

Optimum N rate (lb N ac\(^{-1}\)) vs. Soil Nitrate in top 12 inch (ppm)

- **Grain**
- **Forage**
Soil nitrate levels (top 12 inch)

Optimum N rate (lb N ac$^{-1}$)

Soil Nitrate in top 12 inch (ppm)

Grain
Forage

58%
Leaf Chlorophyll data

Optimum N rate (lb N ac\(^{-1}\))

Percent difference in SPAD

- Grain
- Forage
Optimum N rate (lb N ac⁻¹)

Percent difference in SPAD

- Needed N
- No N needed

65%

Leaf Chlorophyll data
Preliminary Conclusions

1st year Added Nitrogen

Soil Nitrate SPAD
Limited accuracy
Additional analysis

Protein
Next step

- 15 fall sites set up for 2019
- At least 8 spring sites
- 2020
Thank you

Questions?