**Objectives:** Determine 1) biomass production of green manures: red clover and balansa clover intercropped with cereal rye and a mix seeded after cereal rye harvest; 2) grazing value of green manures; 3) corn yield responses to green manures; 4) potential for green manures to reduce N fertilizer rate.

**Hypotheses:** Provided timely summer rainfall, the summer mix will produce the most biomass and grazing value. The clovers will provide more atmospherically-fixed N to the succeeding corn crop. Under ideal growing conditions, the grazing value of the summer mix will offset its greater cost of establishment as well as its lower N value. Under stressed or average growing conditions, one or both of the clovers will provide more value through fall forage harvest and reduced N requirements of the succeeding corn.

**Farmer-Cooperator will:**
- Follow Research Protocols in accordance with Project Design, Data to Collect and Timeline detailed below.
- Take photos throughout the project. Try to capture photos that depict the differences you observe among the treatments.
- Keep in contact with PFI with updates and questions.
- Turn in data and complete post-project survey by November 2021.

**Practical Farmers of Iowa will:**
- Help set up research protocol, monitor progress of project and provide support when needed.
- Publish results in a PFI research report, on PFI website and potentially other outlets.
- Provide $550 research honorarium to cooperator upon receipt of data.

**Project Design:**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red clover</td>
<td>Frost-seed red clover to existing cereal rye crop in late winter/early spring.</td>
</tr>
<tr>
<td>Balansa clover</td>
<td>Frost-seed balansa clover to existing cereal rye crop in late winter/early spring.</td>
</tr>
<tr>
<td>Mix</td>
<td>Drill-seed mix following cereal rye harvest in July.</td>
</tr>
</tbody>
</table>

- Apply these three treatments in a replicated trial: at least four replications of strips.
  - 3 treatments x 4 replications = 12 strips total.
- Strips must be at least as wide as one combine pass and should run the length of the field.
  - Example layout:
Data to Collect (cooperator):

- Green manure cover crop biomass
  - In fall, sample aboveground biomass from each strip.
    - Randomly place 1’x1’ PVC square in strip
    - Use shears to clip all aboveground plant material from within the square
    - Place all samples from a single strip into one paper bag
      - (e.g., one paper bag per strip)
    - Label paper bags accordingly
      - Cover crop: red clover, balansa clover or mix
      - Number of squares sampled from (e.g., 3 squares = 3 ft²)
      - Date of collection
    - Send paper bags to PFI office
      - Samples will be dried and weighed
      - Grazing value will be estimated: https://www.extension.iastate.edu/agdm/crops/html/a1-91.html

- Corn grain yield
  - Harvest and record grain yield and moisture from each strip.

- Optional: Late-spring soil nitrate test (LSNT)
  - When the corn is 6-12 in. tall, collect soil cores to a depth of 12 in. from each strip.
    - Sample collection protocols from ISU:
      - https://store.extension.iastate.edu/Product/Use-of-the-Late-Spring-Soil-Nitrate-Test-in-Iowa-Corn-Production

Project Timeline:

<table>
<thead>
<tr>
<th>Fall 2019</th>
<th>Spring 2020</th>
<th>Summer 2020</th>
<th>Fall 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Seed entire field with cereal rye cover crop.</td>
<td>• Frost-seed red and balansa clovers to rye crop.</td>
<td>• Harvest rye crop.</td>
<td>• Collect green manure biomass.</td>
</tr>
<tr>
<td></td>
<td>• Take photos.</td>
<td>• Drill-seed mix.</td>
<td>• Graze cattle.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Take photos.</td>
<td>• Take photos.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spring 2021</th>
<th>Summer 2021</th>
<th>Fall 2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Terminate green manure cover crops.</td>
<td>• Optional: collect LSNT soil samples.</td>
<td>• Harvest corn from all strips.</td>
</tr>
<tr>
<td>• Plant corn.</td>
<td>• Optional: split strips</td>
<td>• Turn in data and photos.</td>
</tr>
<tr>
<td>• Take photos.</td>
<td>- Typical N rate</td>
<td>• Take post-project survey</td>
</tr>
<tr>
<td></td>
<td>- LSNT recommended N rate</td>
<td></td>
</tr>
</tbody>
</table>

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