Managing Annual Ryegrass as a Cover Crop

Michael Plumer
Natural Resources Management
Reasons to Use Cover Crops

- Improved soil tilth
- Increase Organic Matter
- Increase soil biological activity
- Improve soil structure
- Increase soil moisture holding capacity
- Add nitrogen
- Cycle nutrients
Annual Ryegrass

- Winter annual forage grass
- Used as a lawn grass for new lawns
  - Easy to establish
  - Quick greenup
- Used as summer and winter forage
- Used in critical area seedings for quick cover
What does it look like?
Growth Characteristics

- Winter annual
  - Planted in fall
  - Grows all winter
  - Matures in May
  - Dies in June

- Biennial - can act like one but isn’t
  - Planted in spring
  - Grows vegetatively all year
  - Matures following spring
Uses of Annual ryegrass as a mulch
Ryegrass benefits

- Small ryegrass decomposes readily
- Provides mulch/weed control
- Works for most crops
- Easy to establish broadcast
- Good root mass, adds SOM, adds tilth
- Reasonable cost $0.40 to $0.65/lb.
- Tolerates wet soil
- Stores excess nitrogen (can uptake 300-500#/a)
- Excellent livestock feed value
Residue Quality

Common index (C:N)

Residue < 20 C:N decompose fast > N levels

young ryegrass C:N 12:1
(dependents on N available)

C:N >30 decreases N available in soil

Soybeans  15-25:1
Corn  30:1

Corn stalks  60:1
Wheat straw  80:1
Example of picking up excess nitrogen after corn
Nitrogen Uptake

Example of holding Nitrogen

Corn after Corn
200#N/a = 215 bu/A.
Jan7th = 3642 #/A. annual ryegrass
2” of water leached
84 #/a of available Nitrogen from ryegrass
Ryegrass Management

- Plant dates
- Seeding rates  8-25#/a
- Spring kill before grass joints for quick decomposition
  - Use tillage or plastic to smother
- Ryegrass can retiller/resprout if not killed
- Combine with grazing system
  - Will reduce rooting
  - Make plant easier to control
Ryegrass

Seeding method
- broadcast after harvest
- drilled
- does best if September seeded
- Arial seeded early September

Seeding rate
- broadcast 15-20#/acre
- drilled 8 – 15#/acre
Date of Planting

- South I-70 seed before Oct. 15th
- North of I-70 seed before Oct. 1
- Dormant seeding
  - December – March 1
- Later seeding requires addition of:
  - Manure
  - 30-50#/a of nitrogen
To improve stand/ survivability
Seeding annual ryegrass with rolling harrow
Ryegrass September 15 seeded vs mid October ....11” vs 2” on Nov 4th
Seeded Sept 15 on Sept. 30th
Sept. 15 seeded as of Jan. 6\textsuperscript{th}
12+” height and 3642# dry matter/acre
Roots to 20”
Grazing value from Jan. 6th test

- 21 % Protein level
  - This level can be higher if excess nitrogen is found in soil
  - In heavy manure applications, excess nitrogen raised protein level to 28%

- Relative feed value of 191
  - Better than corn or alfalfa
Variety selection

Sept. 30th seeding  20#/a  2 different varieties
Competition of winter annuals with ryegrass is not competitive if winter annuals present at seeding.
Annual Ryegrass Control

- Tillage very effective
- Mowing after bloom/before complete seed development
  - Variable success
  - Some seed may be produced
- Plastic mulch smothered
  - Smaller easier to control
  - Has fumigant qualities on root knot nematode
- Others?
Intense ryegrass pressure will injure crops, cause nitrogen deficiency
Problem with escaped ryegrass in wheat,
Very competitive
Soil pit investigation of cover crop site
Rooting Depth

– December 10\textsuperscript{th} ryegrass roots 14”
– April 9\textsuperscript{th} to 51”

Corn roots on Claypan soil
– September 4\textsuperscript{th} to 75”

Soybean roots on Claypan soil
– September 4\textsuperscript{th} to 48”
April 9 in silt loam soil
Roots April 9th at 12” depth; third year of ryegrass cover
Note soil structure and worm holes
Corn root mass in silt loam clay pan soil under vetch/ryegrass cover crop
Intensive tillage can destroy soil structure

tilled soil with a line of compaction at 7”
Note root growth restricted to 4 ½” in chisel disk system

Note compacted platy soil below 5”
Tilled compacted area below 4”
6 years cover crops/ corn root development

20
To
23”

23
to
28”

37
to
43”

46
to
50”
Soil profile changes

- Noted movement down of topsoil depth and color (organic matter)
- Noted significant decrease in silt fragipan deposition layer after 3 years !!!!!
- Significant increase in subsoil root – allows for crop root expansion
Shows fragipan layer is decreasing with increased SOM and increased rooting after 6 years of cover crops.
Cover crop rooting depth compared

Cereal rye 18.4”
Annual rye grass 30.6” *

first year cover crop, planted Oct. 1
roots measured April 9th

* Significant .05
## Soil Density

### all no-tilled 9+ years

<table>
<thead>
<tr>
<th>Depth</th>
<th>Ryegrass cover crop</th>
<th>No cover crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>10”</td>
<td>1.49 g/cc</td>
<td>1.66 g/cc</td>
</tr>
<tr>
<td>16”</td>
<td>1.58</td>
<td>1.54</td>
</tr>
<tr>
<td>24”</td>
<td>1.48</td>
<td>1.65</td>
</tr>
</tbody>
</table>
## Soybean Yield

<table>
<thead>
<tr>
<th></th>
<th>Bare</th>
<th>Cereal Rye</th>
<th>Ryegrass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sw</td>
<td>48.2</td>
<td>52.3</td>
<td>60.6*</td>
</tr>
<tr>
<td>NW</td>
<td>51.2</td>
<td>53.8</td>
<td>55.7*</td>
</tr>
</tbody>
</table>

3 replications, each location

* Significant .05
Nematode Properties

Research shows nematode suppression
- Strawberries < root knot nematodes- MAFRA

- Incorporation reduces soybean cyst nematodes --Rigor, Welacky, Anderson
Nematode suppression

Table 2. Effect of root exudates originating from different plant species, on hatching of *Heterodera glycines* eggs.

<table>
<thead>
<tr>
<th>Species</th>
<th>Egg hatching (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Echinochloa crusgalli</em></td>
<td>17.9±1.3*</td>
</tr>
<tr>
<td><em>Glycine max</em></td>
<td>31.3±3.9*</td>
</tr>
<tr>
<td><em>Lespedeza capitata</em></td>
<td>22.9±1.4*</td>
</tr>
<tr>
<td><em>Lupinus perennis</em></td>
<td>16.9±1.8*</td>
</tr>
<tr>
<td><em>Medicago sativa</em></td>
<td>19.9±2.7*</td>
</tr>
<tr>
<td><em>Melilotus officinalis</em></td>
<td>18.7±1.8*</td>
</tr>
<tr>
<td><em>Trifolium hybridum</em></td>
<td>24.9±1.9*</td>
</tr>
<tr>
<td><em>Trifolium repens</em></td>
<td>37.8±2.1*†</td>
</tr>
<tr>
<td><em>Vicia villosa</em></td>
<td>19.0±1.7*</td>
</tr>
<tr>
<td>Control water (perlite)</td>
<td>7.3±1.2</td>
</tr>
</tbody>
</table>

Anderson, Welakey, Rigor  Can. J. of Plant Pathology
## Nematode suppression

<table>
<thead>
<tr>
<th>Common name</th>
<th>Nematodes/g soil</th>
<th>Nematodes/g root</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Avena sativa</strong> L.</td>
<td>1.69±0.31 (17)</td>
<td>6.19±1.71* (13)</td>
</tr>
<tr>
<td><strong>Brassica juncea</strong> (L.) Coss</td>
<td>9.78±0.06 (24)</td>
<td>18.97±4.02 (20)</td>
</tr>
<tr>
<td><strong>Brassica napus</strong> L. var. napus</td>
<td>2.36±0.52 (19)</td>
<td>2.98±1.03* (10)</td>
</tr>
<tr>
<td><strong>Desmodium canadense</strong> (L.) DC†</td>
<td>0.87±0.14 (12)</td>
<td>16.01±2.87 (19)</td>
</tr>
<tr>
<td><strong>Echinochloa crusgalli</strong> (L.) Beauv. var. frumentea (Roxb.) Link</td>
<td>2.16±0.39 (18)</td>
<td>1.95±0.28* (6)</td>
</tr>
<tr>
<td><strong>Lespedeza capitata</strong> Michx†</td>
<td>0.41±0.04* (5)</td>
<td>1.93±0.31* (5)</td>
</tr>
<tr>
<td><strong>Lespedeza hirta</strong> (L.) Hornem†</td>
<td>0.42±0.06* (7)</td>
<td>1.30±0.45* (3)</td>
</tr>
<tr>
<td><strong>Lespedeza × intermedia</strong> (S. Wats.) Reit†</td>
<td>0.51±0.07* (8)</td>
<td>2.35±0.59* (7)</td>
</tr>
<tr>
<td><strong>Lotus perenne</strong> (L.)</td>
<td>0.56±0.08* (9)</td>
<td>0.04±0.04* (3)</td>
</tr>
<tr>
<td><strong>Medicago sativa</strong> (L.)</td>
<td>0.39±0.09* (4)</td>
<td>7.03±1.16* (15)</td>
</tr>
<tr>
<td><strong>Lupinus perennis</strong> L.†</td>
<td>0.75±0.17* (11)</td>
<td>6.94±2.39* (14)</td>
</tr>
<tr>
<td><strong>Medicago sativa</strong> (L.)</td>
<td>0.31±0.11* (3)</td>
<td>2.47±0.65* (8)</td>
</tr>
<tr>
<td><strong>Melilotus officinalis</strong> (L.) Lam.</td>
<td>0.25±0.08* (1)</td>
<td>2.60±0.55* (9)</td>
</tr>
<tr>
<td><strong>Pisum sativum</strong> L. var. arvense Poir</td>
<td>0.62±0.08* (10)</td>
<td>11.60±4.38* (16)</td>
</tr>
<tr>
<td><strong>Raphanus sativus</strong> L.</td>
<td>3.48±0.72 (21)</td>
<td>19.49±4.38 (22)</td>
</tr>
<tr>
<td><strong>Trifolium hybridum</strong> (L.)</td>
<td>1.39±0.43 (15)</td>
<td>1.56±0.49* (4)</td>
</tr>
<tr>
<td><strong>Trifolium pratense</strong> (L.)</td>
<td>0.41±0.09* (6)</td>
<td>13.57±3.31* (18)</td>
</tr>
<tr>
<td><strong>Trifolium repens</strong> (L.)</td>
<td>0.93±0.23 (13)</td>
<td>3.20±0.99* (11)</td>
</tr>
<tr>
<td><strong>Triticum aestivum</strong></td>
<td>9.24±3.02 (23)</td>
<td>17.67±3.89 (21)</td>
</tr>
<tr>
<td><strong>Vicia villosa</strong> (Roth)</td>
<td>7.83±2.36 (22)</td>
<td>3.62±1.23* (12)</td>
</tr>
<tr>
<td><strong>Zea mays</strong></td>
<td>7.49±0.67 (20)</td>
<td>11.74±1.07* (17)</td>
</tr>
<tr>
<td><strong>Control Heterodera glycines</strong> without plant residues</td>
<td>1.09±0.08 (14)</td>
<td>29.47±3.11 (24)</td>
</tr>
<tr>
<td><strong>Soybean cyst nematode</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Soil Fertility Changes

- Take good samples
- Keep good records of changes
- Cover crops can pull fertility from subsoil
- Sample same time and moisture content
TA plot

- O.M
- phosphorus
- potassium
BI plot

- **O.M**
- **phosphorus**
- **potassium**

The graph shows the trend of O.M, phosphorus, and potassium from 2000 to 2003.
Soil Tests in ryegrass Cover Crop

No fertility added
Soil Tests in Cover Crop

(#/a)

- 0 to 6" P
- 14" P
- 20" P
- Subsoil 35" P
- 0-6" K
- 14" K
- Subsoil 35" K

No fertility added
C-C-S rotation
Ryegrass Fertility Impacts

- Cover crops can move nutrients
  - From subsoil to surface
  - Will decrease subsoil levels
- Increased SOM will store nutrients
- Cover crop can store nitrogen for later release
- Cover crop can tie up nutrients if allowed to mature
Ryegrass

- Provides specific benefits
- Requires high level of management
- Can be highly beneficial

All cover crops are weeds in Growing Crops

- Manage accordingly