Rationale of Winter Crops and Double Crops for Bioenergy and More

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Topics for Today

• Potential roles for winter crops
• Rationale
• Potential challenges of winter crops
• Knowledge/Outreach gaps
Potential roles of Cover Crops: Soils

- Erosion control
- Nutrient sequestration
- Weed/pest suppression
- Soil carbon enhancement
- N fixation
- Facilitate no-tillage
Soil Management Advantages

- Long term cover crop effects are real
- Manure and cover crops accelerate soil quality improvement
- Increased manure N credit 15 vs 50%
- Resistance to compaction
- 5-10% higher yields following a cover crop
Potential roles of Cover Crops: Crops

• Weed/pest suppression
• Rotation effects
• Biodiversity
• Additional revenue stream
• Cropping system intensification
Resource utilization in annual cropping systems

Missed opportunities for resource assimilation and dry matter production

Additional opportunities for resource losses

Source: A.H. Heggenstaller
Biomass production in double crop systems

Tradeoff: Missed opportunity for resource assimilation and dry matter production.

Dry matter production or resource loss (mass/time)

Source: A.H. Heggenstaller

Reduced opportunities for resource losses
CORN/BARLEY/SOYBEAN
## Production potential

<table>
<thead>
<tr>
<th></th>
<th>Corn/SB</th>
<th>Corn/Barley/SB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crop yields (lb/a)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corn</td>
<td>11186 (200)</td>
<td>10519 (188)</td>
</tr>
<tr>
<td>Barley grain</td>
<td>-</td>
<td>4710 (100)</td>
</tr>
<tr>
<td>Barley straw</td>
<td>-</td>
<td>2944 (1.5)</td>
</tr>
<tr>
<td>Soybean</td>
<td>3532 (60)</td>
<td>2355 (40)</td>
</tr>
<tr>
<td>Total Grain</td>
<td>14718</td>
<td>17584</td>
</tr>
</tbody>
</table>

+19% increase in grain yield (plus 1.5 tons of straw)
Example Cover Crop Systems

- Corn/wheat/DC soybean
- Corn/wheat/sunflower
- Corn/soybean/barley/soybean/corn
- Corn silage/canola/DC soybean
- Corn silage/oats/Corn silage
- Corn/wheat/camelina/soybeans
- Corn grain/stover/Rye/corn
Potentially exploitable gaps

• Following corn grown for silage
• Following early corn or soybean for grain
• Following wheat or barley in central PA
• Following oats or wheat in northern PA
• Following early harvested processing crops
  – Snap beans
  – Sweet corn
• As a nurse crop to establish forage crops
Potential roles of Cover Crops: Bioenergy

- Low carbon bioenergy feedstock
- Easily processed feedstocks
- Cellulosic feedstocks
- Facilitating other feedstock development
Corn Stover as a Feedstock
2010 Stover Study
Potential challenges of winter crops

• Potential economic returns
  – Market for cover crop
  – Cost of establishment
  – Short term monetization of benefits

• Nutrient uptake and cost

• Full season crop production
Overcoming potential challenges

• Economic returns
  – New markets
  – Value added uses
  – Documenting rotational yield benefits
• Nutrient uptake
  – Recycling nutrients
• Full season crop production
  – Interseeding/Relay cropping
Knowledge gaps

- Cost effective regional processing or transportation
- Modeling of ideal systems for each microclimate
- Careful economic modeling of potential systems
- Best methods to maximize value of commodities
More knowledge gaps

• New crops for our region
• Judicious use of crop residues
• Monetizing conservation benefits
• How to create a sustainable vision
Summary

• Winter crops and current economic and energy climate are creating an opportunity to develop new solutions
• Challenges exist but are not insurmountable
• Careful assessment of economic benefits is critical
Questions?