20 years of experience with green manures

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On our farm

• Maximizing life in soil with green manure and minimizing interventions.

• Studied cases:
  – Intercropping in corn and sunflower
  – Summer fallow
  – Underseeding cover crop in cereals
• 7 pounds/acre of ryegrass during ridge tillage

Intercropping
Results

• Very strong root system
• Compaction reduction during harvest
• Good biomass in spring
• Many earthworms during row cultivation
• Regrows in spring sometime difficult to control (flowers too early)
• Cultivar research to be done
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Related problems

- Sometime difficult to cultivate
- Dry down interrows
- Seed production of raygrass and regrows
- Stain soybean at harvest
Intercropping clover in sunflower

- Clover established during ridge forming pass
- Very aggressive in spring
- Competition for water, nutrients and light between clover and crop (delayed control related to rain)
- Nitrogen availability is too late
- This technique is very soil and climate dependant
Corn yield after sunflower interseeded with clover

<table>
<thead>
<tr>
<th>Years</th>
<th>clover type</th>
<th>bu/ac No manure</th>
<th>bu/ac manure</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>White</td>
<td>124.8</td>
<td>126</td>
</tr>
<tr>
<td>2008</td>
<td>Red Light soil</td>
<td>126</td>
<td>128</td>
</tr>
<tr>
<td></td>
<td>Heavy clay soil</td>
<td></td>
<td>88</td>
</tr>
<tr>
<td>2009</td>
<td>red</td>
<td>94.4</td>
<td>73.6</td>
</tr>
</tbody>
</table>
Since 2010

- Corn has been replaced by soybean in sunflower ridges
- No more need for clover (nitrogen and white mold relation)
- Replaced by ryegrass
Summer fallow experiences

- Common vetch for seeds (replaced by forage peas 40-10)
- High yields of corn the year after
- Very sensitive to diseases in wet years
- Expensive seed difficult to harvest
- Good control of annual weeds but not on perennials (seeded too early)
- Good regrowth in fall
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## Corn yields following common vetch (no manure applied)

<table>
<thead>
<tr>
<th></th>
<th>Corn field</th>
<th>Corn strips (120 ft) Heavy clay</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>148</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>157</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>151</td>
<td>143</td>
</tr>
<tr>
<td>2008</td>
<td>136</td>
<td>126</td>
</tr>
<tr>
<td>2009</td>
<td>129</td>
<td>128</td>
</tr>
<tr>
<td>2010</td>
<td>152</td>
<td>120</td>
</tr>
</tbody>
</table>
Intelligent fallow

Keep clover in wheat stubble until end of May the year after cereal

Chop clover

Offset disk and cultivation until mid August

Seeding of forage peas

Good perennial weed control
Underseeded clover (or alfalfa) in wheat

- Seeded at pre-emergence of wheat with a tine weeder
- “single cut” red clover (4.4lb/ac) mixed with 2.6lb/ac white clover
- Destroyed in November with a scalper
Corn yield following clover (or alfalfa)

<table>
<thead>
<tr>
<th>Year</th>
<th>Preceding Crop</th>
<th>No Manure</th>
<th>Manure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>bu/ac</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>wheat/alfalfa</td>
<td>128</td>
<td>135.04</td>
</tr>
<tr>
<td>2006</td>
<td>wheat/alfalfa</td>
<td>148</td>
<td>150.88</td>
</tr>
<tr>
<td>2007</td>
<td>wheat/alfalfa</td>
<td>144</td>
<td>153.6</td>
</tr>
<tr>
<td>2008</td>
<td>wheat/clover</td>
<td>107.2</td>
<td>108.8</td>
</tr>
<tr>
<td>2009</td>
<td>wheat/clover</td>
<td>102.4</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>wheat/clover</td>
<td>126.4</td>
<td>137.6</td>
</tr>
<tr>
<td>2015</td>
<td>wheat/clover</td>
<td>171.2</td>
<td>173.6</td>
</tr>
<tr>
<td>2016</td>
<td>wheat/clover</td>
<td>145.6</td>
<td>148.8</td>
</tr>
<tr>
<td>2016</td>
<td>wheat/clover</td>
<td>133</td>
<td>135</td>
</tr>
<tr>
<td></td>
<td>wheat/alfalfa</td>
<td>128</td>
<td>137.6</td>
</tr>
</tbody>
</table>
Technique from Manfred Wenz

- Spring destruction of clover (2 in working depth)
- Don’t wake up weeds
- Respect of rhizobium and microbial life
- Soil protected through winter
Big mess for the crop
Modified technique

- Fall destruction of clover (November)
- Efficient in fuel and maintenance
- Scalper: 0.85 gal/ac (8 L/ha), moldboard plow: 2.1 gal/ac (20 L/ha), disks: 1.3 gal/ac (12 L/ha)
## Results since 2011

<table>
<thead>
<tr>
<th>Year</th>
<th>corn/clover bu/ac</th>
<th>corn/clover disk + peas</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>128</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>104</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>168</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td></td>
<td>145</td>
</tr>
</tbody>
</table>

• Following wheat harvest with or w/o underseeded clover
• Direct seeding forage peas into clover or disking and seeding of peas
• Offset disk or scalping or plowing in november
Co-cropping wheat and peas

- Goal: Improve protein level in wheat
- Drill wheat and peas together
- 60lbs/acre soup peas (Meadow) + 140 lbs/ac wheat (Walton)
Protein level with/without manure

Figure 3. Taux de protéine moyen par traitement avec et sans fumier
Conclusion

• No organic production without green manure
• Be careful with the methods you use
• Green manure and minimum tillage is still a challenge
• Having living plants all year around and green manure is our next goal and challenge
Nitrogen: energy required

- urea : 25 gal diesel equivalent/100 lb
- Ammonia : 20 gal diesel/100 lb
- $\text{P}_2\text{O}_5$ : 5,4 gal diesel/100 lb
- $\text{K}_2\text{O}$ : 5,5 gal diesel /100 lb
- 150-50-50 : 42,9 gal diesel/acre
- Glyphosate : 12 litres/kg (1.43 gal/lbs) I.A.
- Manufacture, transport and application included
A mind is like a parachute
It works better when it is opened

Thank you
Conference
Thomas Dewavrin

Question period

Centre de référence en agriculture et agroalimentaire du Québec
Comité agriculture biologique

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