Long-term cover cropping in conventional vegetable systems. 

Can you improve soil health while still tilling? 

YES! We can!
## Soil Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>6.3</td>
</tr>
<tr>
<td>Soil texture</td>
<td>75:18:7</td>
</tr>
<tr>
<td>Sandy loam</td>
<td></td>
</tr>
<tr>
<td>% OM</td>
<td>3.5</td>
</tr>
<tr>
<td>CEC (cmol kg⁻¹)</td>
<td>9.4</td>
</tr>
<tr>
<td>P (ppm)</td>
<td>52</td>
</tr>
<tr>
<td>K (ppm)</td>
<td>248</td>
</tr>
<tr>
<td>Ca (ppm)</td>
<td>927</td>
</tr>
<tr>
<td>Mg (ppm)</td>
<td>79</td>
</tr>
</tbody>
</table>
Ridgetown, ON

Ave. monthly precipitation = 80 mm  3200 CHU
#1 Cover crop planting date
Started in 2008

**Early** (August) vs. **Late** (September)
1) No cover crop
2) Oats 72 lb/ac
3) Cereal rye 60
4) Oilseed radish 12
5) Forage peas 150
6) Hairy vetch 25
 Trial started 2008
Photo Oct 30th
Early planted - 1st-2nd week in August
Late planted - 1st-2nd week in September
Vegetable crop yield was not impacted by when the cover crop was planted.

Choose cover crop for your system!

Possible Implications:

- A growing plant more important than how much it grows
- Shows importance of roots
Cover crop growth

August

October

December

May

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Main Crop

Snap beans  Sweet corn
Snap bean yield

Trial established 2008 – same cover crop on same plot
Processing green bean grown in 2011-2014

<table>
<thead>
<tr>
<th>Cover Crop</th>
<th>Snap bean yield (ton/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oat</td>
<td>a</td>
</tr>
<tr>
<td>Hairy vetch</td>
<td>ab</td>
</tr>
<tr>
<td>Cereal rye</td>
<td>ab</td>
</tr>
<tr>
<td>Forage pea</td>
<td>abc</td>
</tr>
<tr>
<td>No cover</td>
<td>bc</td>
</tr>
<tr>
<td>No N</td>
<td>bc</td>
</tr>
<tr>
<td>No cover</td>
<td>c</td>
</tr>
<tr>
<td>with N</td>
<td></td>
</tr>
<tr>
<td>Oilseed radish</td>
<td></td>
</tr>
</tbody>
</table>

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Trial established 2008 – same cover crop on same plot
Processing sweet corn grown in 2011-2014

Sweet corn yield (t/ac)

- Oats
- Rye
- Oilseed radish
- Peas
- Hairy vetch
- Nocc+N
- Nocc-NoN

Cover crop

Sweet corn yield (t/ac)

2011  2012  2013  2014  ave

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Profit Margins

- Revenue from crop yield over costs of cover crop

Revenue
- Corn $90 per ton
- Snaps $189 per ton

Only takes into account costs that vary among treatments
- Cover crop seed and planting ($34.25 to $50 per ac)
- Herbicide and application (rye only) ($21.70 per ac)

Economic Analysis by Dr. Richard J. Vyn
## Profit Margins

### Compared to no cover crop control

<table>
<thead>
<tr>
<th></th>
<th>Snaps (4 yr ave)</th>
<th>Sweet Corn (4 yr ave)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cover crop</strong></td>
<td>$/ac</td>
<td>$/ac</td>
</tr>
<tr>
<td>Oats</td>
<td>85.01</td>
<td>39.88</td>
</tr>
<tr>
<td>Hairy vetch</td>
<td>42.63</td>
<td>35.81</td>
</tr>
<tr>
<td>Fall rye</td>
<td>37.12</td>
<td>35.78</td>
</tr>
<tr>
<td>Forage peas</td>
<td>32.82</td>
<td>32.82</td>
</tr>
<tr>
<td>Radish</td>
<td>-57.65</td>
<td>No diff</td>
</tr>
</tbody>
</table>

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Long-term cover crop trials (2007 to 2016)
- 122 cover crops planted in 20 trials
- **121 times** crop yields were as good as or better with a cover crop than without

Cover crops we tested:
Oats, Cereal rye, Radish, Radish+Rye, Forage peas, Hairy vetch
## Long-term Cover Crop Trial Summary

<table>
<thead>
<tr>
<th>Cover crop Recommendation</th>
<th>Veg. crop</th>
<th># of Trials</th>
<th>Significance Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any</td>
<td>Sweet Corn</td>
<td>6</td>
<td>5 of 6 yrs</td>
</tr>
</tbody>
</table>

Cover crops we tested:
Oats, Cereal rye, Radish, Radish+Rye, Forage peas, Hairy vetch
MCCC - Vegetable Cover Crop Decision Tool
Michigan: Grand Traverse County Seeding Dates

Location Information
- Location: Michigan, Grand Traverse

Cash Crop Information
- Cash Crop: None or Prevented Planting
- Plant Date: 
- Harvest Date: 

Drainage Information
- Drainage Class: Select a Drainage Class, Flooding: No

Goals
- Goal #1: Select an attribute
- Goal #2: Select an attribute
- Goal #3: Select an attribute

Click on cover crop for further information: Barley, Spring

Nonlegumes
- Barley, Spring
- Barley, Winter
- Buckwheat
- Millet, Japanese
- Millet, Pearl
- Oats
- Rye, Winter Cereal
- Ryegrass, Annual
- Sorghum-sudangrass
- Sudangrass
- Wheat, Winter

Brassicas

Reliable Establishment/Growth
Temp/Moisture Risk to Establishment/Growth
Frost Seeding
Cash Crop Growing Period

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1 Bu Oats and 4 lbs radish per acre
Soil Health

Soil health

“Measured by how good a crop you can grow with no inputs at all”

Frederic Thomas
Soil Health

Increased soil organic matter

- Pulling larger machinery with same horse power
- Less ponding/standing water
- 1000 ac of beans in a drought year yielded in mid-60s

2500 ac of no-till and cover crops corn, soybeans, sugarbeets, winter wheat
Organic Matter vs Organic Carbon

- Soil organic matter
- Soil organic carbon
Soil organic carbon

2015+2016 all sample dates –LVE lab

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Soil organic carbon and yield

\[ y = 0.0073x + 5.3126 \]
\[ r = 0.3810^* \]

2016

Hot and dry year
– benefits of soil health show up
– better yields with better soil

\[ y = 0.0007x + 5.7923 \]
\[ r = 0.0316 \]

2015

Laura L. Van Eerd University of Guelph Ridgetown Campus
No-till approach delivers soil health and savings

A switch to a zero-till system from minimum tillage is paying dividends for a Staffordshire-based grower in terms of cost and environmental savings. Dominic Kilburn reports on how the business is changing and also on the key findings from a wheat fungicide trial which took place on the farm earlier this year.

In addition, Clive says that after several years of operating the zero-till system, the aim is to steadily reduce the annual nitrogen applications down from the current 180kg.

Zero-till works for us here on the light land but I know of many growers on heavy land are also making it work happen – you can find a system that will work on all soil types.

It's a question of being more management focused and persistently re-inventing yourself with a changing mind-set. You've got to be prepared to learn and travel, and, if I'm honest, sometimes fail.

“In essence, the farm's weight is probably my most important success. It proves to me that the no-till works on the farm – that the investment in machinery, labour and other approach to managing the business are right.”

Staffordshire farmer Clive Balye says in no doubt why he moved his farming business from a minimum tillage establishment regime to one of zero-till. A chance to reduce labour and capital expenditure costs across a large combinable crop operation was one incentive, however six years on after making the “leap of faith” the business is reaping the rewards in other ways too.

Total Farming Network

Product X from Company Y

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Clive’s Farming principles

- Always want something growing – would you ever turn off a solar panel?
- No bare soil – reduce water loss
- Maximize diversity – a varied diet is a healthy diet
- Minimize disturbance, allow biology to thrive and build strong networks
- Feed soil biology buy building SOM
- Improve water infiltration with #rootsnotiron

@TWBfarms