Controlled Traffic Farming

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@beyondagronomy
Beyond Agronomy
Three Hills, Alberta
Topics

• Controlled traffic farming
• The case for CTF
• CTF set-ups
• Benefits & Risks
• Nuffield Scholarship
- 3000ft elevation
- 12 inch annual precipitation
- Growing season – 110 days
- No-till 10 years – CTF 7 years
- Wheat, barley, canola, peas, faba beans, lentils
The physical side of soil

Chemical
- N,P,K,S
- Zn, Cu, Fe
- pH
- E.C.
- C.E.C.

Biological
- Bacteria
- Fungi
- Earthworms
- Algae
- Nematodes

Physical
- Texture
- Porosity
- Aggregate stability
- Permeability
Controlled traffic farming

“Crop production system that, by precisely matching machinery axle and equipment widths, restricts soil compaction to permanent traffic lanes, while growing all crop plants in uncompacted cropping beds”
The impact of wheel traffic

The first pass causes 80% of the damage. Axle weights above 10 ton have been shown to:

- Reduce plant available water and infiltration by 40%.
- Reduce earthworm numbers by 60%.
- Increase the power required for tillage or planting by almost 100%.
- Reduce crop yield by > 15%.
- CTF adoption has reduced N2O emissions by 20-50%.
**Wheel traffic**

<table>
<thead>
<tr>
<th>Conventional Tillage</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvester</td>
<td></td>
</tr>
<tr>
<td>Air Seeder/Cultivator</td>
<td></td>
</tr>
<tr>
<td>Scarifier</td>
<td></td>
</tr>
<tr>
<td>Blade Plough</td>
<td>82%</td>
</tr>
<tr>
<td>Footprint</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>No-Till</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvester</td>
<td></td>
</tr>
<tr>
<td>Air seeder</td>
<td></td>
</tr>
<tr>
<td>Boom spray</td>
<td>46%</td>
</tr>
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<td>Footprint</td>
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</table>

<table>
<thead>
<tr>
<th>No-Till plus Controlled Traffic</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvester</td>
<td></td>
</tr>
<tr>
<td>Air seeder</td>
<td></td>
</tr>
<tr>
<td>Boom spray</td>
<td>14%</td>
</tr>
<tr>
<td>Footprint</td>
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</tbody>
</table>

*Figure 39-10. Wheel track coverage of conventional tillage, no-till and controlled traffic.*

(Walsh, 1998)

Advances in No-tillage Farming..... R. Rainbow and R. Derpsch
Equipment footprint

**Tractors**
Challenger MT865: 21 ton
Case 540 Quadtrac: 23 ton
Case 535 4WD: 21 ton
John Deere 9560R: 21.7 ton

**Sprayers**
John Deere 4940 120ft: 17.8 ton dry, 22.3 ton full
Case 4430 Patriot sprayer 120ft: 14.2 ton dry, 18.7 full

**Combines**
Case 8240 combine: 19 ton dry, 28 ton full
John Deere S680: 20.5 dry, 29.5 ton full
New Holland 9.90: 19.3 ton dry, 27.4 ton full
The case for CTF
Freeze-thaw cycle
Wheel traffic
Sandy soil
Compaction: Planting

56ft Centre to Centre

Source: Precision Agriculture Australia
Clay soil
High OM soil
Deep ripping?
Castor wheels
Random vs. CTF
What is nature telling us?
Animals on CTF
CTF equipment set up

45%+ to 15%
Choosing a CTF configuration

1. Start with your combine header width and work back.
2. Residue spread is key.
3. Work on efficiency.
4. Typical 2:1 and 3:1 systems: 30ft, 35ft, 40ft systems.

Examples:
30ft drill, 90ft boom, 30ft header
Or
70ft drill, 105ft boom, 35ft header
Or
80ft drill, 40ft header, 120ft boom
Choosing a CTF configuration

40ft

35ft

30ft
Case 40ft bi-fold
Time to get creative
Steve’s CTF setup
Top five reasons not to do CTF

• Harvest logistics can be complicated
• Residue is difficult to manage after harvest.
• Tram line erosion can be serious.
• You have to measure every single piece of equipment.
• Hard to buy CTF ready equipment from OEM’s.
The really bad!
The not as bad!
The ugly!
The really ugly!
Benefits of CTF
Precise placement
Seed placement
Uniformity

Up to 32% yield increase with optimized spatial patterns of canola plant establishment in western Canada
Row loading
Root exploration
## Nutrient uptake

<table>
<thead>
<tr>
<th></th>
<th>Nitrogen (%)</th>
<th>Nitrate Nitrogen (%)</th>
<th>Sulfur (%)</th>
<th>Phosphorus (%)</th>
<th>Potassium (%)</th>
<th>Magnesium (%)</th>
<th>Calcium (%)</th>
<th>Sodium (%)</th>
<th>Boron (ppm)</th>
<th>Zinc (ppm)</th>
<th>Manganese (ppm)</th>
<th>Iron (ppm)</th>
<th>Copper (ppm)</th>
<th>Aluminum (ppm)</th>
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<tbody>
<tr>
<td><strong>No Traffic</strong></td>
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<td></td>
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<td></td>
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<tr>
<td>Nitrogen (%)</td>
<td>5.51</td>
<td>0.70</td>
<td>0.40</td>
<td>5.36</td>
<td>0.27</td>
<td>1.12</td>
<td>0.10</td>
<td>12</td>
<td>39</td>
<td>91</td>
<td>170</td>
<td>6</td>
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<tr>
<td>Nitrate Nitrogen (%)</td>
<td>3.99</td>
<td>0.21</td>
<td>0.39</td>
<td>3.19</td>
<td>0.14</td>
<td>0.19</td>
<td>0.03</td>
<td>5</td>
<td>19</td>
<td>34</td>
<td>24</td>
<td>4</td>
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<tr>
<td>Nitrogen (%)</td>
<td>5.00</td>
<td>0.55</td>
<td>0.70</td>
<td>4.00</td>
<td>0.50</td>
<td>0.50</td>
<td>0.03</td>
<td>25</td>
<td>50</td>
<td>200</td>
<td>100</td>
<td>25</td>
<td>300</td>
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### Nutrient Sufficiency Ratings

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<th>N/K</th>
<th>P/S</th>
<th>P/Zn</th>
<th>K/Mg</th>
<th>K/Mn</th>
<th>Fe/Mn</th>
<th>Ca/B</th>
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<td>1.3</td>
<td>1.4</td>
<td>157</td>
<td>11.1</td>
<td>306</td>
<td>0.5</td>
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## Nutrient Uptake

<table>
<thead>
<tr>
<th></th>
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<td>42</td>
<td>84</td>
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<tr>
<td>Nitrate Nitrogen (%)</td>
<td>3.99</td>
<td>0.21</td>
<td>0.39</td>
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<td>0.19</td>
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<th>Fe/Mn</th>
<th>Ca/B</th>
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<td><strong>Tram line</strong></td>
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<td>1.3</td>
<td>1.4</td>
<td>157</td>
<td>11.1</td>
<td>306</td>
<td>0.5</td>
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Water Infiltration

No wheel track

Tramline
## Bulk density

<table>
<thead>
<tr>
<th>Site</th>
<th>Depth (inches)</th>
<th>Check</th>
<th>CTF</th>
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<tbody>
<tr>
<td></td>
<td>Db</td>
<td>Pore %</td>
<td>Db</td>
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<tr>
<td>Sandy Loam</td>
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<tr>
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<td>1.36</td>
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<td>1.53</td>
<td>42.14</td>
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<td>Sandy Loam</td>
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<tr>
<td>Site 2</td>
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<td>1.33</td>
<td>49.80</td>
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<td>24-36</td>
<td>1.75</td>
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<td>Clay Sodic</td>
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<td>1.12</td>
<td>57.66</td>
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<td></td>
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<td>1.30</td>
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<td>24-36</td>
<td>1.29</td>
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<tr>
<td>Clay</td>
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<tr>
<td>Site 4</td>
<td>0-6</td>
<td>0.84</td>
<td>68.20</td>
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<td>6-12</td>
<td>0.95</td>
<td>64.21</td>
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<td>12-24</td>
<td>1.05</td>
<td>60.43</td>
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<tr>
<td></td>
<td>24-36</td>
<td>1.20</td>
<td>54.63</td>
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</tbody>
</table>
Time to Infiltrate 1" of Water (seconds)
Timeliness

Random

CTF
Tackling weeds
Wild Buckwheat (#/m²)

Crop:
- Morrin: barley
- Neerlandia: canola
- Trochu: canola
- Westlock: canola

Compared with the check:
- Morrin: P = 0.1994
- Neerlandia: P = 0.4226
- Trochu: P = 0.1835
Cleavers (#/m²)

Crop:
- Lacombe
- Morrin
- Neerlandia
- Trochu
- Westlock
- New Norway

Crop Types:
- Barley
- Canola
- Wheat

P-values:
- Lacombe: P = 0.2863
- Morrin: P = 0.0816
- Neerlandia: P = 0.3356
- Trochu: P = 0.4226
- Westlock: P = 0.2724
- New Norway: P = <0.0001
Side dress UAN in wheat
Side dress nitrogen: CPSW

**Trial 1**
15N split 60N side = 86 bu/ac

**Trial 2**
90N = 101 bu/ac

**Trial 3**
90N split 60N = 124 bu/ac

**Trial 4**
100N split 60N = 10.5 vs 12.3% pro
Side dress vs. streaming UAN: Canola

60 N seeding 120 N side dressed
Yield: 65 bu/ac

60 N seeding 120 N streamed
Yield: 57 bu/ac

Yield increase:
14% or $75.00/ac
Precision spraying
CTFA Yields 2016
bu/ac

CTFA cooperator trials
## Economics of CTF

<table>
<thead>
<tr>
<th>Location</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
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<tbody>
<tr>
<td>Cleardale</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-$2.80 (CPS)</td>
</tr>
<tr>
<td>Dapp</td>
<td>$3.70 (Canola)</td>
<td>$79.33 (CPS)</td>
<td>$54.08 (Peas)</td>
<td>-$7.56 (Canola)</td>
<td>$57.58 (CPS)</td>
</tr>
<tr>
<td>Neerlandia</td>
<td></td>
<td></td>
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<td>$20.27 (CPS)</td>
<td></td>
</tr>
<tr>
<td>Camrose</td>
<td></td>
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<td>$31.80 (Peas)</td>
</tr>
<tr>
<td>Lacombe</td>
<td>-$10.00 (HRSW)</td>
<td>$25.57 (Barley)</td>
<td>$42.50 (W. Wht)</td>
<td>$17.84 (Canola)</td>
<td>-$2.17 (HRSW)</td>
</tr>
<tr>
<td>Trochu</td>
<td>$32.80 (Canola)</td>
<td>$44.04 (Barley)</td>
<td>$9.50 (Peas)</td>
<td>$15.76 (Canola)</td>
<td>$11.99 (Barley)</td>
</tr>
<tr>
<td>Morrin</td>
<td></td>
<td></td>
<td></td>
<td>$23.25 (Canola)</td>
<td>$17.00 (Faba Beans)</td>
</tr>
<tr>
<td>Rolling Hills</td>
<td>-$40.53 (W. Wht)</td>
<td>-$16.04 (Conf. SF)</td>
<td>-$13.02 (Corn)</td>
<td>$6.47 (Yellow Peas)</td>
<td></td>
</tr>
</tbody>
</table>
Conclusion

• Look at your equipment footprint.
• CTF has multiple benefits including yield.
• CTF is the ultimate precision platform!
Nuffield International

• Established in 1947 by William Morris, Lord Nuffield

• Nuffield Farming Scholarships provide a unique opportunity for international travel in the research of topics pertinent to innovation and growth in the business of agriculture

• Nuffield is recognized as the leading agricultural scholarship program, world-wide
Nuffield International

• Approximately 65 scholarships awarded, globally, each year.
• Current Nuffield participating countries: Canada, the UK, Australia, New Zealand, Ireland, France and the Netherlands.
• Associated countries include Brazil, China, India and the USA.
• More than 1,600 Nuffield Scholars, world-wide.
Selection Criteria

• Must an agriculture professional, in any discipline; not confined to primary production.

• 28 – 40 years of age (approx.), but important considerations include level of maturity, life experience and the ability to contribute to industry though this experience

• Must demonstrate the ability to step outside of work, business or operational environment for extended international study.
Nuffield Journey
Nuffield Travel Stats

• 11 weeks of travel
• 7 countries (NZ, AUS$^2$, UK, CAN, US, BZ, MX)
• 68,000 miles
• 134 hrs of flight time
• 52 hrs sitting in 34 airports
• 6 mini-buses
• 4 car rentals
• One tainted Brazilian ice cube!
Controlled Traffic Farming

Final Report
Nuffield Study Tour

By Steve Larocque | March 2012
2007 Canadian Nuffield Scholar
Apply today! April 30th Deadline

www.nuffield.ca
Thank you

Go to www.beyonddagronomy.com and search Nuffield Report or CTF.

Email: steve@beyonddagronomy.com