ISTRO CTF Working Group meeting at LfL, 25-26 May 2011

Venue
Bavarian State Research Center for Agriculture (http://www.lfl.bayern.de/)

Opening
Tim Chamen welcomed the participants and reiterated the aims of the CTF Working Group which centre on reviewing CTF systems and identifying any gaps in knowledge that can be addressed by research, particularly the linkage between tillage, traffic and favourable soil structure. He reported that practitioners were experiencing a 50% reduction in fuel use for crop establishment while maintaining or improving yields. He also stressed that the group should remain in close contact with practitioners to respond to their needs.

Rudolf Rippel, director of the Institute of Agroecology, Organic Farming and Soil Protection then welcomed the group on behalf of LfL, whose work he outlined in the accompanying presentation.

Continuing the presentation, Markus Demmel (joint organiser of the working group meeting) took us through relevant research being conducted at the Center finishing off by mentioning that Weihenstephan claims the oldest brewery in the world, dating from 1040 AD!

Working Group News
The main activity to report since our meeting in Switzerland in August 2010 was the successful submission of an EU proposal under the title “Optisoil”. This had now been assessed and Dave Tinker provided an overview of the assessor’s responses and overall marking. The latter had achieved the overall threshold only and since arriving in Germany, we learned from “inside” sources that the project would not be funded. Dave had anticipated this and encouraged all those present to build on the strength of the consortium of partners which had been established. During discussions later in the workshop, submission of an EU Cooperation in Science and Technology (COST) action was suggested and Dave would follow this up with interested members of the consortium.

Soil Conservation policy and practice in Bavaria
Robert Brandhuber spoke to this topic and provided a comprehensive presentation which highlighted a number of reasons why ploughing was still the dominant basis for crop establishment in Bavaria. Discussion centred on the role of residue chopping to address the corn borer problem and head blight in wheat after maize. It was considered that good management and husbandry had the potential to overcome some of the main problems without plough-based tillage.

CTF and strip tillage research projects at LfL
Markus Demmel outlined the background to these research projects which are being run at three commercial farm sites in Bavaria. The key driving force for these was climate change for which CTF and strip till were seen as a possible means of offsetting its worst effects. The accompanying presentation covers the background, treatment details and conclusions to date.

Gut Wittenfeld
Our workshop then “decamped” from LfL at Freising and travelled around 80 km north west to the 280 ha farm of Thomas Muhr. Cropping includes 40-50 ha of sugar beet and 30 ha of rye (yielding 10 t/ha), which has replaced the second wheat in the rotation. This year they have had 89 mm moisture
deficit in April and another 86 mm in May. Over the past three years they have not ploughed for sugar beet and the alternative tillage equipment is a crucial element of the system, as are also, the combine harvester choppers. Non-plough cultivation is with a Väderstad TopDown which gives a level surface compared with their previous disc-based system. However, today’s planters are not well suited to strip till because they can’t deal with clods, which are actually beneficial for over-wintering of the soil. They have two strip till machines – a 12 row Yetter which has extension arms to allow both 45 cm and 50 cm row spacing. These units weigh 189 kg and have a star wheel which is designed to remove residues from the path of the cultivation tine. The other machine is a Dawn with units weighing 300 kg each and this machine is more compromised by moist soils.

**Geo-Konzept**

In addition to managing the farm, Thomas runs Geo-Konzept, a company specialising in GNSS, RTK and auto-steer of both vehicles and implements. Thomas said that GNSS is for more than just straight lines and their biggest interest this year has been in auto section control on sprayers and implement steer for rows. Steering options include side shift, disc and wheel steer and 3-point linkage shift, although the latter could involve high forces on draught implements. It has also been used for fruit tree planting. One key advantage of RTK row crop implement steering is no further need to have all implement widths the same – the matching of passes is so accurate that any machine width will fit. As far as alternatives to a second RTK receiver for implement steer were concerned, none of these are as accurate and the cost of RTK continues to fall. In terms of the market for RTK, Thomas considered that for farms of between 500-1500 acres, an owned base station was best. For smaller farmers and particularly those with scattered fields, a dealer network or mobile phone option would probably be more suitable. He did however give a word of caution as far as dealer networks were concerned in terms of how long these would be maintained, particularly if prices were driven down too far, and it also depended on how long dealers would need to offer an RTK service to get tractor sales. In Germany, prices were high because they were still driven by the surveying industry. Cheapest delivery is in the Netherlands and indeed free in some areas but he thought that this was not likely to remain so.

Thomas remarked that using a single screen for both ISOBUS and RTK vehicle and implement steering certainly cut down on the clutter in cabs, but there was a certain minimum screen size under which managing the different systems became impractical.

**Strip till research in France**

Jérôme Labreuche gave a short presentation describing crop establishment research which had just started at Boigneville, France looking at emergence and yield of maize using strip till with a “Rotasemis” rotary cultivator. Although it was too early in the trial to draw any conclusions about yields it was apparent that those under direct sowing had at least be maintained compared with traditional practice. Arvalis had also surveyed results from 35 farms using strip till where there was an average saving of €60/ha in establishment costs with strip till but a small extra cost of chemicals.

**Strip till in sugar beet by Südzucker Group**

Veit Nübel of Südzucker, Rübenabteilung Ochsenfurt used his presentation to outline the work they are doing comparing plough and mulch tillage with strip till. The trials have been running since 2009 using two prototype versions of the Horsch Focus strip till cultivator. Using John Deere’s RTK iSteer and side shift on the implements they are able to use a 12 row drill in combination with a 6 row strip till cultivator. A prism roller is used to improve crop emergence. Worm activity in the spring mixes
most of the non-cultivated stubble under the strip till system with the soil within 8 weeks, as clearly illustrated in Veit’s presentation which provides an excellent overview of their work.

**Leading Farmers CZ a.s.**
Pavel Milata gave a short [presentation](#) describing some software (OptiTrail) to improve the efficiency of field operations. This optimises trajectories within a field using specified swath widths, calculates the number of headland circuits, minimal turn radii and contra-flow turns. His presentation included other offerings from Leading Farmers.

**European CTF projects**
Projects were reported from Switzerland, Slovakia and the UK.
Tim Chamen presented the [work being carried out in Slovakia](#) on behalf of Jana Galambosova as well as [a project from the UK](#) completed in 2010. Martin Holpp presented [the work from Switzerland](#).

**Farm “Walks”**
We had three focused walks around the farm. The first was for people to see and have a “hands-on” experience of the Geo-Konzept RTK guidance system working in a Fendt 822 Vario, the second was to look at and discuss the machinery used for the cropping at Gut Witttenfeld and finally a field visit to see the sugar beet and wheat established with the different systems described in the presentation by Markus Demmel. These three “walks” are illustrated and commented upon in the following pages.
In terms of the experiments, there were four establishment treatments with two replications for sugar beet plus a control of standard practice on the farm. Table 1 outlines the treatments and crop establishment data.

### Table 1. Treatments for sugar beet crop establishment in spring 2011 at Gut Wittenfeld. All treatments followed winter rye which received stubble cultivation with discs and were sown with the same precision drill. Where a cover crop was grown, this was established with a disc drill in the autumn following the disc cultivation.

<table>
<thead>
<tr>
<th>Treatment name</th>
<th>Strip till or other cultivator</th>
<th>Depth of strip till, cm</th>
<th>Cover crop</th>
<th>Crop establishment, % In wheel track</th>
<th>Outside wheel track</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strip tillage 1</td>
<td>Dawn Pluribus</td>
<td>13</td>
<td>No</td>
<td>74</td>
<td>63</td>
</tr>
<tr>
<td>Strip tillage 2</td>
<td>Yetter Maverick</td>
<td>18</td>
<td>No</td>
<td>68</td>
<td>59</td>
</tr>
<tr>
<td>Strip tillage 3</td>
<td>Dawn Pluribus</td>
<td>13</td>
<td>Yes</td>
<td>68</td>
<td>84</td>
</tr>
<tr>
<td>Strip tillage 4</td>
<td>Yetter Maverick</td>
<td>18</td>
<td>Yes</td>
<td>89</td>
<td>86</td>
</tr>
<tr>
<td>Control</td>
<td>Stubble cult TopDown (10 cm)</td>
<td></td>
<td>Yes</td>
<td>100</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>Stubble cult TopDown (15 cm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stubble cult Seedbed cultivator</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

A factor in the crop establishment figures was the fact that in the wheel tracks the wheels tended to close up the slot so protecting the seed from predators and from drying out. As with most experiments, it is extremely difficult to measure the effect you want, it is often compromised by something else. However, in this case, it does highlight the need to address very specific differences that the treatments create.
Farm “Walks” at Gut Wittenfeld

RTK guidance and autosteer
Machinery at Gut Wittenfeld

Farm: Thomas Muhr
Gut Wittenfeld
85111 Adelschlag

280 ha arable land, plant production
Mulch tillage without plough > 5 years
loamy soil
avg. height 450 m absolute altitude
avg. temperature 8.0 °C Tem,
avg. 690 mm/a precipitation

Rotation: Sugar beet, winter wheat – winter rye

Mechanisation (key machines):

AGCO Challenger MT 755 C
(tillage, drilling) 224 kW

John Deere 6830
(single seed drill, fertilizing, spraying) 99 kW

Combination cultivator Väderstad Top Down 4.0 m
Cultivator drill combination Väderstad Rapid 6.0 m
Single seed drill Kverneland Monopill 12 rows 5.4 m
Twin disc fertilizer spreader Bogballe 28 m
Trailer crop sprayer John Deere Serie 700 28 m
Combine harvester MF 7272 Cerea 5.5 m
Six row self propelled side loading sugar beet harvester Matrot 5.4 m
Delivery of two sizes of Wifo side shift frames to Gut Wittenfeld (http://www.wifo.nl/)
Yetter “Maverick” strip till cultivator

Dawn “Pluribus” strip till cultivator
Strip Tillage 1 - into stubble mulch

- Winter rye harvest (11.08.2010)
- Stubble cultivation with compact disc harrow “Lemken Rubin” 5 cm deep (12.08.2010)
- Strip Tillage with *Dawn Pluribus* 13 cm deep (13.10.2010)
- Single-seed drilling “Kverneland Monopill” (30.03.2011)
  → Germination (counted at 15.05.2011)
    wheeled / in track 74 %
    un-wheeled / beside track 63 %

Strip Tillage 2 - into stubble mulch

- Winter rye harvest (11.08.2010)
- Stubble cultivation with compact disc harrow “Lemken Rubin” 5 cm deep (12.08.2010)
- Strip Tillage with *Yetter Maverick* 18 cm deep (13.10.2010)
- Single-seed drilling “Kverneland Monopill” (30.03.2011)
  → Germination (counted at 15.05.2011)
    wheeled / in track 68 %
    un-wheeled / beside track 59 %

Strip Tillage 3 - into cover crop (clover)

- Winter rye harvest (11.08.2010)
- Stubble cultivation with compact disc harrow “Lemken Rubin” 5 cm deep (12.08.2010)
- Cover crop seeding with “Väderstad Rapid” (20.08.2010)
- Strip Tillage with *Dawn Pluribus* 13 cm deep (13.10.2010)
- Single-seed drilling “Kverneland Monopill” (30.03.2011)
  → Germination (counted at 15.05.2011)
    wheeled / in track 68 %
    un-wheeled / beside track 84 %
Moisture tension measurements

In both the wheat and sugar beet crops at Gut Wittenfeld soil moisture tension sensors had been installed at various depths in the profile, results of which for the Dittenfeld site this spring were given in slide 15 of the presentation given by Markus Demmel. These showed a significant contrast between the trafficked and non-trafficked soils with the latter showing a consistently lower tension on each date of measurement. The reasons for this could either be greater plant available water or reduced growth, so the yield results will be of particular interest. An example of the Ecomatik Equitensiometers used for these measurements is shown in Fig. 1.
Fig. 1. An Ecomatik sensor used for measuring soil moisture tension

Observation of the wheat following sugar beet revealed few differences in growth, even in the main wheel tracks, as indicated in Fig. 2. This was almost certainly due to the extensive wheeling which unavoidably occurred at harvest in 2010 as illustrated in slide 26 of Markus’s presentation. It is hoped that the length of the unloading auger can be extended to avoid this problem in the future.
Conclusions to date from field experiments

- At harvest in 2010 at Gut Wittenfeld, overall and sugar yields were reduced by the activity of slugs when only strip tillage was used. The problem was perhaps worse with the Dawn Pluribus which worked shallower and moved less soil than the Yetter.
- Sugar beet establishment in 2011 was better after cover cropping which included an extra tillage operation.
- Sugar beet establishment was poorer in the non-trafficked beds in the presence of straw compared with in the wheel tracks but the reverse was the case when more tillage was involved (cover cropping).
- There was less contrast in corn yields with the Dawn Pluribus between the wheel tracks and the non-trafficked rows alongside compared with the Yetter Maverick where yields were greater from the non-wheeled soil. However, none of the differences were significant.
- There were instances where frost damage was greater in the presence of straw residues, this being attributed to less warming of the soil from the sun during the day.
- Integration of CTF with typical Bavarian cropping creates many challenges, mostly associated with harvesting operations. In 2010 the length of the unloading auger on the sugar beet
harvester at Gut Wittenfeld meant that the controlled traffic plots were compromised to a great extent.

- Consistent strip till farming leads to controlled traffic farming!

**Future work and meeting**

Before closing the meeting Tim Chamen stressed the need for the group to maintain close links with the industry and for any research to be closely driven by its needs. This was not always possible due to the sources of funding but the group should remain committed to its underlying focus on research which addressed practical needs and led to improving non-trafficked soil conditions through appropriate and sustainable management.

Dave Tinker had identified a number of people who wished to pursue a COST action and he would be finding out more about the mechanisms involved and would contact others within the consortium to take this forward.

Martin Holpp drew our attention to Agritechnica in November (15 – 19) of this year for which he was trying to get some presenters for the “Smart Farming – intelligent and sustainable plant production” segment of the show. He hoped that there would be a CTF forum with 3 speakers – contact Martin if you are interested. Dave Tinker also mentioned the LandTechnik event which immediately preceded Agritechnica, titled this year “Solutions for Intelligent and Sustainable Farming”.

Two venues were suggested for our next meeting, France and Sweden. Jérôme Labreuche was very happy to host this at Boigneville but could not promise that we would see any research that included CTF. The other suggestion was Uppsala in Sweden where there was a long history of research on compaction. Likely date would be as this year, late May or early June. Subsequent to this workshop in Bavaria, it had been suggested that we should approach the Visual Soil Inspection working group to see if they might be interested in combining our two meetings on this next occasion. **Your views on this, the date and the venue for our next meeting are sought!**

**Acknowledgements**

All present wished to thank Markus Demmel and Robert Brandhuber and their colleagues and to Thomas Muhr for organising an excellent and interesting workshop and to LfL for hosting us at Freising.

People!