Impact of non-plough tillage in long-term trials – Results of the first crop rotation in organic farming

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Introduction

- Conservation soil tillage without ploughing provides advantages concerning soil structure, soil life and erosion protection.
- Ploughing is usually the primary soil tillage in organic farming due to weed control and N mineralisation.
- Some farmers temporarily use reduced tillage without ploughing, but very few farmers permanently switch to reduced tillage or no-till systems with no ploughing in Germany.
- **Aim**: to determine the impact of temporary and permanent non-plough tillage in an organic crop rotation.
### Methods

#### Neuhof - Experimental station LfL

#### Puch - Experimental station LfL

<table>
<thead>
<tr>
<th></th>
<th>Neuhof</th>
<th>Puch</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Soil type</strong></td>
<td>silty loam</td>
<td>sandy loam</td>
</tr>
<tr>
<td><strong>Soil quality (1-100)</strong></td>
<td>62</td>
<td>64</td>
</tr>
<tr>
<td><strong>Ø Annual precipitation</strong></td>
<td>677 mm</td>
<td>882 mm</td>
</tr>
<tr>
<td><strong>Ø Annual temperature</strong></td>
<td>8.7 °C</td>
<td>8.8 °C</td>
</tr>
<tr>
<td><strong>Stock density</strong></td>
<td>stockless*</td>
<td>stockless</td>
</tr>
</tbody>
</table>

* Until 2008 suckler cows

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## Background

### Trial in conventional farming

<table>
<thead>
<tr>
<th>Duration</th>
<th>1997-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop rotation</td>
<td>Winter oilseed rape – winter wheat – winter triticale – spring barley</td>
</tr>
<tr>
<td>Fertilization</td>
<td>Mineral fertilizers</td>
</tr>
<tr>
<td>Crop protection</td>
<td>Chemical</td>
</tr>
</tbody>
</table>

**Variants**
- Conventional ploughing (CP, ploughing after each crop)
- Reduced ploughing (RP, ploughing every fourth year)
- Conservation tillage (CT, no ploughing)

**Other**
- Cultivators were used for soil tillage in CT

Conversion to organic farming in 2012 and 2013 (biennial grass-clover leys)
Methods

Trial in organic farming (starting 2014)

- Crop rotation: grass-clover ley (one year, mulched), winter wheat, spring oat, faba bean and winter rye
- Stockless farming → no fertilization
- Variants remained the same
  - Reduced ploughing: ploughing after grass-clover leys (only Puch) and oat (Neuhof and Puch)
- Block design with three replication
- Large-scale plots, cultivation with customary in practice technique
Yield at Puch

Different letters denote significant differences (SNK, p < 0.05), ns = not significant;
CP = conventional ploughing (100 %),
RP = reduced ploughing (ploughing after grass-clover leys and oat),
CT = conservation tillage (no ploughing)
Yield and Weed pressure, Puch

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Correlation between weeds and yield

Puch

R = -0.699*

* Significant (p < 0.05)

Neuhof

R = -0.02
Weed pressure in wheat 2015 at Neuhof
Weed pressure in oat 2018 at Puch

Conservation tillage to the left, conventional ploughing to the right
First conclusions

- First crop rotation in organic farming!
- Crunch point non-ploughing after grass-clover leys
- Successful implementation particularly at the experimental station Puch with higher precipitation difficult
- At Puch, reduced ploughing interesting compromise
- At Neuhof, conservation tillage seem possible without yield depression
Thank you for your attention