The arable vegetation of Baltic organic cereal fields as shaped by crop management

Objectives

**Aim:** Better utilization of crop diversification strategies for weed management. To control weed densities and maintain diverse arable weed vegetation that is manageable in the long-term.

**Objective:** Investigate the role of crop diversification strategies on weed vegetation on farms.

I. International utilization of crop diversity strategies

II. What is the influence of crop diversity strategies on:
   - Weed density
   - Weed species numbers
   - Weed diversity

III. Study the influence of crop diversity strategies on the weed community
Method - Weed survey and explanatory variables

Weed survey
- Taking place at organic farms in spring sown cereals, BBCH stage 61-69
- Transect of 100m², 3 replications per field, 207 fields in 2015-2016
- Estimation of weed species density

Explanatory variables
- Collection of field history data

Statistical analysis
- Linear mixed models, multivariate analysis,
- canonical correspondence analysis (CCA)

<table>
<thead>
<tr>
<th>Density Classes</th>
<th>100 m²</th>
<th>m²</th>
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<tbody>
<tr>
<td>I</td>
<td>0-20</td>
<td>&lt;1</td>
</tr>
<tr>
<td>II</td>
<td>20-50</td>
<td>&lt;1</td>
</tr>
<tr>
<td>III</td>
<td>50-100</td>
<td>0.5-1</td>
</tr>
<tr>
<td>IV</td>
<td>100-200</td>
<td>1-2</td>
</tr>
<tr>
<td>V</td>
<td>200-500</td>
<td>2-5</td>
</tr>
<tr>
<td>VI</td>
<td>500-1000</td>
<td>5-10</td>
</tr>
<tr>
<td>VII</td>
<td>1000-5000</td>
<td>10-50</td>
</tr>
<tr>
<td>VIII</td>
<td>5000-10000</td>
<td>50-100</td>
</tr>
<tr>
<td>IX</td>
<td>10000-50000</td>
<td>100-500</td>
</tr>
</tbody>
</table>
Method - Site
Definitions

Main crop: Cash crop
  • This includes grass clover leys, that are cut

Undersown crop: A cover crop sown at the same time as the main crop, but not harvested as a cash crop.
  • In this study mostly grass clover, grass or clover solely, or vetch

Crop mixtures: Two crops sown together, both used as cash crops.
  • In this study crop mixtures most often consisted of a cereal/legume mix

Winter Catch Crop: Winter cover crop, that is present when no cash crop is present. Is not harvested as a cash crop.
  • Grass Clover, but also mustard, oilseed rape and green cover mixtures
Results I – Management implemented
### Results – Management implemented

<table>
<thead>
<tr>
<th></th>
<th>Denmark</th>
<th>Finland</th>
<th>Germany</th>
<th>Latvia</th>
<th>Sweden</th>
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<tbody>
<tr>
<td><strong>Organic (years)</strong></td>
<td>16,65</td>
<td>17,11</td>
<td>19,81</td>
<td>11,7</td>
<td>16,02</td>
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<td>5,31</td>
<td>4</td>
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<td><strong>Undersow</strong></td>
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<td>0,21</td>
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<td>0,72</td>
<td>0,47</td>
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<td>0,59</td>
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<tr>
<td><strong>Winter Catch Crop</strong></td>
<td>0,65</td>
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<td>0,41</td>
<td>0,88</td>
<td>0,02</td>
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<td>0</td>
<td>0,67</td>
<td>0,76</td>
<td>0,16</td>
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<td>0,14</td>
<td>0,22</td>
<td>0,53</td>
<td>0,15</td>
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<tr>
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<td>0,47</td>
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<td>1,07</td>
<td>0,75</td>
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<td>1,14</td>
<td>1,18</td>
<td>0,81</td>
<td>0,85</td>
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<tr>
<td><strong>Cereals</strong></td>
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<td>2,5</td>
<td>3,02</td>
<td>3,5</td>
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<tr>
<td>stdev</td>
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<td>0,82</td>
<td>0,99</td>
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<tr>
<td><strong>Other Crops</strong></td>
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<td>0,64</td>
<td>0,75</td>
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<tr>
<td>stdev</td>
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<td>0,85</td>
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<td><strong>SandPercentage</strong></td>
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<td><strong>Yield (t/ha)</strong></td>
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<tr>
<td>stdev</td>
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<tr>
<td><strong>Harrowing (#)</strong></td>
<td>0,75</td>
<td>0,23</td>
<td>0,71</td>
<td>0,6</td>
<td>0,88</td>
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<td>0,42</td>
<td>0,74</td>
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</table>
Results - Weed occurrence

(197 species)
Results II - Weed Density, Species numbers, Diversity

- **Density**
  - Log(Density)
  - Countries: Denmark, Finland, Germany, Latvia, Sweden

- **Species numbers**
  - Countries: Denmark, Finland, Germany, Latvia, Sweden

- **Diversity**
  - Shannon index
  - Countries: Denmark, Finland, Germany, Latvia, Sweden
### Mixed Model anova

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>(log) Weed Densities</th>
<th>Species Numbers</th>
<th>Shannon Index</th>
<th>Unit</th>
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<tr>
<td>Farm</td>
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<td>Survey Year</td>
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<td></td>
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<tr>
<td>Years Organic</td>
<td>Years under Organic Management</td>
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<tr>
<td>Management</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Crop Present</td>
<td>OPea -1.21 ± 0.54 *</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Trit 0.55 ± 0.26 *</td>
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<tr>
<td></td>
<td>Srye -11.73 ± 5.07 *</td>
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<tr>
<td></td>
<td>Srye -0.99 ± 0.43 *</td>
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<tr>
<td>Yield</td>
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<tr>
<td>Harrowing</td>
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<tr>
<td>Crop Diversity</td>
<td></td>
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</tr>
<tr>
<td>Undersow</td>
<td>2.24 ± 0.65 ***</td>
<td>0.17 ± 0.054 **</td>
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<tr>
<td>Crop Mixtures</td>
<td></td>
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<tr>
<td>Winter Catch Crop</td>
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<tr>
<td>Other Crop</td>
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</table>

Information removed, these are unpublished data and will be produced in an article in the future.

*P<0.05  
**P<0.01  
***P<0.001
Results III – Weed community

- Geographical dispersal

Ordination plot (CCA) displaying all sites effected by 8 management variables.
Results III – Weed community

Ordination plot (pCCA) displaying the 94 most frequent species as effected by 8 management variables.
I. Crop diversity strategies are use in low intensities (based on the information provided) and depend on local socio-economic and environmental conditions.

II. Winter cover crops affect weed species numbers and diversity positively. Densities were not affected by the implementation of crop diversity strategies.

III. The data show that the crop diversity strategies have a subtle influence on the weed community, where winter catch crops affect annuals and perennials differently.
Thank you for your attention!

Thanks to all participating farmers, partners and Core Organic