Soil seedbank diversity of different niches within arable farmland

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Introduction.

- Weeds that germinate from the soil seedbank are the best indicator of arable diversity ...
- ...and indiscriminate herbicide use has caused a serious decline in farmland diversity.
- Though germination methods use simple treatments to break seed dormancy, ...
- ...they may not be completely effective and dormant seeds (diversity) may remain in the soil.
- We plan to use naturally occurring bioactive chemicals to assess the hidden dormancy.

However, first we had to define the baseline levels of diversity for our study areas.

Measuring the baseline levels of soil seedbank diversity.

Approximately 1 m³ of soil (20 cm deep) was extracted from four diverse locations (shown above).

- Location 1: high pilmore: the fallow ground site.
- Location 2: the standing ground. Use to store and access heavy farm machinery.
- Location 3: a wildflower-meadow strip. This borders a field that is under crop rotation.
- Location 4: within a barley crop.

- Soil was homogenised and fifty soil replicates were processed for each location.
- These were positioned in a randomised-plot design within a glasshouse (shown opposite).

Biodiversity estimates using the Shannon Index.

Shannon diversity index (H) : fallow > wildflower strip > crop > standing ground (p < 0.05)
Shannon Evenness (H') : fallow > wildflower strip > crop > standing ground (p < 0.05)

Table 1.

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
<th>S</th>
<th>N</th>
<th>H</th>
<th>HE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fallow</td>
<td>9.3 ± 0.35</td>
<td>108.3 ± 5.85</td>
<td>1.22 ± 0.03</td>
<td>0.81 ± 0.01</td>
</tr>
<tr>
<td>2</td>
<td>Cropped</td>
<td>8.8 ± 2.4</td>
<td>110.3 ± 5.85</td>
<td>1.15 ± 0.05</td>
<td>0.83 ± 0.02</td>
</tr>
<tr>
<td>3</td>
<td>Wildflower margin</td>
<td>8.7 ± 0.56</td>
<td>106.7 ± 1.58</td>
<td>1.27 ± 0.03</td>
<td>0.83 ± 0.01</td>
</tr>
<tr>
<td>4</td>
<td>Standing ground</td>
<td>6.6 ± 0.55</td>
<td>74.7 ± 2.49</td>
<td>0.72 ± 0.06</td>
<td>0.36 ± 0.02</td>
</tr>
</tbody>
</table>

S = Number of different species found within each replicate (species richness). N = Total number of individuals found within each replicate.

Arguably, evenness (H'; Table 1 above), is the best measure of diversity, and on this basis:

- The fallow soil seedbank is most diverse.
  - Shown by the greater number of different species and the total number of individuals (Table 1).
  - Surprisingly, cropped = fallow soil seedbank: but the former is dominated by only 5 species (Table 2).

- The wildflower-margin strip = cropped seedbank.
  - This is surprisingly and due to especially low number of individuals (N) in the wildflower meadow (Table 1).
  - But, each site is dominated by a only 5 and 4 species respectively... (Table 2).

- This may reflect the common cultivation histories for these sites.
  - Both have been cropped and exposed to herbicides.
  - The wildflower meadow strip is sown with a limited species and perhaps at low density.

The standing ground seedbank is least diverse.

- This indicates the positive impact of soil disturbance that allows viable seed to resurface.
- Disturbance should be followed for a period of non-disturbance to facilitate re-seeding.

Conclusions to promote the diversity of wild plants in agricultural landscapes.

- Avoid frequent heavy mechanical damage to the soil surface.
- Allow soil disturbance/turn-over, and allow time for re-seeding afterwards.
- Avoid herbicides and artificially sowing of annuals.
- Use the resources of the existing seedbank; these appear significant - even in cropped soils.
- Best-disturbance practice needs determined through empirical experimentation.

References.


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