Growing cover crops in organic arable crop rotations: Best practices from Denmark

Problem
Reduced soil quality, soil erosion, nutrient losses and high weed pressure are common challenges in arable farming. Cover crops can help to overcome these problems. But they are ‘yet another expense’ and might compete with the main crop for water, light and nutrients. Thus, successful implementation of cover crops requires knowledge of where in the rotation to grow them, which species to grow, and when and how to manage them.

Solution
Growing cover crops solves many of the problems related to arable farming. Based on extensive experiences with cover crops in Denmark, SEGES has drawn conclusions for management of cover crops in arable rotations.

Outcome
When sown correctly at the right time, in the right position within the rotation, cover crops retain nutrients, conserve water, prevent soil erosion, improve soil fertility and quality, and suppress weeds. Growing cover crops is recognized as a climate-smart agricultural practice.

Practical recommendation
Where to position and when to time cover crops in the rotation?
- Grow cover crops in the 1st and 2nd year after ploughing of clover-grass to avoid nitrogen losses.
- Grow nitrogen fixing cover crops on soils with low fertility.
- Sow cover crops into or immediately after the main crop. In row crops, sow the cover crop in combination with the last hoeing. If the harvest of the main crop is rather early, sow the cover crop after harvest.
- The earlier a cover crop is sown in August, less nitrogen is lost. Each day of delay in sowing a cruciferous cover crop in August results in loss of about 2 kg of N per ha.
- Do not sow cruciferous cover crops into main crops shortly before the harvest, as weed competition may be too high for successful establishment of the cover crop.
- Cover crops sown in spring usually establish well and safely. For spring-sown cover crops use clover mix rather than ryegrass to satisfy nitrogen needs.
- On sandy soils with irrigation, undersow spring crops with wide row distances after the main crop has developed 1-2 nodes high to allow hoeing of the main crop in early stages.
- In winter crops, sow cover crops (clover mix rather than ryegrass) in spring as early as possible.
- Use cover crops after application of large amounts of solid manure, as it helps to retain the nitrogen.
- In lupines or broad beans, undersow a cover crop followed by a spring crop the next year. If a winter crop is chosen instead, perennial weeds might flourish.

Applicability box
Theme
Soil quality and fertility, Nutrient management, Pest control, Weed management

Geographical coverage
Cool, temperate climate

Application time
August/spring (in the Danish context)

Required time
No additional time required

Period of impact
Succeeding crop

Equipment
Regular sowing equipment

Best in
All organic agricultural crop rotations
Cover crops and weed control

- Problems with creeping thistle, sow-thistle and coltsfoot do not rule out cover crops: Sow the cover crop immediately after an early harvest and ploughing. Repeat ploughing in spring before sowing a spring crop.
- To reduce couch-grass, mechanical treatment in autumn is more efficient than growing a cover crop.

Choice of cover crop species

<table>
<thead>
<tr>
<th>Time of sowing</th>
<th>Main crop competition</th>
<th>Soil type</th>
<th>Species</th>
<th>Amount kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>Minor competition (e.g. weakly fertilized spring wheat or barley)</td>
<td>All soil types</td>
<td>Ryegrass (early)</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>White clover + Ryegrass</td>
<td>2 + 8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ryegrass (early)</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Red clover + Ryegrass</td>
<td>3 + 8</td>
</tr>
<tr>
<td>After harvest</td>
<td>Sandy soils</td>
<td></td>
<td>Winter rape</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Winter vetch + Rye</td>
<td>40 + 40</td>
</tr>
<tr>
<td></td>
<td>Clayey soils</td>
<td></td>
<td>Yellow mustard or Fodder radish</td>
<td>8 + 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Common vetch + Yellow mustard</td>
<td>30 + 5</td>
</tr>
<tr>
<td>Spring</td>
<td>Minor competition</td>
<td>All soil types</td>
<td>Ryegrass (early) or Ryegrass + Chicory</td>
<td>10 + 5 + 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Italian ryegrass</td>
<td>10</td>
</tr>
<tr>
<td>After harvest</td>
<td>Sandy soils</td>
<td></td>
<td>Winter rape</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Winter rape + Rye</td>
<td>3 + 40</td>
</tr>
<tr>
<td></td>
<td>Clayey soils</td>
<td></td>
<td>Yellow mustard or Fodder radish</td>
<td>8 + 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Winter rape + Rye</td>
<td>3 + 40</td>
</tr>
</tbody>
</table>

Figure: Recommended cover crop species and combinations based on N-availability, timing, soil types and crop competition.

Further information

- www.landbrugsinfo.dk/udfasning (Danish website)
- http://www.landbrugsinfo.dk/Oekologi/Planteavl/Filer/efterafgroeder_fakta.pdf (Danish factsheet)

Use the comment section on the Farmknowledge platform to share your experiences with other farmers, advisors and scientists! If you have any questions concerning the method, please contact the author of the practice abstract by e-mail.