Catchment Management for Water Supply Protection:

Green cover after maize & Wessex Water’s cover crop work to date

Tim Stephens
Senior Catchment Adviser, Wessex Water
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Where we are working
Safeguard Zones

Source: Patrick Goldsworthy, VI
Nutrient enrichment causing algal growth >>>>>>>>

Habitat damage from sedimentation >>>

<<<<<< High and rising nitrate trends
Typical practices causing nitrate leaching

- Field not appropriate for use e.g. crop (e.g. maize), for early/late grazing or for spreading slurry
- Imprecise application of nutrients
- Over-fertilisation (inc. organic manures) – rate and timing
- Inversion tillage
- Crops not fulfilling their potential and sub-optimal soil structure / health
- Lack of green cover over-winter
- Late harvesting & late establishment
- Growing higher leaching crop types
- Fertiliser type

Farming practices
Typical livestock farming practices that can cause nitrate leaching

- Insufficient storage of livestock manures leading to untimely application
- Leaking slurry stores
- High stocking rates
- Over-feeding of protein
- Inappropriate out-wintering

Source: AHDB
The nitrogen challenge

Winter Wheat: Post-harvest SMN on 8th Oct 2015 (kgN/ha)

- Fertilised for high yield, actual yield was average
- Fertilised for average yield, actual yield was average
Earlier harvest allows earlier establishment of the following crop

Wheat drilled after earlier maturing variety

Wheat drilled after late maturing variety (same farm, same date)
Crop nitrogen uptake of a cover crop and the amount of nitrogen prevented from leaching by that cover crop.

*Source: Wessex Water porous pot data from 17 Dorset farms in the winters of 2014/15 and 2015/16*
When does nitrate leaching happen?
Cumulative nitrogen leached during winter 2015/16 – Deverel Farm trial

Deverel Farm cover crop trial – Winter 2015/16

- Plot 1 - Cultivated Stubble, Undrilled Control
- Plot 7a - Oil Radish 10kg/ha
- Plot 8a - Oil Radish 15kg/ha
- Plot 8b - Oil Radish 15kg/ha + starter N
- Plot 9a - Oil Radish 20kg/ha
- Plot 10a - Kings Structure Mix
- Plot 11a - EFA Rye & Vetch Mix

kg N/ha
Cover crop trials – winter 2016/17

Deverel Farm, Blandford Forum
- Oil radish variety comparison

Kingston Maurward College, Dorchester
- multi-species comparison
- oil radish variety comparison
- drilling date comparison
Average crop N at 15th November 2016
- Kingston Maurward Trial

- Drilled 7th Sept average crop N (kg/ha)
- Drilled 28th Sept average crop N (kg/ha)
c. 60% of N in leaf, 40% in root

Interim results from Deverel Farm replicated oil radish trial

Total crop N at 9th January 2017 - Deverel Farm trial

kgN/ha

Variety

Siletina  S. Nova  Romessa  Lunetta  Bokito  Barracuda  Toro  Terranova  Radical  Evergreen  Structurator  Till Radish  Mix

Total Crop P at 9th January 2017 - Deverel Farm Trial

kgP/ha

Variety

Siletina  S. Nova  Romessa  Lunetta  Bokito  Barracuda  Toro  Terranova  Radical  Evergreen  Structurator  Till Radish  Mix

c. 40% of P in leaf, 60% in root
Maize undersowing trial. Hurst Farm, nr Dorchester

IRG in slurry

IRG with Einbock

18-25 kg crop N/ha on 3rd Jan

27 kg crop N/ha on 3rd Jan
Fovant, Wiltshire. Early Nov 2016. Grass seed broadcast into fairly late-drilled maize. The grass took well and generally did what was required.
Pearce Seeds cover crop trials between crops of continuous maize (near Taunton)

<table>
<thead>
<tr>
<th>Plot No.</th>
<th>Crop</th>
<th>Sowing rate (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Winter Wheat</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>Forage Rye</td>
<td>150</td>
</tr>
<tr>
<td>3</td>
<td>Early English Vetch</td>
<td>125</td>
</tr>
<tr>
<td>4</td>
<td>Vetch &amp; Festulolium</td>
<td>75</td>
</tr>
<tr>
<td>5</td>
<td>Berseem Clover</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>Westerwolds</td>
<td>25</td>
</tr>
<tr>
<td>7</td>
<td>Festulolium</td>
<td>25</td>
</tr>
<tr>
<td>8</td>
<td>Tetraploid Ryegrass</td>
<td>25</td>
</tr>
</tbody>
</table>
GOOD SOWING TECHNIQUE NECESSARY

Establishment varies significantly based on method of sowing seed.

3 trials in 2014
Per cent germination
12
27
45

Source: MGA Technical note Apr 2015
(Photos from Hans Spelling Oestergraard, SEGES, Denmark)
Specialist Drill + Seed + £5/ac Grant from WUF

Complying with GAEC regulations (Good Agricultural, Environmental Condition) will probably prohibit farmers from leaving maize stubbles over winter in the future. Planning to establish a crop or cover after maize harvest is often not realistic because of autumn soil conditions and problems of late sowing. Under-sowing maize with grass, legumes and other species is, however, becoming a practical option. Grass can also count as an ‘ecological focus area’ option.

Field Options Ltd +
Wye and Usk Foundation

Maize Under-Sowing
Price Structure

Spring 2016

Prices below are per acre; drilling and seed included.
Price is dependant on the species to be sown, the area to be drilled and the round trip the drill has to make for each job. Select from tables below.
Farmers can order a combination of species.
Deduct £5.00/acre from the prices below to give the net price.
This will be subject to VAT and terms below.

<table>
<thead>
<tr>
<th>No. 1. IRG Option</th>
<th>Cost/acre ex VAT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10-20 Miles (Avg.15)</td>
</tr>
<tr>
<td>10-20 acres</td>
<td>£31.36</td>
</tr>
<tr>
<td>21-40 acres</td>
<td>£30.26</td>
</tr>
<tr>
<td>40-100 acres</td>
<td>£29.19</td>
</tr>
<tr>
<td>&gt;100 acres</td>
<td>£28.66</td>
</tr>
</tbody>
</table>
Photos taken:
*Herefordshire, 30<sup>th</sup> January 2017*

**Drilled + press wheel drill**

**Broadcast + grass rake (next door field)**
Undersowing methods conclusion

• There is an optimum time to undersow, typically in June
  – Too early = competes with maize and could be affected by residual herbicides
  – Too late = maize canopy closes preventing grass from establishing

• Broadcasting and harrowing in seed between rows is too inconsistent

• Drilling is the solution
  – Without depth control and pressure wheel - better
  – Depth control and pressure wheel - the best, especially for small seed species

• Higher seed rates do not always secure the best establishment
Research Review No. 90

A review of the benefits, optimal crop management practices and knowledge gaps associated with different cover crop species

White, C.A.\textsuperscript{1}, Holmes, H.F.\textsuperscript{2}, Morris, N.L.\textsuperscript{3}, and Stobart, R.M.\textsuperscript{3}

\textsuperscript{1}ADAS Gleadthorpe, Meden Vale, Mansfield, NG20 9PD
\textsuperscript{2}ADAS Boxworth, Cambridge, CB23 4NN
\textsuperscript{3}NIAB TAG, Morley Business Centre, Morley, Wymondham, Norfolk, NR18 9DF

This review was produced as the final report of a 9 month project (21140001) which started in November 2015. The work was funded by a contract for £26,347 from AHDB Cereals & Oilseeds.
Typical over autumn/winter N uptake, N release for the following crop and C:N ratio for cover crop species

<table>
<thead>
<tr>
<th>Species</th>
<th>Typical autumn/winter N uptake (kgN/ha)</th>
<th>Typical N release for following crop (kgN/ha)</th>
<th>C:N ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil radish</td>
<td>70-127</td>
<td>10-50</td>
<td>13-20</td>
</tr>
<tr>
<td>White mustard</td>
<td>57-116</td>
<td>30-40</td>
<td>14</td>
</tr>
<tr>
<td>Rye</td>
<td>30-61</td>
<td>24</td>
<td>82</td>
</tr>
<tr>
<td>Hairy vetch</td>
<td>154</td>
<td>132</td>
<td>11</td>
</tr>
<tr>
<td>Crimson clover</td>
<td>28</td>
<td>60</td>
<td>11-25</td>
</tr>
</tbody>
</table>

Source: AHDB Research Review No. 90, Dec 2016
<table>
<thead>
<tr>
<th>COSTS</th>
<th>BENEFITS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed</td>
<td>Saving from reduction in N fertiliser for following crop</td>
<td>£20-£30/ha</td>
</tr>
<tr>
<td>Establishment costs</td>
<td><em>OR</em></td>
<td></td>
</tr>
<tr>
<td>Destruction / spraying off</td>
<td>Extra income from yield boost to following crop</td>
<td>£40-60/ha</td>
</tr>
<tr>
<td>Total costs:</td>
<td>Total in-year benefits</td>
<td>£20-60/ha</td>
</tr>
</tbody>
</table>

**PLUS OTHER POTENTIAL BENEFITS:**
- Forage value (grazing or silage)  
  £40/ha estimate
- Reduced establishment costs for next crop  
  £35/ha estimate
- Long term benefits to soil, prevention of soil erosion etc.  
  £?/ha
- As Ecological Focus Areas  
  £?/ha
- Weed/pest suppression  
  £?/ha
- Countryside Stewardship / other funding  
  Up to £114/ha
Why an online auction?

- An administrative tool to assist in reaching Wessex Water’s catchment management objectives
- Move the focus to £/kg of N not £/ha
- Farmers set their price, not Wessex Water
### Table 1 – Field Specific Maturity Scores for your farm

<table>
<thead>
<tr>
<th>Field Name/Number</th>
<th>Hungry Hill</th>
<th>Smugglers Lwr Barn</th>
<th>Post Harvest Commitments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Score</td>
<td>11</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Field Name/Number</td>
<td>South Close</td>
<td>Grd</td>
<td><strong>What was done:</strong> During the farm visit active management of post-maize crop field management was discussed. Options discussed included:</td>
</tr>
<tr>
<td>Field Score</td>
<td>10</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

**Recommendations –**

- Scores 6-12 – Choose varieties with maturity scores equal to, or one point above or below the score generated during the field visit.
- Scores 13 or over – These fields are very high risk in terms of maize growing. Your options are to:
  - Continue growing maize, ideally choosing a very early >11 MGA maturity score, prioritising early drilling, harvest, and post-harvest stubble management on these fields over lower scoring, less risky, fields.
  - Consider growing early >11 MGA maturity score varieties under plastic film. Plastic film tends to speed up maturity by between 2 and 3 weeks compared to the same variety grown in the open.
  - Consider alternative crops such as whole-crop cereal or grass silage on these very high-risk fields.
What can farmers and agronomists do to reduce nitrate leaching?

- Move away from inversion tillage unless necessary
- Ensure accurate and timely nutrient application
- Grow good, even crops with good NUE*:
  - Good soil health and balanced fertility
  - Earliest autumn drilling possible
  - Appropriate variety and field selection
- Apply no more N than the crop’s realistic requirement, allowing for N from organic manures
- Maximise green cover over-winter

*Nitrogen Utilisation Efficiency
Conclusions

• Early harvest gives you more options
• Undersowing is inconsistent unless you can drill it
• Best species for post-harvest establishment are grasses and cereals
• If you aren’t going to be able to get good green cover then cultivate to at least ensure water infiltration
• Beware over-cultivation
• Organic manures need careful planning and management. Allow for their nutrients when calculating NPK inputs
• Legislation may make pro-active management of maize stubbles mandatory in future
For more information, please contact:

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timothy.stephens@wessexwater.co.uk

www.wessexwater.co.uk/catchmentmanagement