GOD GREEN MANURES

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¹ Mains of Thankerton, Lanarkshire
Green manures

• *Crops grown with the intention that they will be ploughed in to benefit the following crop*
  – Green manures
  – Green cover
  – Cover crops
  – Catch crops
Why grow them?

- **Greening compliance**
  - Counts as an EFA (environmental focus area)
  - Establishment of a temporary crop in the autumn
  - Weighting factor of $0.3 \times$
  - Incorporate before spring crop
  - Must not be used for agricultural production, i.e. no grazing
Why grow them?

• AECS option
  – *Stubbles followed by green manure in an arable rotation*
  – £498.49 /ha
  – No sprays: before or during
  – No nutrients (fertiliser, dung, etc.): during
  – Establish in spring (after 1\textsuperscript{st} March)
  – Keep until 15\textsuperscript{th} August or 1\textsuperscript{st} March
Agronomic benefits*

- Soils?
- Weeds and pests?
- Yield?
- Biodiversity?

*Cover crops: a practical guide to soil and system improvement, NIAB (2015)
Soils

• Big root system benefits:
  – Soil structure
  – Organic matter
  – Soil biology
• Provide ground cover during soil erosion risk periods
Weeds and pests

• Short term weed control
  – Suppression of weeds before following crop

• Longer term weed control (i.e. sterile brome)
  – Stale seedbed approach: allow weeds to germinate in the back-end, then destroy before they set seed

• Pest control
  – Brassicas may have biofumigant activity against soil-borne pests
Yield

- Nitrogen retention – ‘catch’ crop
- Nitrogen fixation from any legumes in the mix
- Improved soil structure
- Weed reduction?
- Increase in pollinators (for oilseed rape and pulse crops)
Biodiversity

• Winter cover and habitat
• Benefits birds, mammals, and insects
• Flowering species in summer benefits pollinators
Seed mixes

• An **AECS** mix must have at least one annual flowering plant, e.g. clover, phacelia, vetch, and must be established from 1st March

• An **EFA** compliant mix requires two or more of these:

<table>
<thead>
<tr>
<th>Barley</th>
<th>Oats</th>
<th>Triticale</th>
<th>Rye</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clover</td>
<td>Vetch</td>
<td>Alfalfa</td>
<td></td>
</tr>
<tr>
<td>Mustard</td>
<td>Radish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phacelia</td>
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</tbody>
</table>
Seed mix components

• These components can be split into 4 broad groups
• These groups have different characteristics

<table>
<thead>
<tr>
<th>Group</th>
<th>Crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereal</td>
<td>Barley, Oats, Triticale, Rye</td>
</tr>
<tr>
<td>Legume</td>
<td>Clover, Vetch, Alfalfa*, Peas</td>
</tr>
<tr>
<td>Brassica</td>
<td>Mustard, Radish, Rape</td>
</tr>
<tr>
<td>Other</td>
<td>Phacelia, Chicory, Buckwheat</td>
</tr>
</tbody>
</table>

* Unlikely to do well in wetter, more acidic Scottish soils
## Green manures

- The different characteristics of the groups give them advantages and disadvantages

<table>
<thead>
<tr>
<th>Group</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereal</td>
<td>Establishment, seed availability</td>
<td>Pest/disease ‘green bridge’</td>
</tr>
<tr>
<td>Legume</td>
<td>Fixes nitrogen</td>
<td>Establishment (back end)</td>
</tr>
<tr>
<td>Brassica</td>
<td>Establishment, roots open up the soil</td>
<td>Clubroot risk, can dominate the mix when mature</td>
</tr>
<tr>
<td>Phacelia</td>
<td>Beneficial to pollinators</td>
<td>Poor frost tolerance</td>
</tr>
</tbody>
</table>
Field lab

- Green manure mixes* sown on a farm in Lanarkshire
- In between winter barley and spring barley
- Sown for EFA compliance
- Will there be any other benefits?

* Courtesy of Hutchinsons, thanks to Keith Brand
Trial site
## Seed mixes

### Oats, vetch, & phacelia
- oats @ 100 kg/ha;
- vetch @ 20 kg/ha;
- phacelia @ 5 kg/ha

### Oats and rye
- oats @ 90 kg/ha;
- rye @ 90 kg/ha

### Oats and radish
- oats @ 120 kg/ha;
- radish @ 15 kg/ha

### Mustard & radish*
- mix @ 20 kg/ha

*Established following discing winter barley stubbles, and then sowing. Lots of winter barley volunteers.
Mustard & radish
Oats & rye

Mustard & radish

Oats, vetch & phacelia

Oats & radish

Mustard & radish
Assessments

• Cost (seed, cultivations)

• Green manure
  – Yield – potential for organic matter?
  – Protein – amount of N for following crop?

• Soil
  – Visual Evaluation of Soil Structure (VESS)
  – Earthworm number, weight and diversity

• Following crop
  – Yield
  – Weeds / volunteers
  – Visual assessment (residual nitrogen)
Earthworms

Worm weight (g)

Worm number

- **oats & radish**
- **radish & mustard**
- **oats, vetch, & phacelia**

- Worm weight (g)
  - **Worm weight (g)**
  - **Worm number**
Dry matter yield (t/ha)

- radish & mustard*
- oats & radish
- oats, vetch, & phacelia
- oats & rye
Protein and ME (per ha)

**Crude protein (kg/ha)**

- Radish & mustard: 500
- Oats & radish: 500
- Oats, vetch, & phacelia: 800

**ME (MJ/ha)**

- Radish & mustard: 25,000
- Oats & radish: 40,000
- Oats, vetch, & phacelia: 45,000
- Oats & rye: 45,000
So what’s best?

• In this trial...

• Oats, vetch, and phacelia for soil structure

• Mustard and radish (least cultivations in establishment) is best for earthworms

• Oats and rye for bulk and nitrogen

• We won’t really know until the following crop of spring barley is ready
What next?

• A visit to Leslie’s in spring to see the green manure
• Measurements in the green manure and spring barley crop
• Look at the results, and think about what they mean
• SRUC and the James Hutton Institute are also doing green manure trials, look at their findings
• Are green manures worth sowing?