If you are thinking of including cover crops in the rotation it is important to decide how they can benefit your farm business and where they can fit into your rotation.

Cover crops on bare land over winter offer benefits for soils, water quality, wildlife and the farm business. In groundwater catchments they are a crucial management option to help reduce nitrate losses, protecting drinking water supplies and our rivers and seas. They can also open up other beneficial management techniques such as minimum cultivation on heavier soils.

**Benefits of Cover Crops:**

**For Soil:**
- Cover crops help to prevent soil erosion and run-off, keeping soil in the field.
- Deep-rooting crops will help to improve soil structure in compacted soils.
- Cover crops build soil organic matter which improves soil structure and water holding capacity helping to protect against extreme and prolonged rainfall and drought conditions.
- Reduce water-logging, and increase workability of heavy soils.
- The presence of crops over winter sustains mychorrhizal fungi, and maintains soil biota which promotes healthy soil biodiversity.

**For water quality:**
- Cover crops established early will put on a lot of growth, taking up nutrients, particularly nitrites, from the soil and prevent them from leaching through the soil profile, out of the rooting zone and into groundwater.
- The green cover intercepts rainfall, reducing surface capping, and taking up water which can prevent soil erosion and run-off over winter and reduce sediment and phosphate pollution to surface water.

**For wildlife:**
- The ground cover provided by the crops will provide shelter for wildlife over the winter months.
- The soil is likely to be richer in soil invertebrates, feeding birds and other wildlife over winter.
- Some early-sown cover crops can provide a late nectar source in mild autumns.

**Other agronomic benefits:**
- Can result in more friable soils, reducing the need for spring cultivations.
- Cover crops that establish well provide competition to weeds, helping to suppress them and reducing herbicide bills.
- Cover crops also take up P and K therefore helping to maintain soil indices.
- Mustard (in particular) contains glucosinolates which are released when the crops are rolled, cut or incorporated, which mixes with a naturally occurring enzyme and water to produce a fumigant that can be deadly to weeds, soil-borne pathogens and nematodes.
- Can enable direct drilling on heavy soils where over-winter ploughing is current normal practice.
- Deep rooting crops can bring up trace elements from deep in the soil profile.
- Can result in healthier plants as a result of many of the factors above.

**Cover crops have wider benefits to the farm business:**
- Recycle nutrients making them available to the following spring crop, reducing the amount of fertiliser required, and/or increasing yields.
- Can reduce fuel use / draft requirement.
- Requires less machinery as enables wider use of minimum tillage.
- Can provide winter grazing.
- More sustainable management of soils protects the key asset on any farm, and looks after the foundation of the business.

**Cover Crops and Greening**

As part of the new requirements for Basic Farm Payment claimants from 1 January 2015, farmers with 30ha or more arable land need to have the equivalent of 5% of this land in Ecological Focus Areas (EFAs).

Cover and catch crops are one of the 5 EFA options available.

For this option farmers must use a sown mix of at least 2 different crops, one a cereal and one a non-cereal. The current list of crops that can be grown are:
- Mustard
- Vetch
- Oats
- Phacelia
- Barley
- Rye
- Lucerne

Alternatively, grass can be undersown in to the previous crop, particularly useful for late harvested crops such as maize where it may not be possible to establish a sown mix after harvest.

Cover crops have to be established by the 1st October and retained until the 15th January. Catch crops have to be established by 31st August and retained until 1st October.

Catch and cover crops have an equivalence applied to them, so 1 ha of the crop = 0.3 ha of EFA.

**Planning for Cover Crops:**

If you are thinking of including cover crops in the rotation it is important to decide what you want them to achieve and plan accordingly:

1. Identify the beneficial properties you want to harness
2. Identify the cover crops that can do this
3. Based on the crops being sown identify the earliest possible sowing date, seed rate, sowing depth and establishment method
4. Undertake early removal of grass weeds including cereal volunteers if needed, and then let competition from the cover crop take over
5. Consider how cover crops sit with your rotation and whether they could affect your disease management i.e. clubroot in oilseed rape
6. Check if the cover crops are eligible for greening

**Useful Contacts:**

**Catchment Sensitive Farming:**
- Poole Harbour: Charlotte Woodford: 07824 498959
- Dorset Stour: Tim Stoner: 07823 355427
- Hampshire Avon: Andrew Russell: 07901 523983
- FWAG SouthWest: 01823 355427
- NFU County Advisers:
  - Dorset: Louise Stratton: 01305 231000
  - Wiltshire: Andrea Wilcombe: 01722 441133
- Wessex Water Catchment Advisers:
  - Adrian Moore: 07500 033498
  - Louise Moderski-Rush: 07854 580910
  - Tim Stephens: 07823 370048

**Prepared by FWAG SW and Catchment Sensitive Farming on behalf of the Environment Agency**
Understanding What Cover Crops Can Do

Why is nitrogen leached?
Only some of the nitrogen applied to a crop is taken up and used. R520 states that the average nitrogen use efficiency by crops by soil type is:
- Light sand: 70%
- Medium and clay soils: 60%
- Shallow soil over chalk: 55%

This means that 30-45% of applied nitrogen is not used by the crop; and because nitrate is readily soluble and not strongly attracted to soil particles, it is vulnerable to leaching in the autumn and winter months when soil drainage occurs. The quantity of nitrate at risk of leaching is influenced by crop type, crop management, and crop N uptake during the autumn which reduces the soil nitrate content.

How much nitrogen do cover crops take up?
Sowing date, variety of cover crop, weather and destruction date all affect the amount of nitrogen that is taken up by the cover crop. However, sowing date is key. August-sown cover crops take advantage of longer, warmer days to put on rapid early growth and develop an effective root system. Therefore they are much better than later sown cover crops at taking up lots of nitrogen before the leaching period begins. In addition, cover crops have more effect in mild, wet winters than cold, dry winters, as in dry conditions the nitrate is less available and the rain is less likely to leach out of the rooting zone by the spring. Therefore in light of climate change predictions of warmer, wetter winters, the need for cover crops increases.

Choosing the Right Crops - Why Grow Them?
Choose crops providing the properties that are needed and suit local conditions:
- Deep rooting crops such as radish will be beneficial where soil structural problems or drainage are an issue
- Some crops, particularly mixes from continental companies, have low frost resistance so should be avoided in ‘frost pockets’
- Some sensitivity to frost is useful to reduce biomass towards the end of the crops life and will aid incorporation
- Legumes are not well suited to areas at high risk of nitrate leaching as the root nodules can break down over winter releasing N
- Cereals could provide a green bridge for pests and diseases so think about whether this might impact on the subsequent spring crop
- Forage rye grows quickly and provides an excellent root mass to bind soil together
- Some varieties of mustard, radish and oats can help with nematode reduction
- If growing oil seed rape, clubroot resistant varieties of oil radish are available
- Fast growing cover crops that produce a lot of biomass such as fodder radish can be used to build soil organic matter

Buckwheat is effective at solubilising P and can help to build P levels in the soil. It is important to look at all of the establishment and management costs of growing cover crops, however once you place a value on the benefits they offer, most are cost-neutral.

Once the crop mixture has been selected, that will achieve the benefits required, see if they are eligible as an Ecological Focus Area as part of your Greening requirement. If Greening is the driver for cover crops a simple mix including farm saved seed could suit many situations, but take advice from an agronomist on the best mix to suit the farm, its soils, and rotation. Under the Plant Varieties Act 1997, if using farm saved seed, ensure that all eligible varieties are declared to the British Society of Plant Breeders.

How to Grow Cover Crops

To maximise the beneficial effects of your chosen cover crops it is essential to grow them well, sowing at the optimum time for the selected crops.

Seed rate:
Sowing rate will vary considerably depending on seed size/TGW, sowing date and other crops in the mixture. Overall, the aim is for a thick crop and a high density of roots. Indicative seed rates:
- Mustard: 10 kg/ha
- Radish: 10-20 kg/ha
- Vetch: 40 kg/ha

Establishment:
Most crops require sowing as early as possible, immediately after harvesting the previous crop, so August or September in most areas. This ensures that crops have at least 8 weeks of good growing conditions, which they need to establish well for the winter, and it also helps to minimise nutrient loss.

The appropriate sowing method depends on soil type and seed species to be sown. Aim to use a method that conserves moisture, and is quick and cost effective. Consider seed size and ensure mixes do not separate in the hopper.

How do I plan N fertiliser rates after cover crops?
There is limited evidence currently available on how much N from cover crops should be taken into account when establishing subsequent crops. The rest has a crucial role helping to build up soil organic matter, improving soil structure, water holding capacity and fertility, so essential to soil health.

How to plan N fertiliser rates after cover crops?

Average nitrate concentrations in winter leachate following different previous crops.

<table>
<thead>
<tr>
<th>Seed/ha</th>
<th>Fresh ton/ha</th>
<th>Ton Dry Matter/ha</th>
<th>% N content</th>
<th>Kg N/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>W. Turnip Rape</td>
<td>35</td>
<td>27.5</td>
<td>3.2</td>
<td>3.15</td>
</tr>
<tr>
<td>Oil radish top</td>
<td>45</td>
<td>29</td>
<td>2.9</td>
<td>4.76</td>
</tr>
<tr>
<td>Forage rye</td>
<td>97</td>
<td>17.9</td>
<td>2.3</td>
<td>4.6</td>
</tr>
<tr>
<td>Mustard</td>
<td>70</td>
<td>14.5</td>
<td>2.2</td>
<td>3.18</td>
</tr>
<tr>
<td>Stubble turnips</td>
<td>30</td>
<td>28.2</td>
<td>1.37</td>
<td>3.42</td>
</tr>
</tbody>
</table>

How to Sow

Options for crop destruction are to graze, spray, flail or do nothing. The best option depends on crop, soil type and whether using the cover crop towards Greening. Grazing or topping the crop in early January if ground conditions are suitable can help to reduce the volume of biomass to incorporate. Grazing also converts the nitrogen to a more available form as animal manure. Be aware cover crops used for Greening cannot be grazed until the cover crop period is over.

Winter cold will help to kill off cover crops, reducing the work needed in the spring. You can direct drill in to cover crops, typically after spraying off.