

# COVER CROPS

## TECHNICAL GUIDE



# Welcome to your copy of the Agrii Cover Crops technical guide for 2023.



**The information within the guide is based on the results and experiences of the Agrii R&D trials into all aspects of the use of cover crops since the trials program started in 2014.**

The interest in utilising catch, cover and companion crops as part of a sustainable farming system is increasing year on year as **growers look towards minimal tillage and improving Nitrogen Use Efficiency (NUE)** as methods to reduce establishment and input costs, whilst improving the health of their biggest asset, their soils in the longer term. The move to minimal tillage needs to be planned and managed to reduce the potential negative effect on crop yield which remains the key driver of profitability. The **Environmental Land Management (ELM)** scheme and the **Sustainable Farming Incentive (SFI)** options within it offer an opportunity for growers to be supported on this journey.

Within the guide you will find information on the potential benefits of catch and cover cropping, details of species and varieties, a range of summer catch and autumn cover crop mixtures, guidance on establishment and termination of covers and options for OSR companion crops.

**We continue with the Agrii R&D trials** to evaluate new species and varieties, establishment techniques, companion cropping and soil biota changes across a range of soil types to enable us to offer you the benefit of the knowledge gained.

**Simon Hobbs**  
Cover Crop Technical Seed Specialist

# WHAT COVER CROPS CAN DO

Cover crops used correctly as part of your soil management strategy can deliver the following benefits:

- + **Capture and recycle nutrients** left over from the previous crop, rather than being leached away.
- + **Fix** nutrients from the atmosphere in association with soil bacteria.
- + **Improve soil structure** through root penetration at different depths – subject to the species used. Channels created by the roots open up the soil allowing free movement of air and water through the soil profile, even breaking up compacted layers at depth.
- + **Protect the soil from erosion** by water and wind, by holding soil in place with root and foliage growth.
- + **Help to suppress weed growth** either by direct competition and/or by allelopathic effect.
- + **Create a large biomass of fresh organic matter** which, when returned to the soil, will release nutrients over time to the following crops through the action of the soil biota. This helps to build organic matter levels and improve soil structure, particularly in low soil disturbance establishment systems.
- + **Increase the quantity of the biota** (bacteria, earthworms, fungi, insects) in the soil over time by having a growing crop and increased organic matter available for more of the year to feed them consistently. The increase in soil biota will then speed up the breakdown of organic matter, bring the carbon:nitrogen ratio into balance and make nutrients readily available to the cash crop.
- + **Growing the appropriate species** and varieties of cover and companion crops for your farm rotation can help reduce pest problems, particularly soil nematodes and cabbage stem flea beetle.
- + **Potential to save on cultivation costs** by direct drilling following a cover crop that has improved or maintained soil structure.
- + **Encourage farmland wildlife and beneficial insects** by creating cover and a food source over an extended period.
- + **Improve overall soil health**, which is the foundation for helping to promote good crop health, enhancing crop yields and farm sustainability.
- + **In the longer term, cover crops used as an integral part of the farming strategy** will improve farm incomes and sustainability by increasing soil fertility and productivity whilst reducing input costs.
- + **In our own trials work we have already seen some of these benefits** from the use of cover crops compared to following land between cash crops.
- + **The key element in improving soil health and productivity in the long term**, is to increase its organic matter content and maintain living roots in the soil for as much of the year as possible. This can be done by selecting the correct cover crops for your farming operation.
- + **Carbon sequestration:** cover crops can have a positive long-term effect on reducing greenhouse gases through the interaction between a diverse living cover and the soil biota, which are capable of storing the carbon element within the soil structure.

# WHY SOIL HEALTH IS IMPORTANT

Soil is fundamental for crop production, supporting delivery of 95% of the UK's food, and storing around 80 years' worth of GHG emissions in the form of carbon.<sup>#</sup> Soil health can be defined as the continued capacity of a soil to function as a vital living ecosystem that sustains plants, animals and humans. Healthy soils grow healthy crops that are better able to withstand disease and compete against grassweeds.



Agrii was one of founding partners of the Harper Adams Soil and Water Management Centre.

## Soil is an ecosystem that can be managed:

- + A healthy soil provides a habitat for soil microbes to flourish and diversify – providing the nutrients that crops need to grow and prosper.
- + Soils store two thirds of the fresh water on the planet\* and this function is determined by the level of organic matter in the soil. The loss of soil biodiversity reduces its water infiltration capacity, as well as its capacity to store water, lowering food production and worsening the impact of drought.
- + The carbon contained within soil organic matter represents one of the largest carbon stocks on Earth and plays a major role in mitigating climate change. In the UK our soils hold an estimated 9.8 billion tonnes of carbon.\*\* When soil is eroded, the carbon stored in soils is lost in the form of greenhouse gases. Globally it is estimated that 26% of the carbon stored in the top one metre of soil has been lost since pre-historic times (FAO 2015).
- + A well structured soil anchors crops and plants – allowing root systems to extend downward through the soil and in turn stabilise plants so that they can grow efficiently.
- + A well structured soil allows less erosion by wind or rain and reduces the likelihood of flooding due to improved porosity.
- + The minerals and microbes in soils help to filter, buffer, degrade and detoxify potential pollutants – including industrial by-products and atmospheric pollution.
- + Soil isn't an inert growing medium. Rather, a healthy soil is home for billions of organisms, including bacteria, fungi, insect larvae and earthworms that are the foundation of an intricate below-ground ecosystem.
- + Most of these organisms – big and small – are an essential part of enhancing the nutrients that stimulate plant growth.

<sup>#</sup>Environment Agency 2019  
<sup>\*</sup>IUCN - [www.iucn.org/resources/issues-briefs/conserving-healthy-soils](http://www.iucn.org/resources/issues-briefs/conserving-healthy-soils)  
<sup>\*\*</sup>Soil Association figures

**Further information:** You can view these documents using the links, or go to [www.agrii.co.uk/greenhorizons](http://www.agrii.co.uk/greenhorizons), or ask your agronomist for a copy.



More information on the potential benefits of cover crops to soil health and organic matter levels can be found in **Green Horizons Insight Report 1: Improving Soil Resilience**.



The **Soil Resilience Strategy (SRS)** is Agrii's R&D-based soil strategy. Find out more in our SRS brochure.

## The 'One Health' concept

Shows the relationship between ecosystems – soils, plants, animals and human health as being closely intertwined.

(Adapted from: *The soil- human health nexus*. Edited by Rattan Lal, 2021.)



# GREEN HORIZONS

## Utilising cover crops to replace lost carbon in the soil

We often think about feeding the crop with nitrogen, but how often do we think about feeding the soil with carbon?

Carbon is the main food source for soil biology, and higher levels of carbon in your soils leads to improved resilience. A healthy, structurally sound soil will be more efficient at nutrient cycling and maximising how much of what we apply is made available to the crop.

Each year, we remove carbon from the system by harvesting a cash crop and sometimes removing straw. This process alone, over time, takes carbon out from our soil, reducing organic matter and nutrient levels.

There are many ways of replacing the carbon we remove, and cover cropping is one of them. Providing continuous cover, cover crops can protect soils from erosion from heavy rainfall, and improving water retention in periods of drought. They require patience, persistence and fine-tuning, but the long-term result if done correctly can be significant for soil resilience and crop productivity.

### CASE STUDY

### DUNKIRK iFARM, NEAR GATESHEAD: COVER CROP TRIALS

**At Dunkirk Farm, the team are utilising regenerative techniques and cultural controls in a drive to increase the resilience of their soils and overall farm business for the long term.**

No insecticides are used on the farm, and they're moving towards a complete no-till approach. In addition to this, together with the local Agrii team, they've developed trials looking at different cover crop mixes – measuring soil organic carbon, active carbon and microbial biomass to determine the impact of cover crops on overall soil health.

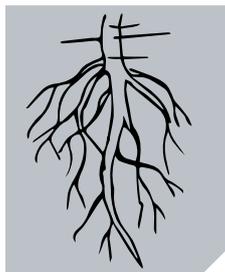
“The results from our trials show that diverse mixes offer a greater overall benefit to soil health from a biological point of view” says Agrii cover crops specialist, Simon Hobbs. “Our results have also shown that the bigger the biomass above and below ground, the higher the initial carbon drawdown. In addition, cover crops have brought both high nutrient retention and biological activity to the iFarm soils, especially compared with fallow fields.”

Read the full case study in  
**Green Horizons Insight Report 1:  
Improving Soil Resilience**

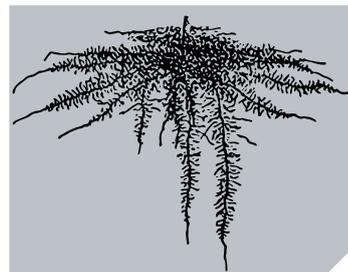


# COVER CROP VARIETIES IN DETAIL

## WHITE MUSTARD – BRACO



## PHACELIA – STALA



### USE



### DRILLING

Late summer, mid September latest.  
Full seed rate drilled at 12kg/ha. Typical TGW 8g.

### HOW TO DESTROY

If late summer sown, a strong frost should destroy the crop, although root and stems will remain. In the south it may need spraying off or rolling before it sets seed.

### OTHER INFORMATION

- + C:N ratio 30.
- + Reliable, very fast establishment.
- + Good at extracting moisture and nutrients from the upper soil profile.
- + Beet cyst nematode reducing variety.
- + Lower seed cost.



Late summer drilled crops need to go in before the end of August. Full seed rate drilled at 10kg/ha. Typical TGW 2g.

If late Summer sown a hard frost will destroy the crop, in milder conditions rolling or spraying before seed set may be required.

- + C:N ratio 20.
- + Reliable, fast establishment.
- + Very fibrous root system down to 8cm creating a very good soil structure in drilling zone.
- + Good surface nutrient capture and mobilisation, strong mycorrhizal association.

**KEY:**

Soil Structure



Nematode Reduction



Weed Control



Nutrient Capture



Nutrient Production



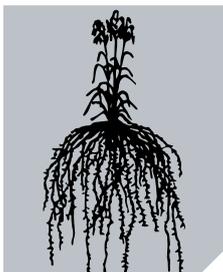
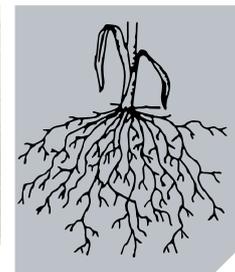
Frost Susceptible



Grazing/Silage



Environmental Benefits

**BLACK OATS – TOSCANE/LUXURIAL****FORAGE RYE – HUMBOLT/POWERGREEN****USE****DRILLING**

Best sown late summer, before end of August.  
Full seed rate drilled at 30kg/ha. Typical TGW 20g.

Best sown from mid August until early October.  
Full seed rate drilled at 160kg/ha. Typical TGW 38g.

**HOW TO DESTROY**

Black oats are frost sensitive and can die back naturally during prolonged cold periods.

Spray off in the spring or graze or silage.

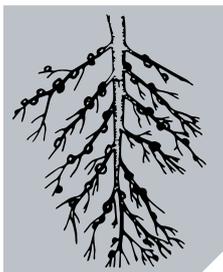
**OTHER INFORMATION**

- + C:N ratio 25.
- + Good establishment.
- + Large fibrous root system creates good soil structure.
- + Resistant to diseases, take all and good tolerance to BYDV.
- + Reduction of root knot and root lesion nematodes.

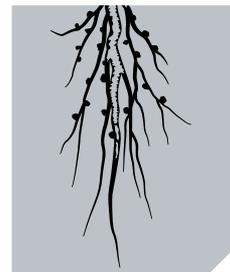
- + C:N ratio 35.
- + Reliable, quick ground cover.
- + Extensive root system, good scavenger of nutrients, will continue to grow even in cold conditions.

# COVER CROP VARIETIES IN DETAIL

## PURPLE SPRING VETCH – BINGO/TITANE



## COMMON VETCH – ARGON



### USE



### DRILLING

Drill before the end of August.  
Full seed rate 30kg/ha. Typical TGW 39g.

Drill before the end of August  
Full seed rate 50kgs/ha. Typical TGW 55g.

### HOW TO DESTROY

Late summer sown, a strong frost should destroy the crop.

Late Summer sown, a hard frost will stop growth.

### OTHER INFORMATION

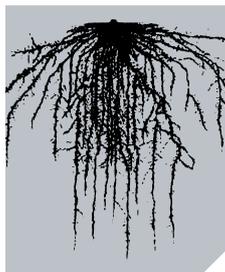
- + C:N ratio 12.
- + Purple vetch are the fastest growing of the vetch species which enables them to catch and fix the maximum amount of nitrogen in the limited time available.
- + Useful as a companion crop for OSR.

- + C:N ratio 12.
- + Common vetch are a reliable element in mixtures capable of fixing nitrogen with medium fast establishment.
- + Very good strong root system to improve soil structure.

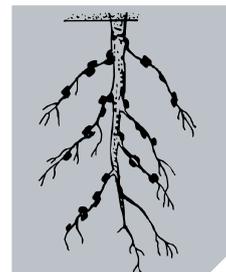
**KEY:**



## CRIMSON CLOVER – HEUSERS OSTSAAT



## BERSEEM CLOVER – TABOR



### USE

### DRILLING

### HOW TO DESTROY

### OTHER INFORMATION

Full drill rate 15kg/ha before the end of August.  
Typical TGW 5g.

Spray off, if not killed by frost.

- + C:N ratio 16.
- + Faster establishment and good biomass.
- + Strong tap root and lateral roots.

Drill before the end of August at 10-15kg/ha.  
Typical TGW 3g.

Late summer sown, a strong frost should destroy the crop.

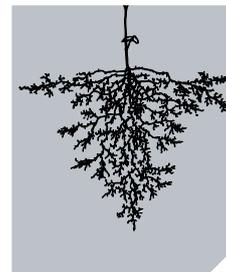
- + C:N ratio 14.
- + Tabor is a single cut variety that will not regrow if topped.
- + Very quick growing with a long tap root.
- + Useful as a companion crop for OSR.

# COVER CROP VARIETIES IN DETAIL

## BUCKWHEAT (*FAGOPYRUM TATARICUM*) – LIFAGO



## COMMON BUCKWHEAT (*FAGOPYRUM ESCULENTUM*)



**USE**

**DRILLING**

**HOW TO DESTROY**

**OTHER INFORMATION**

Best sown before the end of August.  
Full seed rate 30kg/ha. Typical TGW 18g.

Will be killed by a light frost.

- + C:N ratio 28.
- + Fast establishment and good ground cover due to greater leaf area.
- + Fibrous shallow root system capable of mobilising phosphate in the soil.
- + First choice companion variety for OSR.

Best sown before the end of August.  
Full seed rate 50kg/ha. Typical TGW 26g.

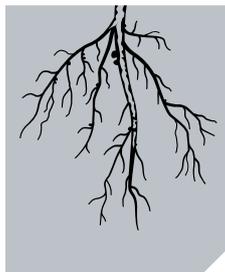
Will be killed by a light frost.

- + C:N ratio 28.
- + Fast establishment and moderate ground cover.
- + Earlier and more prolific flowering habit.
- + Fibrous shallow root system capable of mobilising phosphate in the soil.
- + More attractive to beneficial insects.

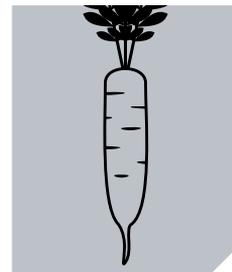
**KEY:**



**HAIRY VETCH – HUNGVILOSA/REA**



**ASIAN/DAIKON RADISH**



**USE**



**DRILLING**

Drill before the end of August.  
Full seed rate 40kgs/ha. Typical TGW 40g.

Best sown before the end of August.  
Full seed rate 12kg/ha. Typical TGW 20g.

**HOW TO DESTROY**

Spray off in the Spring. Very cold tolerant.

Will be destroyed by a hard frost.

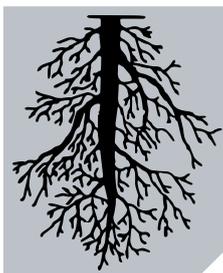
**OTHER INFORMATION**

- + C:N ratio 12.
- + Hairy vetch are a reliable element in mixtures capable of fixing nitrogen with medium fast establishment.
- + Very good strong root system to improve soil structure.
- + Winter hardy.

- + C:N ratio 35.
- + Very large, strong tap root, good for soil structure improvement.
- + Large root scavenges and holds more nutrients.

# COVER CROP VARIETIES IN DETAIL

## OIL RADISH – TORO



## NEMATODE REDUCING VARIETIES

**Group 1:** Reduction of Beet Cyst Nematodes by over 90%

### DOUBLEMAX

- + Resistant to root knot nematode. (*Meloidogyne chitwoodi*).
- + Very high levels of BCN reduction.
- + Good early vigour.
- + Medium biomass.
- + Extensive strong root system.
- + Very late maturity.
- + Frost hardy to -5°C.

**Group 2:** Reduction of Beet Cyst Nematode of 70-90%

### COBRA

- + Multi resistance to beet cyst and root knot nematode. (*Meloidogyne chitwoodi*).
- + Very vigorous early growth.
- + Large biomass.
- + Extensive strong root system.
- + Late maturity.
- + Frost hardy to -5°C.

### SMART RADISH

- + New from Norwest Seeds NZ.
- + Improved radish for cover cropping and forage.
- + Fast establishment and early growth.
- + Large tap root with fibrous lateral roots.
- + High leaf to stem ratio for better ground cover and forage quality.



### USE



### DRILLING

Sow from late July to mid September. Full seed rate 12-20kg/ha depending on use. Typical TGW 11g.

### HOW TO DESTROY

Spray off in early spring, unless destroyed by several hard frosts (-5°C).

### OTHER INFORMATION

- + C:N ratio 30.
- + Very strong tap root will break through compacted soil.
- + Good scavenging and holding of nutrients within high biomass crop.
- + Non-host to clubroot.

# WHICH COVER CROP TO GROW? WHAT DO YOU WANT TO ACHIEVE?

## Which soil issue is most important to resolve?

Soil structure, nutrient capture and fixation, erosion control, low organic matter/carbon capture, weed suppression, a reduction in harmful nematodes or a requirement to increase the number of beneficial insects.

## What positive effects are you looking to achieve?

Reduce cultivation/establishment costs, improve soil fertility, raise organic matter levels, reduce input costs and in the longer term improve overall soil health and farm sustainability.

## Key considerations:

- + **What is your crop rotation?** Avoid cover crops that may increase disease and pest pressure in close rotations.
- + **When will you be able to drill the cover crop?** Generally best growth/results come from early August sowings, choice of species should change if September sown.
- + **How long do you want the cover to last?** Do you require a short term cover prior to late autumn sowing, a longer term frost-susceptible mix which may save on destruction costs, or a full cover until the spring to maintain soil protection?
- + **Will the catch/cover crop be used for livestock grazing** to produce additional income?
- + **What type of drill** will you use to establish the following crop?
- + **What soil type do you have and is it well structured?** Heavier or poorly structured soils will require extra attention and careful species selection to maximise the benefit of a cover crop.
- + **What is the likely Carbon:Nitrogen ratio of the cover crop?** The C:N ratio of a species/mixture gives an indication of the speed of breakdown and release of nutrients. This is important to understand as you may need to adjust your nutritional inputs to the following crop depending on when this occurs.
- + **High C:N ratio covers crops** will take nitrogen from the soil reserves as the soil biota starts the process of breaking down the carbon in the cover crop, which can restrict the amount of nitrogen freely available in the early stages of the following crop.
- + **Low C:N ratio cover crops** will conversely break down much more quickly, making nutrients available earlier, and returning a greater percentage of the total within the life-cycle of the following crop.



# WHAT DO YOU WANT TO ACHIEVE WITH YOUR CATCH/COVER CROP?

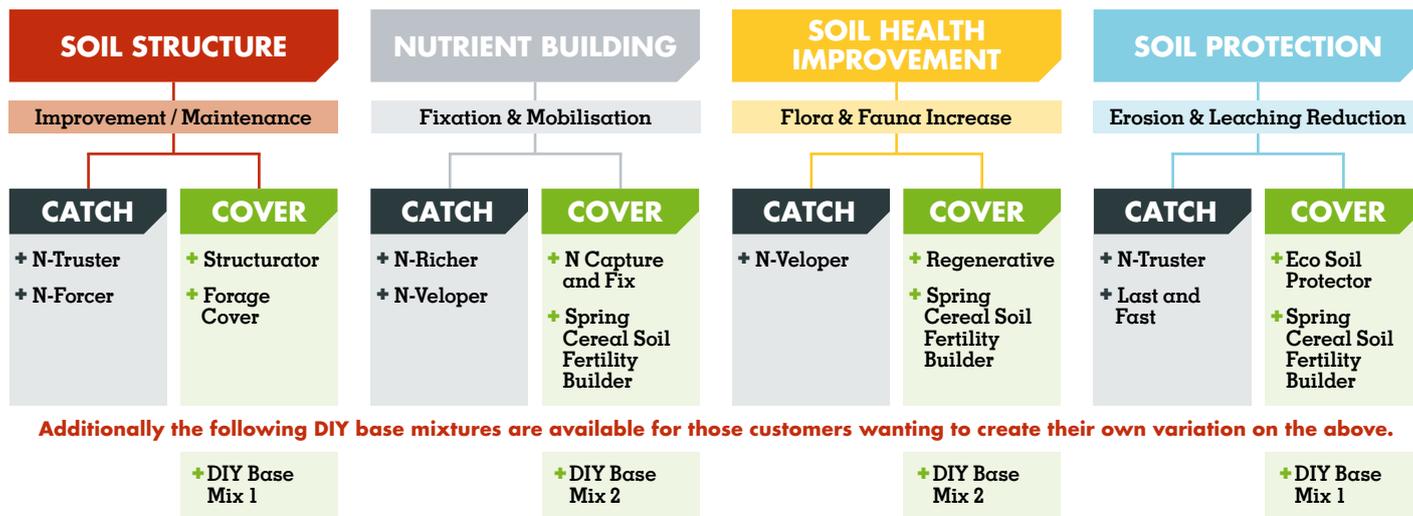
## Quick guide to selection of Agrii catch and cover crop mixtures.

Full mixture details, benefits and advice are shown in the following pages.

**CATCH CROPS – DURATION JUNE TO OCTOBER**

**COVER CROPS – DURATION JULY TO FEBRUARY**

### MAIN OBJECTIVE / TASK REQUIRED OF MIXTURE



Additionally the following DIY base mixtures are available for those customers wanting to create their own variation on the above.

All of the above cover crop mix options comply with the Sustainable Farming Incentive (SFI) requirements for the cover crop element in the intermediate level.

# SPRING/SUMMER CATCH CROP MIXTURES

## N-TRUSTER: MIX 1

|                             | %  | Kgs/ha | Seeds/m <sup>2</sup> |
|-----------------------------|----|--------|----------------------|
| Winter rye                  | 70 | 21     | 57                   |
| Spring vetch                | 30 | 9      | 15                   |
| <b>Seed rate 30kg/ha</b>    |    |        | <b>72</b>            |
| <b>Drill depth: 10-20mm</b> |    |        |                      |

**A reliable cereal and legume combination for use before OSR.**

- + Sow from April – May.
- + Medium biomass cover.
- + Nutrient holding and nitrogen fixation.
- + Soil structure maintenance.

## N-RICHER: MIX 2

|                            | %  | Kgs/ha | Seeds/m <sup>2</sup> |
|----------------------------|----|--------|----------------------|
| Crimson clover             | 55 | 4.4    | 88                   |
| Berseem clover             | 30 | 2.4    | 80                   |
| Phacelia                   | 15 | 1.2    | 60                   |
| <b>Seed rate 8kg/ha</b>    |    |        | <b>228</b>           |
| <b>Drill depth: 5-10mm</b> |    |        |                      |

**A fast establishing mix of Clovers and Phacelia for use before OSR or cereals.**

- + Sow from late April to mid June.
- + Low C:N ratio allows fast release of nutrients.
- + Roots provide a good friable tilth for direct drilling.
- + Attractive to beneficial insects.



# SPRING/SUMMER CATCH CROP MIXTURES

## N-VELOPER: MIX 3

|                          | %  | Kgs/ha | Seeds/m <sup>2</sup> |
|--------------------------|----|--------|----------------------|
| Spring purple vetch      | 50 | 6      | 15                   |
| Buckwheat                | 35 | 4.2    | 17                   |
| Phacelia                 | 15 | 1.8    | 90                   |
| <b>Seed rate 12kg/ha</b> |    |        | <b>122</b>           |

**Drill depth: 10-20mm**

**A combination of tried and tested species for use before OSR or Cereals.**

- + Sow from late April to mid July.
- + Purple vetch included for maximum nitrogen fixation.
- + Creates a friable soil structure enabling direct drilling.
- + Boosts soil health and beneficial insect populations.



## N-FORCER: MIX 4

|                          | %  | Kgs/ha | Seeds/m <sup>2</sup> |
|--------------------------|----|--------|----------------------|
| Crimson clover           | 35 | 4.2    | 84                   |
| Oil radish               | 35 | 4.2    | 35                   |
| Tillage radish           | 30 | 3.6    | 18                   |
| <b>Seed rate 12kg/ha</b> |    |        | <b>137</b>           |

**Drill depth: 5-10mm**

**A combination of deeper rooting radish species and clover for use before cereals on lighter soils.**

- + Sow from mid June to early August.
- + High biomass potential and nutrient capture.
- + Soil conditioning.
- + Forage option.



# SPRING/SUMMER CATCH CROP MIXTURES

## LAST AND FAST: MIX 5

|                            | %  | Kgs/ha | Seeds/m <sup>2</sup> |
|----------------------------|----|--------|----------------------|
| Buckwheat                  | 52 | 6.25   | 27                   |
| Linseed                    | 32 | 3.85   | 50                   |
| Phacelia                   | 16 | 1.9    | 96                   |
| <b>Seed rate 12kg/ha</b>   |    |        | <b>173</b>           |
| <b>Drill depth: 5-10mm</b> |    |        |                      |

### Husbandry guidance:

- + Sown as the last catch crop of the summer ahead of autumn cereals, this mix includes species that are relatively fast to establish.
- + Leguminous species which require a longer period of time to fulfil their potential are not included as standard, however vetches could be added if establishment is planned at the beginning of the sowing window.
- + Phacelia could be substituted for white mustard where a lower cost option is required but care should be taken to consider flea beetle risk as well as impact on other brassicas grown within the rotation.
- + Providing a fibrous combination of roots in the mix is ideal for soil conditioning in the top 5-10cm and the inclusion of buckwheat also helps to make phosphate more available for the subsequent cereal crop.
- + Once established the cover can provide a useful tool to aid soil moisture management as autumn approaches.

- + A wide sowing window allows planting from late July through to early September, but best results will be from those covers sown earlier. Opportunities for placement could be following early harvested crops such as winter barley or oilseed rape as well as introducing some welcome life back into soils that have lain bare through summer fallow.
- + Aim for a seed depth of around 5-10mm taking particular care to ensure seed is fully covered – note that phacelia will not germinate if exposed to sunlight.
- + Adequate soil moisture is the key to success in this summer drilling window so every effort should be made to drill directly behind the combine or around a period of expected rainfall.
- + As with other small seeds a fine tilth in the seeding zone followed by firm consolidation is essential.

### Termination guidance:

- + The termination of these covers should be managed according to the planned drilling technique for the subsequent cereal crop.
- + Where direct drill machinery that can cope with standing biomass is to be used, mixes such as these can be terminated within a few days of drilling to provide a certain amount of evapotranspiration until the main crop is ready to sow.
- + Where more traditional 'min-till' cultivation methods are to be employed ensure timely termination takes place to minimise difficulties of biomass with cultivation and drilling equipment.



# AUTUMN/WINTER COVER CROP MIXTURES

## STRUCTURATOR

Use in OSR-free or extended rotations on medium/heavy soils.

- + Strong, diverse root systems
- + Helps to create a structured soil profile
- + Reduces diffuse pollution
- + High biomass

|                                | %  | Kgs/ha | Seeds/m <sup>2</sup> |
|--------------------------------|----|--------|----------------------|
| Winter rye                     | 35 | 7      | 19                   |
| Black oats                     | 25 | 5      | 25                   |
| Oil radish                     | 15 | 3      | 26                   |
| Linseed                        | 10 | 2      | 25                   |
| Phacelia                       | 10 | 2      | 98                   |
| Daikon radish                  | 5  | 1      | 7                    |
| <b>Seed rate 20kg/ha</b>       |    |        | <b>200</b>           |
| <b>Cover crop C:N ratio 36</b> |    |        |                      |

## REGENERATIVE MIX

Designed to intercept the maximum amount of sunlight in order to enhance carbon capture and boost soil health.

- + Multi-species mix for maximum diversity
- + Nutrient capture and fixation
- + Varied root types to stimulate soil biology and improve structure

|                                | %  | Kgs/ha | Seeds/m <sup>2</sup> |
|--------------------------------|----|--------|----------------------|
| Spring vetch                   | 30 | 6.9    | 12                   |
| Black oats                     | 20 | 4.6    | 23                   |
| Linseed                        | 10 | 2.3    | 29                   |
| Crimson clover                 | 12 | 2.8    | 56                   |
| Sunflower                      | 10 | 2.3    | 4                    |
| Buckwheat                      | 7  | 1.6    | 10                   |
| Oil radish                     | 6  | 1.4    | 11                   |
| Phacelia                       | 5  | 1.1    | 57                   |
| <b>Seed rate 23kg/ha</b>       |    |        | <b>202</b>           |
| <b>Cover crop C:N ratio 24</b> |    |        |                      |

All of the cover crop mixtures on these pages should provide the following benefits to the grower, in addition to their specific uses:

- + Mop up, hold and fix nutrients.
- + Reduce leaching.
- + Increase levels of organic matter and soil biota.
- + Improve soil structure.
- + Suppress weeds.
- + Provide habitat for farmland wildlife and improve farm sustainability and income.

## N CAPTURE & FIX

Use in all rotations on light/medium soils.

- + High inclusion of leguminous species
- + Capable of fixing high N levels
- + Medium biomass

|                                | %  | Kgs/ha | Seeds/m <sup>2</sup> |
|--------------------------------|----|--------|----------------------|
| Black oats                     | 48 | 8.7    | 44                   |
| Spring vetch                   | 28 | 5.1    | 9                    |
| Crimson clover                 | 8  | 1.4    | 30                   |
| Berseem clover                 | 8  | 1.4    | 48                   |
| Phacelia                       | 8  | 1.4    | 74                   |
| <b>Seed rate 18kg/ha</b>       |    |        | <b>205</b>           |
| <b>Cover crop C:N ratio 23</b> |    |        |                      |

## ECO SOIL PROTECTOR

Economic cover crop for all rotations.

- + Fast establishing nutrient capture and fix
- + Full season cover
- + Medium biomass

|                                | %  | Kgs/ha | Seeds/m <sup>2</sup> |
|--------------------------------|----|--------|----------------------|
| Winter rye                     | 80 | 28     | 76                   |
| Vetch                          | 20 | 7      | 12                   |
| <b>Seed rate 35kg/ha</b>       |    |        | <b>88</b>            |
| <b>Cover crop C:N ratio 35</b> |    |        |                      |

The species and varieties used within the mixtures have been specially selected to meet UK conditions, with particular emphasis on speed of establishment, maturity date and field performance.

Seed size – thousand grain weight (TGW) is also an important consideration in species/variety selection, with the aim to reduce variability which aids drilling and helps target the optimum plant numbers per square metre.

# AUTUMN/WINTER COVER CROP MIXTURES

## SPRING CEREAL – SOIL FERTILITY BUILDER

Cereal-free mix for light/medium soil types.

- + Nutrient capture and fix
- + Lower C:N ratio
- + Medium/high biomass

|                                | %  | Kgs/ha | Seeds/m <sup>2</sup> |
|--------------------------------|----|--------|----------------------|
| Spring vetch                   | 42 | 8.4    | 14                   |
| Oil radish                     | 20 | 4      | 34                   |
| Crimson clover                 | 15 | 3      | 60                   |
| Buckwheat                      | 15 | 3      | 17                   |
| Phacelia                       | 8  | 1.6    | 80                   |
| <b>Seed rate 20kg/ha</b>       |    |        | <b>205</b>           |
| <b>Cover crop C:N ratio 20</b> |    |        |                      |

## FORAGE COVER CROP MIX

Dual purpose mix for cover and forage on all soil types.

- + Soil conditioning and forage production
- + High biomass
- + Nutrient capture and fix

|                                | %  | Kgs/ha | Seeds/m <sup>2</sup> |
|--------------------------------|----|--------|----------------------|
| Winter rye                     | 55 | 13.75  | 38                   |
| Spring vetch                   | 20 | 5      | 9                    |
| Leafy turnip                   | 10 | 2.5    | 60                   |
| Smart radish                   | 10 | 2.5    | 21                   |
| Phacelia                       | 5  | 1.25   | 62                   |
| <b>Seed rate 25kg/ha</b>       |    |        | <b>190</b>           |
| <b>Cover crop C:N ratio 38</b> |    |        |                      |

The following two cover crop mixtures have been developed to provide a balanced base mixture for farmers who want to design their own mixture to target a specific issue by utilising on-farm seed or bought-in straight species.

## DIY COVER CROP BASE MIXTURE 1

- + Combination of three reliable species
- + Suited to all soil types
- + Suitable for all rotations

|                         | %  | Kgs/ha | Seeds/m <sup>2</sup> |
|-------------------------|----|--------|----------------------|
| Buckwheat               | 52 | 4.1    | 17                   |
| Linseed                 | 32 | 2.6    | 33                   |
| Phacelia                | 16 | 1.3    | 64                   |
| <b>Seed rate 8kg/ha</b> |    |        | <b>114</b>           |

## DIY COVER CROP BASE MIXTURE 2

- + High legume content to target nitrogen fixation
- + Boost soil health and beneficial insects
- + Suited to medium/lighter soils

|                          | %  | Kgs/ha | Seeds/m <sup>2</sup> |
|--------------------------|----|--------|----------------------|
| Spring vetch             | 48 | 5.75   | 10                   |
| Buckwheat                | 26 | 3.15   | 13                   |
| Crimson clover           | 16 | 1.9    | 38                   |
| Phacelia                 | 10 | 1.2    | 60                   |
| <b>Seed rate 12kg/ha</b> |    |        | <b>121</b>           |

### ADDITIONAL SPECIES TO ADD TO TARGET SPECIFIC ISSUES:

#### Soil structure on heavier soil types:

- + Radish species – smart, daikon and oil types

#### Diffuse pollution reduction / nutrient capture:

- + Cereals – rye and black oats
- + Radish – high biomass types
- + White mustard

#### Nitrogen fixation and soil health:

- + Vetch species – common, hairy and purple
- + Clovers – berseem and crimson

Bespoke custom mixtures are available from our Agrii Lincoln seed production facility, please enquire.

Seed should be drilled before the end of August to ensure good establishment and maximise biomass.

Adjust seed rates to account for soil conditions and drilling date.

# ESTABLISHING THE COVER CROP

## Key considerations:

### TIME OF DRILLING



Many of the species require reasonable soil temperatures and day length. Drill immediately after harvest, ideally most cover/catch crops should be drilled by the end of August to give sufficient biomass and rooting.

### DRILLING RATES



The quantity of seed required for a good cover will vary with the types of species included within the mix in relation to seed size, plant architecture and drilling date. The target seed number for a diverse species mix drilled in early August would be 150 – 200 seeds per m<sup>2</sup>. Higher seed rates, 250 – 350 seeds per m<sup>2</sup> with a diverse mix within an established cover cropping system have shown to provide greater soil health benefits.

### SOIL MOISTURE LEVELS



Good seed/soil/moisture contact is required to get quick emergence of the mixtures. Soil moisture needs to be conserved and ideally minimal soil disturbance should be considered during the sowing period.

### SOIL NUTRIENTS



To achieve a well grown cover crop, early nutrition in the form of nitrogen is required, depending on previous cropping soil N reserves and if there is a high level of straw residue, approx. 20-30 kg of N/ha will be required to aid establishment.

### PREVIOUS CROP



An important consideration particularly if there are high levels of straw residues; cover crops could be held back and overall level of establishment will be disappointing.

If following winter barley, then removal of the barley straw would be useful, if not the straw and chaff residues need to be evenly distributed prior to drilling.

Very good establishment of cover crops has been achieved behind pea and bean crops, also after a fallow situation.

### PESTS



Slug pressure needs to be assessed following the previous crop. If the pressure is high then slugs need controlling before establishing the cover crop. Pea and bean weevil can cause serious problems for the vetches and clover species, if the pressure is high and insect activity is causing damage, the appropriate insecticide should be used.

### ESTABLISHMENT TECHNIQUE



Cover crops need good soil structure and a workable soil to achieve maximum growth. Soil compaction needs to be addressed both for the cover and also for the following crop, therefore subsoiling should be completed if required.

A subsoiler with a tine that stops large amounts of surface disturbance should be considered; again loss of soil moisture is an important consideration.

Broadcasting seed 7-10 days before harvest is an option to achieve earlier establishment and spread work load, but only if the soil structure is good, the correct species mix is used and an even spread pattern can be achieved.



# DRILLING THE FOLLOWING CROP

To maximise the benefit of the cover crop within the farm rotation, the following areas need to be considered before establishing the following crop.



## Key considerations:

### TARGET DRILLING DATE



Have a target drilling date on which to base your planning and operations.

### DESTRUCTION OF COVER CROP



If the cover crop has not been destroyed by frost or grazed, you will need to consider the soil type and density of the cover to determine when to spray off the cover in order to allow time for the soil surface to dry to aid drilling. This could be up to 8 weeks on heavy soils with a dense cover crop.

### PESTS



Assess the slug pest pressure before crop establishment, treat if necessary.

### CROP NUTRITION

The nutrient requirement of the following crop may differ to normal practice in respect to application timing and amount used depending on the cover crop species within the mix.

The C:N ratio of a particular mix will determine the time it will take and how much nitrogen will be required from the soil N reserve to decompose the cover crop residue and release nutrients to the following crop. This is because the soil micro-organisms require a C:N ratio of 24:1 to work efficiently and maintain a healthy balanced soil.

Cover crop residues with a higher C:N ratio will require more N from the soil and therefore less is initially available to the following crop, inhibiting growth.

Low C:N ratio residues including N fixing species will release excess N quickly boosting early crop growth and reducing the overall N requirement.

The target is to maintain a crop residue covering the soil surface with a C:N ratio of between 25 and 30 to help maintain a healthy living soil that will release nutrients at a uniform rate.



### DRILLING

Whichever type of drill you use to establish the next crop, the aim is to move only the minimum amount of soil required to create good seed to soil contact.

Excessive soil movement will stimulate unwanted weed germination and undo some of the benefits gained from the cover crop.



# OILSEED RAPE COMPANION CROPS

- + **Agrii has been trialling a range of companion crops for use with oilseed rape** to assess their ability to reduce the damage done by Cabbage Stem Flea Beetle (CSFB) and their larvae as one part of the strategy to grow OSR successfully.
- + Agrii trials have shown the use of buckwheat, when established well, reduced the damage to oilseed rape plants by the adult CSFB during the establishment phase and continued to do so through the autumn until the first cold nights when the buckwheat died back. This extended period of protection reduced the number of CSFB eggs laid on the OSR and importantly resulted in lower larvae numbers per plant in the spring.
- + It has also been noted in trials that OSR plots that had a buckwheat companion crop appeared to be more vigorous and with an even growth habit in the spring. This may be a consequence of reduced larvae damage or a benefit of its phosphorus scavenging and release properties boosting the OSR.
- + Having identified buckwheat as the best companion crop option for OSR CSFB defence, we tested the species of buckwheat available, *Fagopyrum Esculentum* and *Fagopyrum Tataricum*, to identify the one with the best attributes and performance. **Lifago (*Fagopyrum Tataricum*)** proved to be the best option (see information opposite), although both types are effective.
- + In areas with low CSFB pressure and where soil structure and nutrient building are more important than **Tabor berseem clover** and **Bingo purple vetch** will help enhance establishment and crop growth.
- + Companion crops should be used as part of the oilseed rape establishment strategy, but not relied upon solely as the only defence against CSFB. **Please see the Agrii 8 Point Plan for cultural control of cabbage stem flea beetle for more information: <https://www.agrii.co.uk/wp-content/uploads/2020/08/8-Point-Plan-CSFB.pdf>**



## Lifago buckwheat

**Lifago (*F. Tataricum*) gave the best results in field trials, although both types were effective. Lifago has a unique combination of traits:**

- + Seed TGW, size and shape – allowing easier mixing, better seed flow and lower seed rates.
- + Plant development and structure – fast emergence, large leaf area and later flowering habit giving the OSR seedling more protection for longer.
- + Cold susceptibility and phosphorus release – readily dies back and breaks down in low temperatures releasing nutrients to the established OSR crop.

### Comparison of *Esculentum* and *Tataricum* buckwheat



### Comparison of buckwheat seed



The lower TGW and shape of Lifago allows easier mixing with the OSR seed. Recommended sowing rate 10kg/ha with oilseed rape seed.

# OILSEED RAPE COMPANION CROPS

## Companion crop options

We have seen very positive results from the use of companion crops with oilseed rape from improved establishment, reduced CSFB larvae numbers, to higher biomass and better crop health and yield, when used as part of the Agri 8 Point Plan for success with OSR crops.

The companion crop mixtures below have been designed not only to help protect against CSFB but also to enhance crop establishment and improve growth during the season.



### LIFAGO BUCKWHEAT 100%

#### SEED RATE:

10kg/ha = 60 seeds/m<sup>2</sup>

- + Maximum cover to deter CSFB
- + Root exudates mobilise soil phosphate

### PROTECT AND FIX

LIFAGO BUCKWHEAT 65%  
TABOR BERSEEM CLOVER 35%

#### SEED RATE:

10kg/ha = 150 seeds/m<sup>2</sup>

- + CSFB deterrent
- + Phosphate mobilisation and nitrogen fixation
- + Pivotal tap root of Tabor helps OSR rooting

### DEFENDER

LIFAGO BUCKWHEAT 50%  
TABOR BERSEEM CLOVER 25%  
FENUGREEK 25%

#### SEED RATE:

10kg/ha = 130 seeds/m<sup>2</sup>

- + CSFB deterred by Lifago cover
- + Fenugreek odour helps deter CSFB
- + Fenugreek and Tabor fix nitrogen and improve soil structure

### FIX AND DETER

TITANE PURPLE VETCH 50%  
LIFAGO BUCKWHEAT 50%

#### SEED RATE:

12kg/ha = 50 seeds/m<sup>2</sup>

- + CSFB deterred by Lifago cover
- + Titane purple vetch provides nitrogen fixation and longer term cover after the buckwheat dies back



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For all your seed enquiries please contact your Crop Inputs Specialist on one of these numbers or your local Agronomist.

Please note that the content within this document does not represent advice, which should always be tailored to local situations. Please speak to your adviser for more detailed information on any of the topics covered.



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