

## 21510033: Assessment and analysis of field trials at the Strategic Cereal Farm West

### Overview of trials for harvest 2020

The table below outlines which assessments are required on each of the trials for harvest 2020. More detailed information on the assessments required within each work package and each of the trials are provided on the following pages.

		Trials						Deadline for assessments to be completed
		1. Cultivation OSR	2. Cultural and biological OSR	3. Fungicides wheat	4. Headland wheat	5. Mechanical weeding wheat	6. Flower strips	
Work packages	1: Soil health scorecard	✓	✓	✓	✓	✓	✓	April 2020
	2: Crop rooting	✓			✓			September 2020
	3a: Crop biomass	✓	✓	✓	✓	✓	✓	September 2020
	3b: Crop disease			✓			✓	September 2020
	4: Weeds					✓	✓	September 2020
	5: Pests & natural enemies	✓	✓			✓	✓	September 2020

## Work package assessment descriptions

### *Work package 1: soil health scorecard*

Work package 1 should be completed on the following trials:

- Cultivation oilseed rape
- Cultural and biological oilseed rape
- Fungicide wheat
- Headland wheat
- Mechanical weeding wheat
- Flower strips

Applicants should propose appropriate sampling strategies which take account of the trial design and field characteristics, for example, variation in soil type.

Within work package 1 we require sampling of the soil health parameters identified within the Soil Biology and Soil Health Partnership Project 2 report (available [online](#)), as follows:

- pH
- routine nutrients (extractable P, K, Mg)
- bulk density
- penetrometer resistance
- visual evaluation of soil structure (VESS)
- loss on ignition (soil organic matter)
- respiration (Solvita test, NRM)
- earthworms
- microbial biomass C
- potentially mineralisable N
- total N
- nematodes

The results of work package 1 should be analysed and reported on using the scorecard approach outlined in the above-mentioned report.

### *Work package 2: crop rooting*

Work package 2 should be completed on the following trials:

- Cultivation oilseed rape
- Headland wheat

Applicants should propose appropriate sampling strategies which take account of the trial design and field characteristics, for example, variation in soil type.

Within work package 2 we require assessment of crop rooting at establishment and post-flowering as follows:

- root angle
- number of seminal roots (cereals)
- number of nodal roots (cereals)
- branding density score
- photograph of root crown
- below ground fresh and dry biomass

- tiller number
- above ground fresh and dry biomass
- GPS locations being collected at each sample points

We also require assessments of root length density between flowering and grain fill in wheat, and between flowering and harvest in oilseed rape, as follows:

- Soil cores to 1 m depth
- Measuring root length density (RLD) and root biomass in 20 cm soil layers

### *Work package 3: crop biomass and disease assessments*

Work package 3 has been divided into two sub-packages, specifically: 3a crop biomass, and 3b crop disease.

Work package 3a crop biomass should be completed on the following trials:

- Cultivation oilseed rape
- Cultural and biological oilseed rape
- Fungicide wheat
- Headland wheat
- Mechanical weeding wheat
- Flower strips

Applicants should propose appropriate sampling strategies which take account of the trial design and field characteristics, for example, variation in soil type.

Assessments should be completed in winter wheat at the following timings:

- Crop emergence (GS10) – plant counts
- Start of stem extension (GS30, T0) – plant and tiller counts
- Stem extension (GS31-33, T1) – tiller counts
- Flag leaf emerged (GS39, T2) – tiller counts
- Flowering (GS61-65, T3) – tiller and ear counts
- Milk development (GS71) – ear counts

Assessments should be completed in oilseed rape at the following timings:

- Leaf production (BBCH 19)
- Early stem extension (BBCH 31)
- Late flower (BBCH 67)
- Before pod ripening (BBCH 79)
- Swathing (BBCH 97)

At each timing the following assessments should be completed:

- Growth stage
- NDVI
- Fresh and dry above ground biomass
- Tissue sampled for full nutrient analysis including
  - Nitrogen
  - Sulphur
  - Phosphorous
  - Potassium
  - Magnesium
  - Calcium

- Copper
- Manganese
- Zinc
- Iron
- Boron

From the plant assessments collected in work package 3a, work package 3b crop disease should be completed on the following trials:

- Fungicide wheat
- Flower strips

Assessments of foliar, stem and ear disease should be completed in winter wheat (3 trials) at the following timings:

Growth stage	Foliar disease	Stem disease	Ear disease
GS30	40 tillers, 3 leaf layers		
GS31-33	40 tillers, 3 leaf layers	25 tillers	
GS39	40 tillers, 3 leaf layers		
GS61-65	40 tillers, 3 leaf layers		
GS71	40 tillers, 3 leaf layers	25 tillers	50 fertile tillers

### *Work package 4: weeds*

Work package 4 should be completed on the following trials:

- Mechanical weeding wheat
- Flower strips

Applicants should propose appropriate sampling strategies which take account of the trial design and field characteristics, for example, variation in soil type, treatment focus.

### *Work package 5: pests & natural enemies*

Work package 5 should be completed on the following trials:

- Cultivation oilseed rape
- Cultural and biological oilseed rape
- Flower strips

The following assessments have been identified as priorities, and applicants should propose appropriate assessments and sampling strategies which take account of the trial design and field characteristics, for example, variation in soil type, treatment focus.

- Slugs
- Cabbage stem flea beetle
- Aphids
- Natural enemies
- Pollinators

## Trial descriptions

The trial descriptions below are provided as a guide. Where appropriate, please include alternatives to the proposed trial design in your application based on your experience. Alternative trial designs should consider the intended aim of the Strategic Cereal Farm, budget and logistics of establishing and managing trials with farm scale machinery.

### 1. Cultivation OSR

**Trial aim:** Assessing the impact of cultivation depth on oilseed rape rooting

The following work packages should be completed on this trial:

- Work package 1: soil health scorecard
- Work package 2: crop rooting
- Work package 3a: crop biomass
- Work package 5: pests and natural enemies

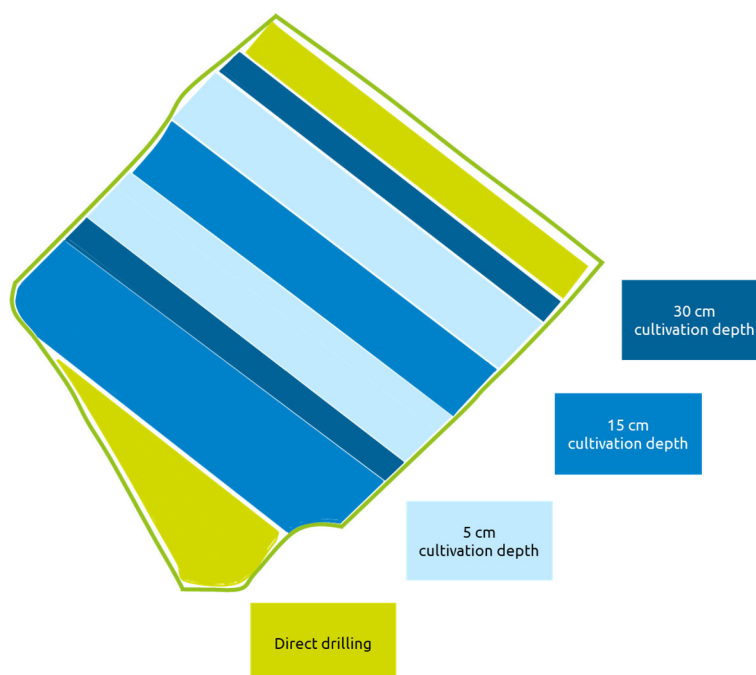
**Trial background:** A recently published AHDB project aimed to study the phenotypic and genetic diversity of rooting at depth between different varieties. This study stated that wheat root systems may not be optimal for the acquisition of subsoil water, due to excessive root growth in surface layers and inadequate soil exploration at depth. The optimum root length density (RLD) to take up water has been defined as  $1\text{cm}/\text{cm}^3$  but past studies in UK field environments have shown evidence to support current wheat cultivars having RLDs less than this defined value below 40 cm depths. This issue is of current importance due to the predicted decrease in summer rainfall in the UK and the sensitivity of anthesis and grain fill growth stages to water limited conditions.

In 2018-2019 the Strategic Cereal Farm West investigated the impact of cultivation depth on winter wheat rooting – the [project overview is available online](#). We would like to repeat this trial in oilseed rape for harvest 2020.

#### Trial design – replicated tramline:

- Field name: 15
- Field size (hectares): 16
- Soil type: medium/ heavy
- Harvest 2019 crop: winter wheat
- Harvest 2020 crop: oilseed rape
- Number of treatments: 4
- Number of replications: 2
- Total number of plots: 8

**Trial layout:** The following trial layout is provided as a guide does not represent the exact locations of the treatments.



## 2. Cultural and biological OSR

**Trial aim:** to determine whether cultural and biological controls strategies can be used to mitigate the effects of cabbage stem flea beetle.

The following work packages should be completed on this trial:

- Work package 1: soil health scorecard
- Work package 3a: crop biomass
- Work package 5: pests and natural enemies

**Trial background:** An AHDB funded project "[Integrated pest management of cabbage stem flea beetle \(CSFB\) in oilseed rape](#)" investigated alternative control options for CSFB including defoliation of CSFB larvae infested crops. The researchers reported that mowing in December or January significantly reduced CSFB larval numbers and increased yields, although differences in yield were not statistically significant. Only a small proportion of larvae were able to reinvade OSR plants from mown plant debris.

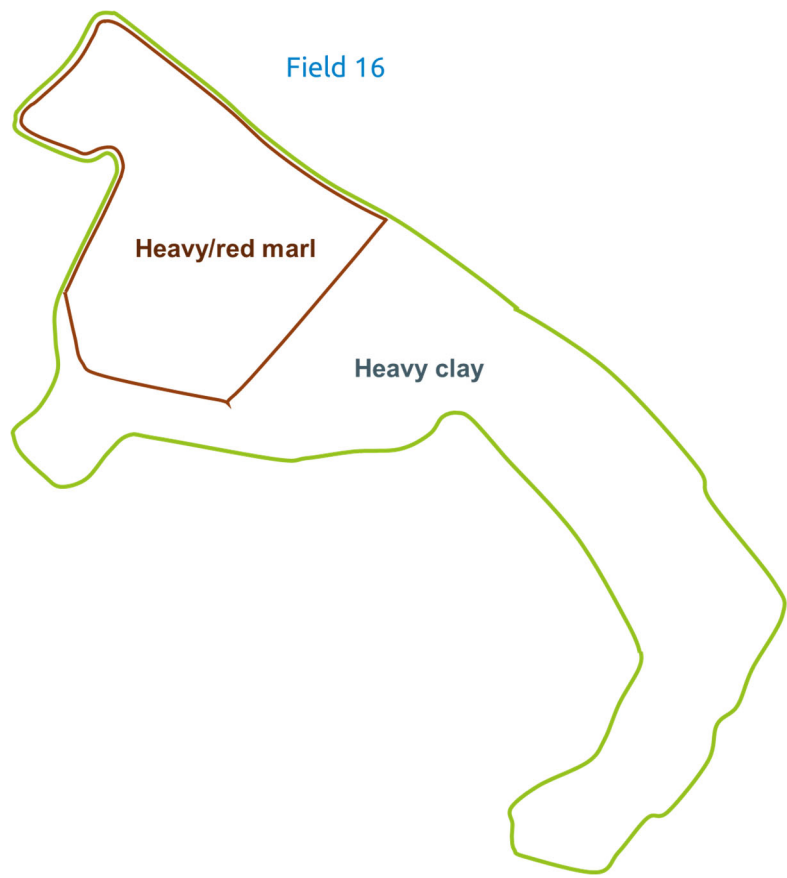
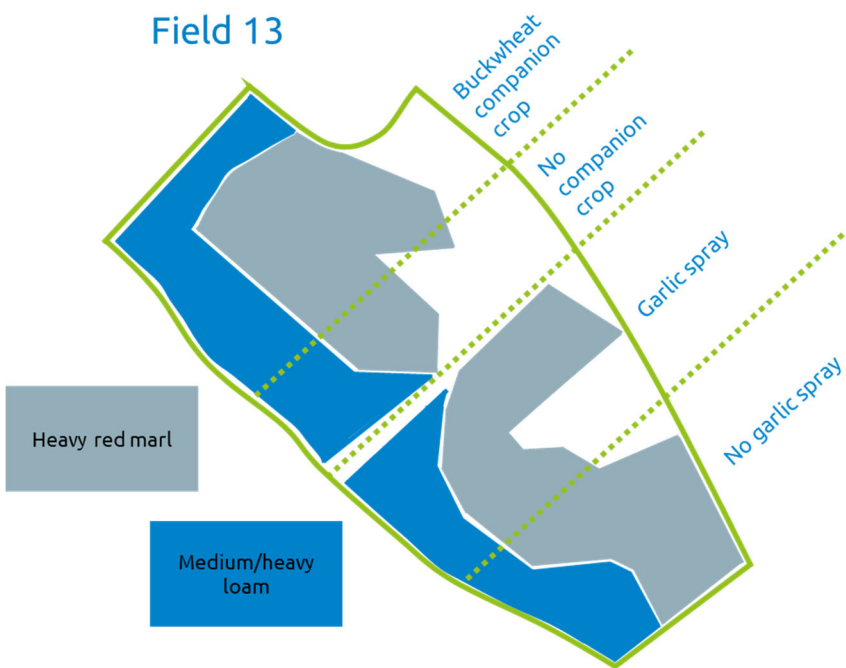
Furthermore, in 2015, an AHDB sponsored Nuffield Scholar, Andrew Howard, [reported on the potential for companion cropping and intercropping on UK arable farms](#). It was reported that intercropping may reduce pest abundance and damage due to the "dilution effect, physical barrier effects and the chemical effect".

We would like to trial three different cultural and biological management strategies for harvest 2020.

### Trial design – multiple split fields:

Field name:	16	13
Field size (hectares):	18	18
Soil type:	medium/ very heavy	heavy red marl/ medium heavy loam
Harvest 2019 crop:	Winter wheat	Winter wheat
Harvest 2020 crop:	Oilseed rape	Oilseed rape
Number of treatments:	2 (topped, untreated)	4
Number of replications:	0	0
Total number of plots:	2	4

**Trial layout:** We have purposefully not provided a trial layout for the defoliation oilseed rape trial in field 16 (shown below). Applicants should therefore propose an appropriate split-field trial design which takes account of the trial aim and field characteristics, for example, variation in soil type. Trial layouts are provided as a guide and do not represent the exact locations of the treatments.



### 3. Fungicides wheat

**Trial aim:** To determine the effect of reduced input regimes and cost of production to promote stewardship and raise awareness of practical anti-resistance measures.

The following work packages should be completed on this trial:

- Work package 1: soil health scorecard
- Work package 3a: crop biomass
- Work package 3b: crop disease

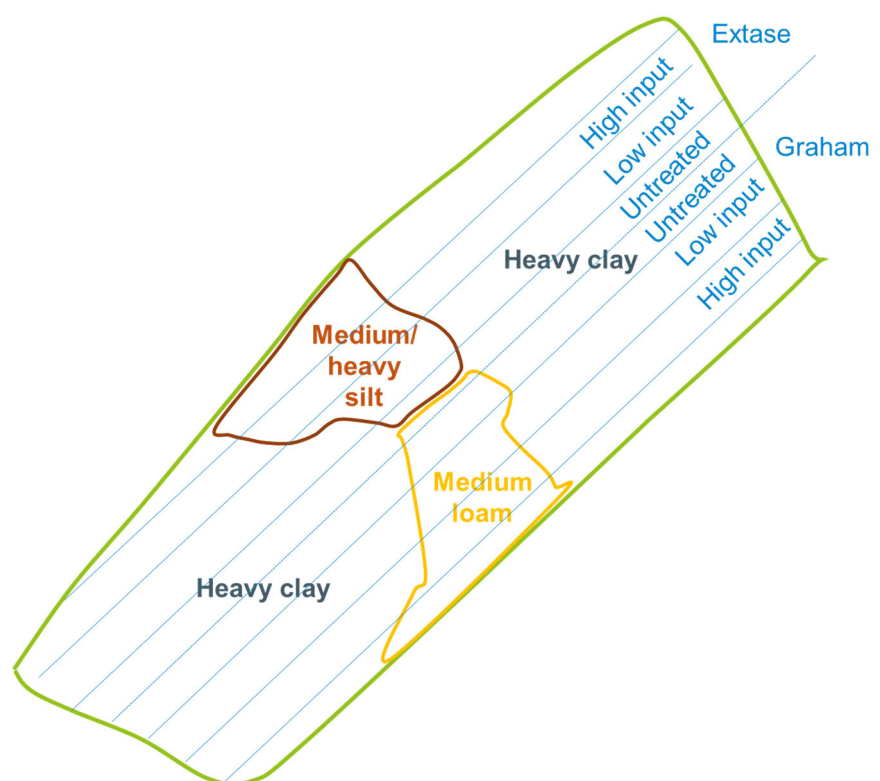
**Trial background:** In order to maintain activity of fungicides and disease control there needs to be a step-change in the way cereal fungicides are used. AHDB already plays a key role in fungicide anti-resistance through monitoring and research of key diseases to develop the most effective anti-resistance strategies, including more resistant varieties. The AHDB Recommended Lists have raised minimum standards for variety disease resistance which potentially enables the reduced use of, and thus reduces pressure on, fungicides.

In 2018-2019 the Strategic Cereal Farm West investigated the impact of fungicide inputs on winter wheat var. Graham – the [project overview is available online](#). We would like to repeat this trial in two varieties for harvest 2020.

#### Trial design – tramline trial:

- Field name: 40
- Field size (hectares): 9
- Soil type: medium/ very heavy
- Harvest 2019 crop: spring barley
- Harvest 2020 crop: winter wheat (var. Extase and Graham)
- Number of treatments: 6 (2 varieties, 3 fungicide inputs – high, low, untreated)
- Number of replications: 0
- Total number of plots: 6

**Trial layout:** The following trial layout is provided as a guide does not represent the exact locations of the treatments.





#### 4. Headlands wheat

**Trial aim:** To determine the impact of cultivation depth and cropping on minimising headland compaction.

The following work packages should be completed on this trial:

- Work package 1: soil health scorecard
- Work package 2: crop rooting
- Work package 3a: crop biomass

**Trial background:** Research studies have reported that due to soil over-compaction, average winter wheat yields can be reduced by 14% on field headlands. Furthermore, headlands can be associated with 8% of erosion events. The aim of this trial is to determine whether yield is reduced on the headlands and whether different cultivation strategies can alleviate these differences.

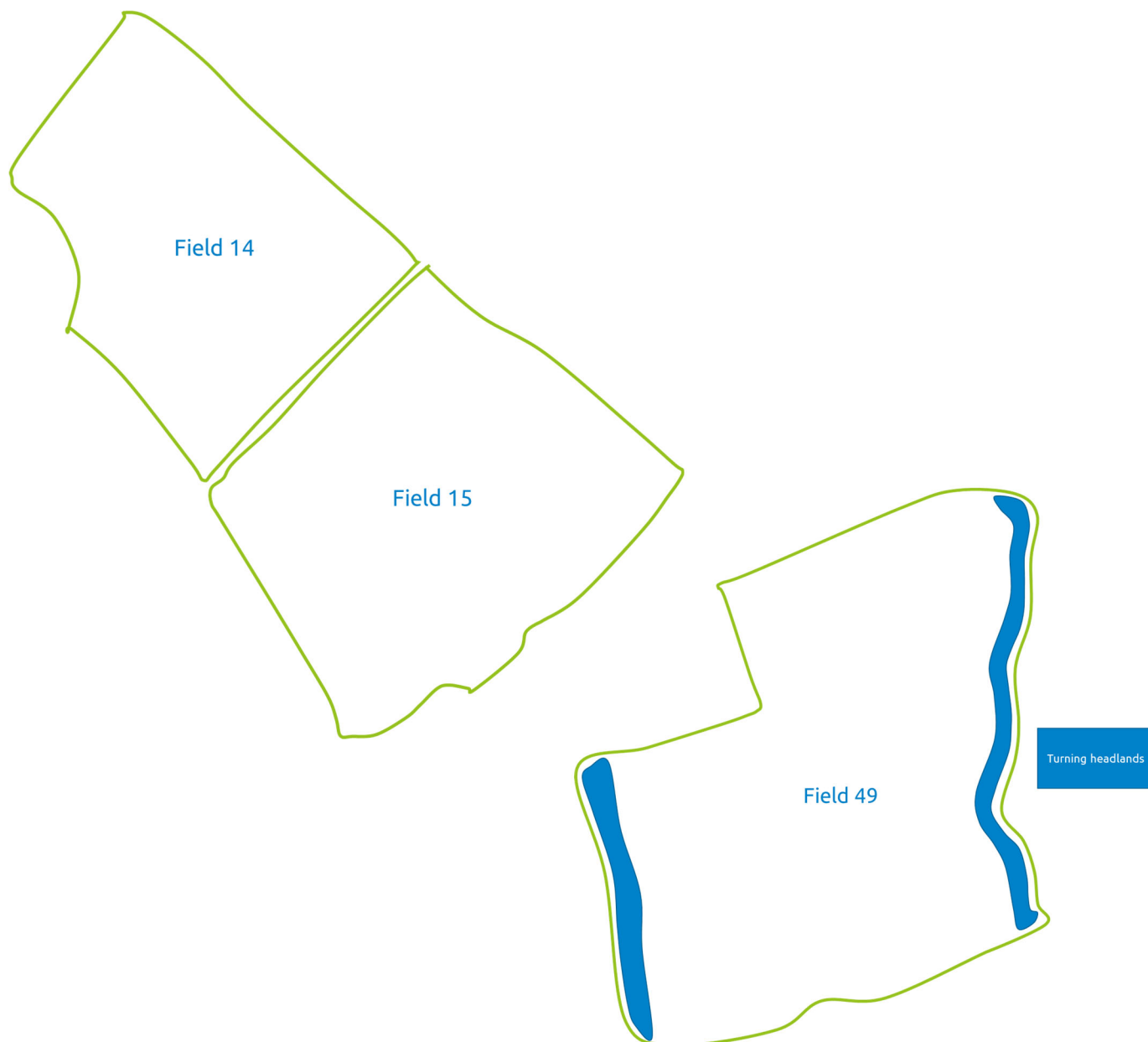
In 2018-2019 the Strategic Cereal Farm West investigated the headland effect in winter wheat var. Graham – the [project overview is available online](#). We would like to repeat this trial for harvest 2020.

We would like to repeat this trial for harvest 2020 across 3 fields, as detailed below.

#### Trial design:

Field name:	14	15	49
Field size (hectares):	16	16.8	5.5
Soil type:	Medium/heavy	Medium/heavy	Medium
Harvest 2020 crop:	Winter wheat	Winter wheat	Winter wheat
Number of treatments:	2 (uncropped cultivated stewardship headland, field)	2 (cropped cultivated headland, field)	2 (cropped cultivated headland, field)
Number of replications:	2 (headlands only)	2 (headlands only)	2 (headlands only)
Total number of plots:	3	3	3

**Trial layout:** The following trial layout is provided as a guide does not represent the exact locations of the treatments.



## 5. Mechanical weeding wheat

**Trial aim:** To determine the efficacy on mechanical weeding on autumn weed control.

The following work packages should be completed on this trial:

- Work package 1: soil health scorecard
- Work package 3a: crop biomass
- Work package 4: weeds
- Work package 5: pests & natural enemies

Density of weed species should be assessed before and after treatment.

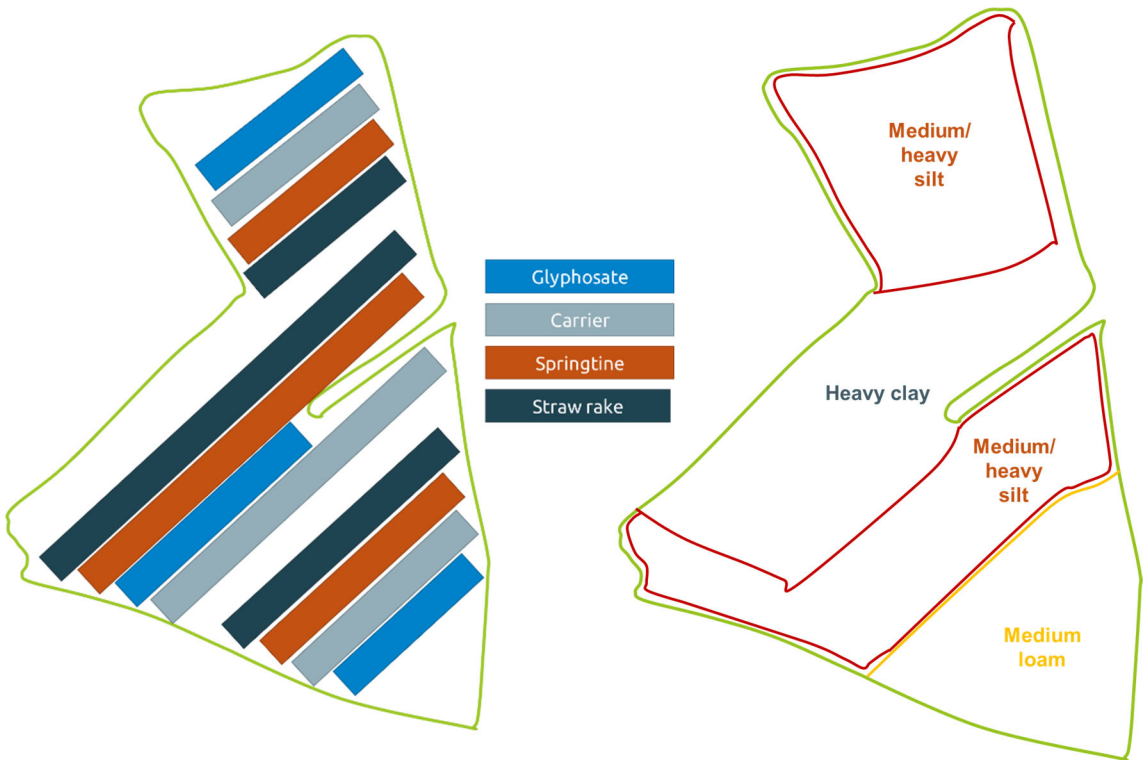
**Trial background:** Weed management has become an increasing challenge due to changing EU regulations, herbicide resistance and a lack of new control methods. We therefore require integrated approaches which use both cultural and chemical control. Mechanical weeding is often viewed as a desirable alternative to chemical weed control and a method of reducing reliance on herbicides.

We would like to trial the impact of different cultural weed control strategies compared to farm standard, as detailed below.

### Trial design:

- Field name: 41
- Field size (hectares): 14.5
- Soil type: medium/heavy
- Harvest 2019 crop: oilseed rape/ spring barley
- Harvest 2020 crop: winter wheat
- Number of treatments: 4 = glyphosate, carrier (shallow discus), springtine, straw rake
- Number of replications: 3
- Total number of plots: 12

**Trial layout:** The following trial layout is provided as a guide does not represent the exact locations of the treatments.



## 6. Flower strips

**Trial aim:** To determine the impact of perennial flower strips on beneficial insect and pest populations.

The following work packages should be completed on this trial:

- Work package 1: soil health scorecard
- Work package 3a: crop biomass
- Work package 3b: crop disease
- Work package 4: weeds
- Work package 5: pests & natural enemies

**Trial background:** An AHDB sponsored PhD student investigated the impact of flower strips on wild pollinator populations in apple production. It was [reported](#) that the flower strips attracted a range of insects and there was a benefit of pollination on fruit yield.

Within arable crop production, margins of pollen and nectar flower can be used to increase numbers of pollen and nectar feeding insects. In 2004, AHDB published research on [Managing biodiversity in field margins to enhance integrated pest control in arable crops](#). The researchers reported that non-crop habitats constitute one of the most important sources of biodiversity within farmland. In many arable areas, field margins are the only major non-crop habitat, acting as the main source of beneficial species, and it has been recognised for some time that field margins can play an important role in the development of novel manipulation techniques to enhance insect predators and parasitoids.

We would like to determine the impact of perennial flower strips, established in spring 2018, on beneficial insect and pest populations, as detailed below.

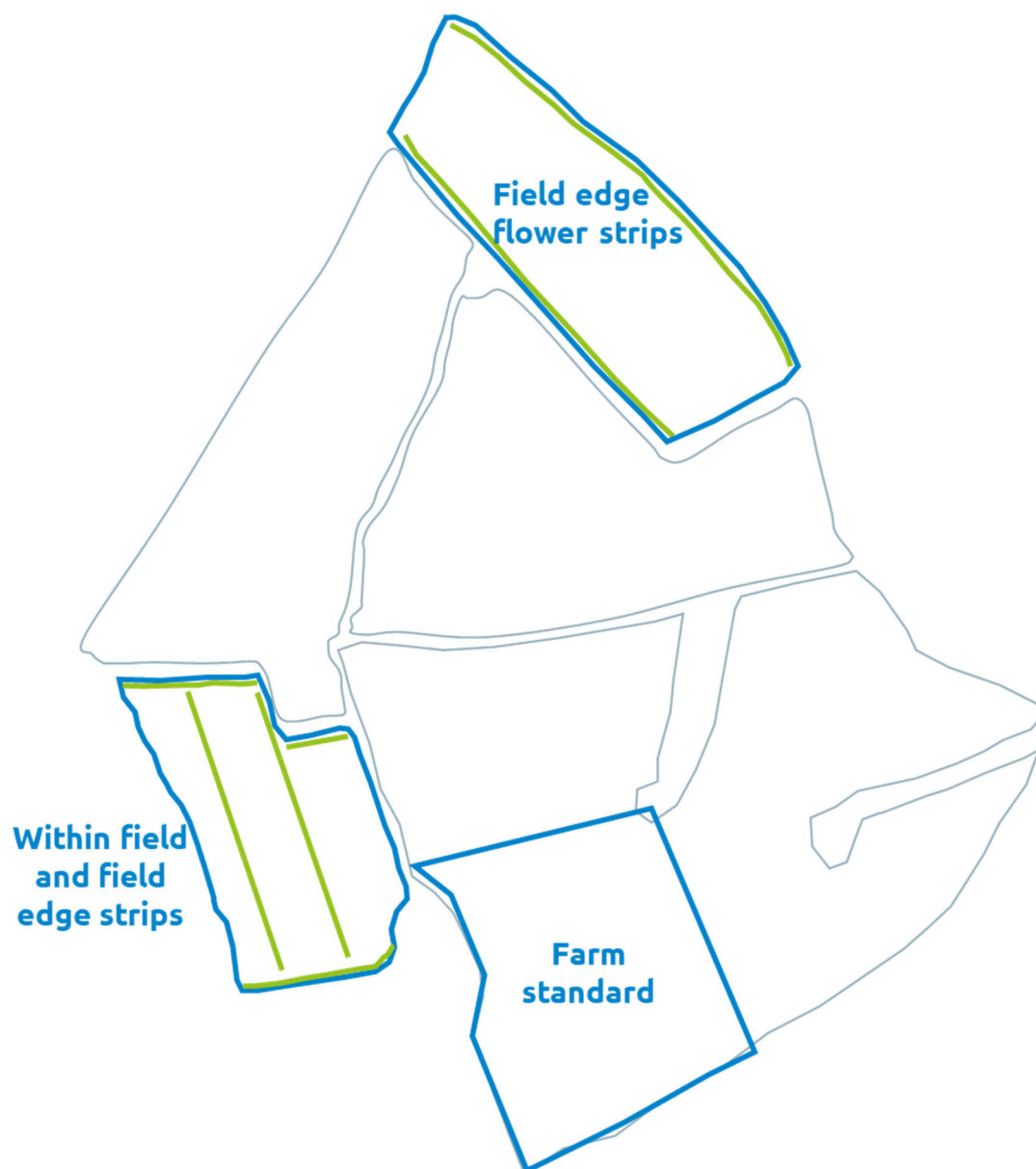
**Trial design:** This trial is located at two sites: Site 1 Strategic Cereal Farm West, and Site 2 Petworth Monitor Farm. Assessments at both sites should be completed using a methodology appropriate to generate robust data to complement an on-farm demonstration. Proposals should suggest a two-tiered approach, whereby assessments at Site 1 can be completed more intensively taking into account the aim of the Strategic Farms is to test research in a commercial situation and provide farmers with practical ways of conducting their own on-farm testing and assessments. Assessments at Site 2 should be completed using a methodology that could be utilised and replicated by farmers on their own businesses.

Site location and layouts of each of the trials are provided below.

**Site 1:** Strategic Cereal Farm West, Squab Hall Farm, Bishops Tachbrook, Leamington Spa, Warwickshire CV33 9QB.

Treatment name:	Farm standard	Field edge flower strips	Within field and field edge flower strips
Field name:	42	40	43
Field size (hectares):	32	9	7.5
Soil type:	medium, heavy, very heavy	Medium, very heavy	Medium
Harvest 2019 crop:	spring barley/ oilseed rape	Oilseed rape	Oilseed rape
Harvest 2020 crop:	Wheat	Wheat	Wheat

**Trial layout:** The following trial layout is provided as a guide does not represent the exact locations of the treatments.



**Site 2:** Petworth Monitor Farm, Moor Farm, Petworth, West Sussex GU28 0HD

Treatment name:	Farm standard	Field edge flower strips	Within field and field edge flower strips
Field name:	10.A	14.A	06.A
Field size (hectares):	13.2	6.18	10.99
Harvest 2020 crop:	Spring beans	Spring beans	Spring beans

**Trial layout:** The following trial layout is provided as a guide does not represent the exact locations of the treatments.

