September 2021

Project Report No. 647

On-farm trials at

Strategic Cereal Farm West

(2018–2021)

AHDB Cereals & Oilseeds is a part of the Agriculture and Horticulture Development Board (AHDB).

CONTENTS

1. Introduction

Host Farmer: Rob Fox
Location: Squab Hall Farm, Warwickshire
Duration: 2018–2021

AHDB Strategic Cereal Farms put cutting-edge research and innovation into practice on commercial farms around the UK. Each farm hosts field-scale and farm-scale demonstrations, with experiences shared via on-farm and online events to the wider farming community.

Strategic Cereal Farm West ran for three years (2018–2021), following on from three years (2014–2017) as a Monitor Farm. The arable farm tested approaches to reduce the environmental impact of farming, while maintaining productivity. The rotation includes winter wheat, winter barley, winter oilseed rape, spring beans and spring barley.

The farm hosted four main trials:

1. **How stubble management affects black-grass**

This trial tested the effectiveness of stubble management cultivation strategies on black-grass control in winter wheat. It compared the farm standard approach with two other cultivation approaches – which, unlike the farm standard, did not include the use of glyphosate.

2. **How cultivation depth affects crop rooting**

Low rainfall can constrain cereal yields, especially at critical growth stages. Climate change is likely to make this more problematic. This trial examined how cultivation system depth affects soil health, crop rooting, yields and cost of production.

3. **How flowering strips and grass margins affect pest populations**

This trial examined whether field margins and flower strips encourage populations of beneficial organisms that contribute to pest control. The approach tested flower strips in the field and at the edges of fields. It also assessed the impact of grass margins.

4. **How to reduce fungicide inputs**

The loss of chemistry, fungicide resistance and input costs mean it is important to identify better ways to manage cereal diseases. This trial tested the cost-benefit of fungicide input programmes, building upon AHDB fungicide performance data and disease resistance data in the Recommended Lists (RL).

For further information about Strategic Cereal Farms, visit ahdb.org.uk/strategic-cereal-farms

2. Baseline data

Soil health

At the start of the project, assessments were conducted to provide baseline soil data for nine fields at Strategic Farm West.

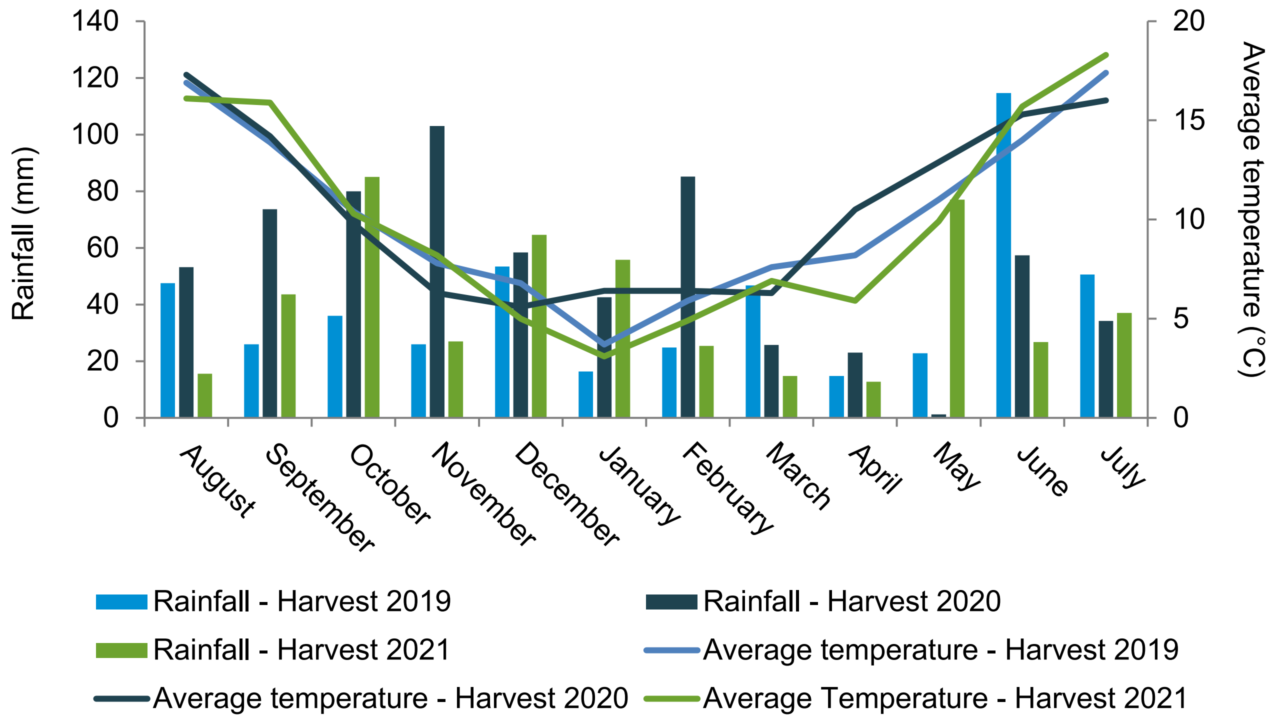
The approach included assessment of soil structure, laboratory soil analysis, earthworm assessments, electrical conductivity scanning and crop assessments.

Visual evaluation of soil structure (VESS) and bulk density results showed evidence of compaction across the farm, with poorer soil structure observed on soils with a heavier texture.

Earthworm numbers were depleted across several of the fields.

Weather station

A weather station was installed to capture temperature and rainfall data for the duration of Strategic Cereal Farm West.



3. How stubble management affects black grass

Trial start: September 2020

Trial end: August 2021

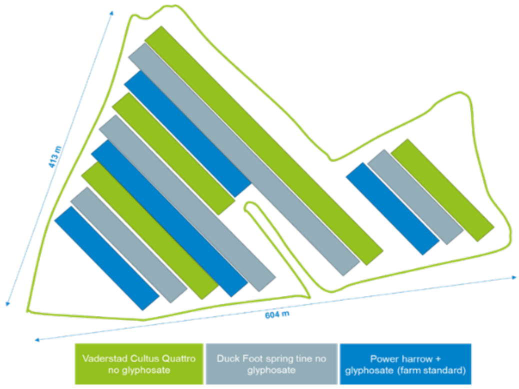
Rationale

Research shows a clear benefit from integrating chemical and cultural controls to manage weed populations, including black grass. This replicated tramline trial tested the effectiveness of stubble management strategies before drilling KWS Saki winter wheat.

Method

A 12-hectare field with soil types range from shallow over sandstone to very heavy clay, featured three treatments:

1. Power harrow (3–8 cm depth) with glyphosate (farm standard control treatment)
2. Duck foot spring tine (4–7 cm depth), no glyphosate
3. Vaderstad cultus quattro (4 – 8 cm depth), no glyphosate



Initial cultivations occurred on 18 September 2020, with cultivations repeated in treatments 2 and 3 on 30 September 2020. Wheat was drilled (tine drill) on 1 October 2020 at a rate of 185 kg/ha.

Results summary

At the first cultivation (18 September 2020), black-grass levels were quite low and only found on the headlands. On 26 October 2020, a second weed assessment found cleavers across the field. In April 2021, black-grass was found on the heavier soils, with cleavers on six of the tramlines.

The farm standard treatment resulted in good tilth and small crumb size. The cultivation lifted spring barley volunteers out of the soil, which dried and died on the surface.

The duck foot spring tine cultivation did not bring up any weed populations from depth. It also left mini ridges in the soil and did not remove all the volunteers.

The Vaderstad cultus quattro resulted in variation in the cultivation depth and affected the quality of the seedbed, with larger clod sizes and surviving volunteers (which could be difficult to control without glyphosate).

4. Cultivation depth and crop rooting

Trial start: September 2018

Trial end: August 2021

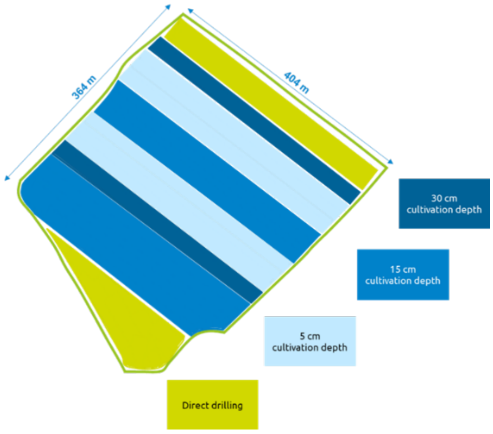
Rationale

Low rainfall can constrain cereal yields, especially at critical growth stages. Climate change is likely to make this more problematic. This trial examined how cultivation systems affect soil health, crop rooting, yield and cost of production. It aimed to make winter wheat more resilient to climatic extremes.

Method

The trial started in 2018 with three cultivation depths, with direct drilling added in 2019:

1. Direct drilling
2. 5 cm depth (disc cultivator and shallow spring tine before drilling)
3. 15 cm depth (single pass deep soil disc cultivator and a shallow spring tine before drilling)
4. 30 cm depth (single pass deep soil disc cultivator and a shallow spring tine before drilling)



Results summary

Direct drilling and shallow cultivation (5 cm depth) increased topsoil strength and was associated with steeper root angles and greater rooting in the subsoil compared to deeper cultivation. However, field variation in subsoil properties had a greater impact on measured crop traits compared to cultivation treatments. At harvest, there were no significant yield differences.

Regular monitoring of soil structure is vital to inform soil management. The most effective and practical method for determining soil structure is a visual and physical examination of the soil profile (e.g. VESS).

Earthworm counts were found to be a useful indicator of overall soil health and are important in the development of good soil structure.

5. Reduced fungicide applications – managed lower inputs

Trial start: September 2019

Trial end: August 2021

Rationale

The loss of chemistry, fungicide resistance and input costs mean it is important to identify better ways to manage cereal diseases. This trial tested the cost-benefit of fungicide input programmes, building upon AHDB fungicide performance data and disease resistance data in the Recommended Lists (RL).

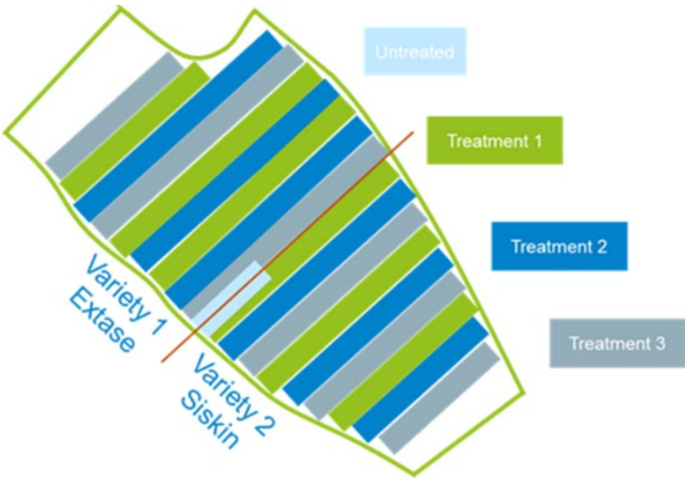
Method

In the initial years, a simple split-field trial, established with winter wheat (Graham), compared a farm standard with a low-input programme, where applications were applied in response to disease risk. This identified no significant differences between any treatment.

For harvest 2021, a more complex replicated tramline trial was established in an 18-hectare field (field 13) – mainly a heavy-red marl and medium-to-heavy loam soils. The trial design was selected to minimise the effect of the soil variation in the field on the results.

It compared two winter wheat varieties (KWS Extase and KWS Siskin) under three treatments:

1. Farm standard fungicide programme
2. Low-input fungicide programme
3. Biorational programmes



A fungicide untreated (control) was also tested in a relatively small area (to limit overall negative yield impacts). The field was drilled on 30 September 2020 at a seed rate of 208 kg/ha.

Results summary

Similar approaches have been tested at other Strategic Cereal Farms. The trials at Strategic Cereal Farm West only ran for two years and it is difficult to draw conclusions from them. However, the results will be considered as part of a more in-depth analysis that considers the wider Strategic Cereal Farm series.

6. In-field flower strips

Trial start: July 2020

Trial end: August 2021

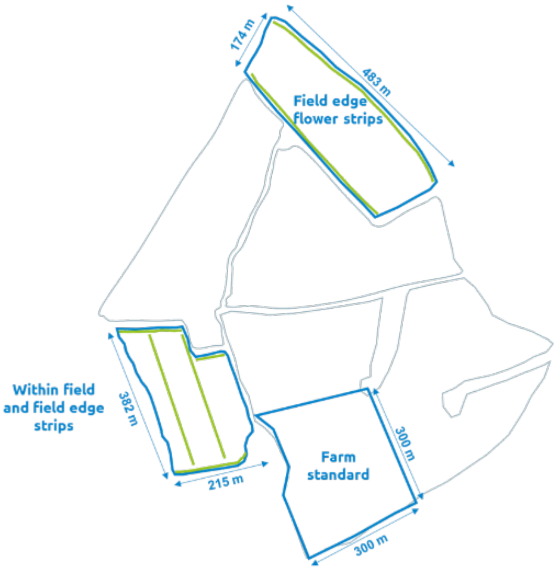
Rationale

Non-crop habitats are important sources of biodiversity. For example, field margins and flower strips provide habitats for insects that are beneficial for pollination and pest control.

Method

This field-scale trial examined whether such habitats could help reduce insecticide use on commercial farms. The trial was conducted across three fields.

1. Control with no flower strips (field 42) – 32 ha field, clay soil
2. Flower strips at two field edges (field 40) – 9 ha field, medium-to-heavy soil
3. Flower strips in the field (x 2) and at two field edges (field 43) – 5 ha field, medium soil



The margins and strips were 6 m wide. The mix was broadcast in late summer into a firm, fine, weed-free seedbed and rolled. The cash crop was winter wheat (RGT Saki), which was drilled on 29 September 2020 (seed rate 192 kg/ha).

Results summary

The average numbers of pests and natural enemies (recorded during key trapping periods) are presented in the following tables. The tables also indicate whether the result was relatively bad (red), average (amber) or good (green) relative to the other fields sampled in this study. Results suggested that slugs were found in higher numbers further away from field margins. Yield in the field with the flower strips in and around the field (field 43) was highly variable. This was most likely due to in-field variation. No evidence that crop performance was negatively impacted 30 m either side of the floral strips.

2021 results	Grass margin	Floral margin	Crop	Floral strip
Field 40	X	0	0.2	X
Field 42	2	X	3	X
Field 43	X	21	0.6	16
Units = average number of slugs per trap; Threshold for treatment = 4 slugs per trap				

2021 results	Grass margin	Floral margin	Crop	Floral strip
Field 40	X	10.6	3.6	X
Field 42	8.5	X	2.8	X
Field 43	X	9.4	1.9	6.5
Units = average number of aphids per trap over three week period				