

# P2007349: Assessment and analysis at AHDB Strategic Cereal Farms

## Strategic Cereal Farm West: Work package 7 - Cultivation

### 7.1 Trial background

Previous AHDB research has reported that wheat root systems may grow excessively in surface soil layers, have inadequate soil exploration at depth and therefore cannot access subsoil water. Research has shown that at a depth of 40 cm, wheat cultivars do not achieve the optimum root length density of 1cm/cm<sup>3</sup> for plants to take up water. It is important that farmers can develop practical solutions to this problem, especially as the UK is predicted to experience continued decrease in summer rainfall and the sensitivity of anthesis and grain fill growth stages to water limited conditions.

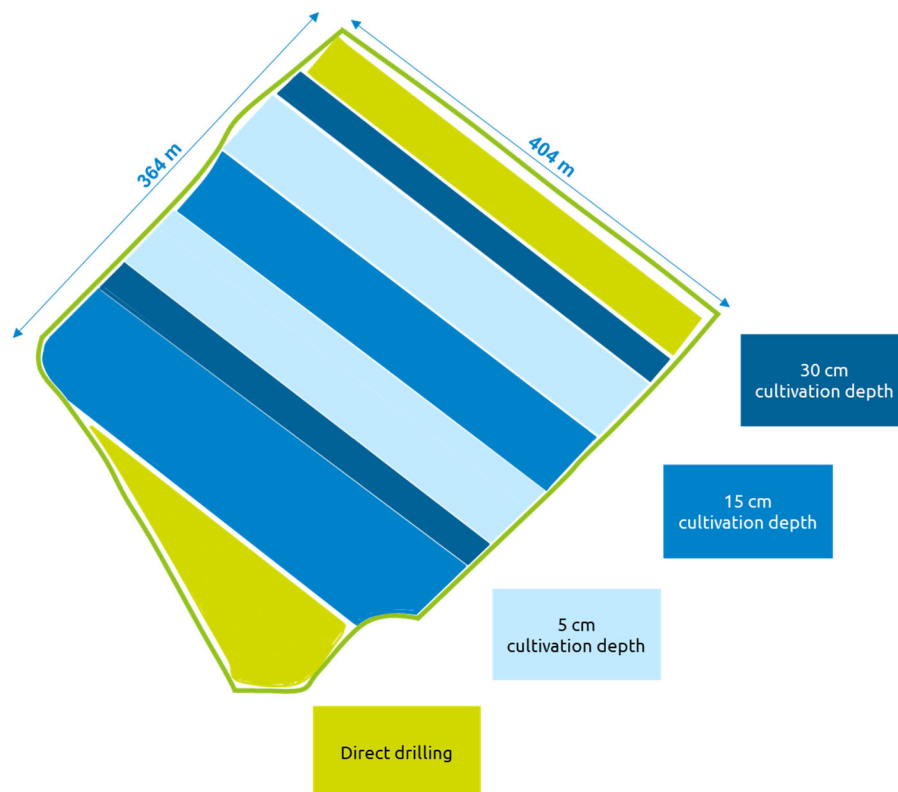
The Strategic Cereal Farm West cultivation trial was established to test the extent to which cultivation systems can be used to improve soil health and promote improved crop rooting at depth and to demonstrate the integration of new cultivation systems into a farm business. The trial was established in 2018 and will continue for the duration of the programme.

**Trial aim:** To determine the impact of cultivation system on soil health, crop rooting and yield.

### 7.2 Trial design – replicated tramline trial

- Field number: 15
- Field size (hectares): 16
- Soil type: clay (~38% clay content)
- Harvest 2019 crop: winter wheat
- Harvest 2020 crop: spring beans
- Harvest 2021 crop: winter wheat
- Number of treatments: 4
- Number of replications: 2
- Total number of plots: 8

The trial layout provided in Figure 7.1 is provided as a guide does not represent the exact location or dimensions of the trial.



**Figure 7.1 Cultivation trial layout at Strategic Cereal Farm West**

### 7.3 Assessments

The assessments completed to date are listed below. This list is intended as a guide, and proposals in this current call should look to build upon this dataset to enable benchmarking of invertebrate groups between fields and between years.

In 2018, the cultivated treatments were assessed using the draft AHDB/BBRO soil health scorecard. In 2019, the direct drill treatment was assessed using the same methodology. We propose to re-sample the treatments using a reduced list of parameters than the full scorecard approach, but proposals should consider the aim of the trial and the trial design.

- Soil
  - Topsoil VESS
  - Earthworms
  - Penetration resistance to 50 cm
  - Soil moisture 0-15 cm, 15-30 cm, 30-50 cm (to calibrate penetrometer resistance measures)
  - Bulk density at 0-15 cm, 15-30 cm, 30-50 cm
- Crop rooting
  - To date, shovelomics (York et al. 2018) has been used to allow a high-throughput measure of crop rooting in the field. This method involves excavating the crop and the top 20-30 cm of soil and phenotyping the root crown for root architecture traits that can be associated with crop establishment and crop vigour and infer deeper rooting (Slack et al. 2018). After washing the soil off the roots multiple traits are assessed, depending on

- the crop type, including for cereals: root angle, number of seminal roots, number of nodal roots, density score, photograph of crown root, tiller number, above and below ground fresh and dry biomass
- RLD and root biomass has been assessed by deep coring post-harvest to a depth of 1 m
  - Crop growth and development assessed at key timings during the growing season (Table 7.1)
  - In addition to the assessments previously completed on this trial, the evaluation of cultivation systems on soil carbon should be included in responses to this call

**Table 7.1 Crop growth and development assessments on the cultivation trial at Strategic Cereal Farm West**

<b>Timing</b>	<b>Assessments</b>
Crop emergence (GS10)	Plant counts, growth stage, NDVI every two weeks for 6 weeks following emergence if treatments are likely to affect emergency or early establishment
Start of stem extension (GS30)	Plant and tiller counts, growth stage, NDVI, above ground (fresh and dry) biomass, tissue analysis
Stem extension (GS31-33)	Tiller counts, growth stage, NDVI, above ground (fresh and dry) biomass, tissue analysis
Flag leaf emergence (GS39)	Tiller counts, growth stage, NDVI, above ground (fresh and dry) biomass, tissue analysis
Flowering (GS61-65)	Tiller and ear counts, growth stage, NDVI, above ground (fresh and dry) biomass, tissue analysis
Grain fill (GS71-75)	Tiller and ear counts, growth stage, NDVI, above ground (fresh and dry) biomass, tissue analysis
Pre-harvest	Harvest index and grain and straw tissue analysis (%N)
Yield	Yield analysis using yield map data