

# DO ROTATIONS AND CULTIVATION AFFECT SOIL HEALTH?

The Sustainability Trial in Arable Rotations (STAR) project is a long-term large-scale ongoing rotational experiment, managed by NIAB TAG. It has been exploring ways of improving the sustainability, stability and output of conventional arable farming systems on a clay loam (heavy soil) at Otley in Suffolk for over a decade.

The cultivation system research examines the interaction of:

- rotations – continuous winter wheat, winter wheat with combinable break crops (autumn/spring), winter wheat with alternate year fallow (cover crop); and
- cultivations – inversion (plough), deep non-inversion (c. 20cm) and shallow non-inversion (c. 10cm).

## Impacts on yield

Winter wheat yields show little difference between cultivation systems. However, with break crops included there is a drop-off in yield (4-11%) under the non-inversion systems.

Rotational choices have tended to have a greater impact on margin than primary tillage decisions, with the winter cropping rotation (all cultivations) providing the highest margin. Tillage results in little difference between the plough and deep non-inversion. Across rotation, there is an increase in margin under non-inversion tillage as a result of lower costs associated with seedbed preparation. However, in the winter cropping rotation, a couple of poor break crops (winter beans) resulted in lower margins under non-inversion tillage cf. plough tillage.

## Impacts on soil health

Plots were sampled in spring 2018. An assessment was made of treatment (rotation, cultivation) effects on soil health indicators and linked to crop performance (winter wheat) and overall rotational performance.

There were no significant differences between tillage treatments in any of the main scorecard measures. None of the soil health measures currently included in the scorecard, determined in the spring, were well correlated with 2018 wheat yield.

Soil type has an over-riding effect on many of the soil health indicators, irrespective of management decisions (i.e. rotation or cultivation). Timeliness of cultivation, rather than cultivation system per se, is the most important factor controlling impacts on soil.

With little apparent difference in soil health being evident from either rotational or cultivation approaches, further work from autumn 2018 will examine the introduction of a 3-year complex herbal ley to look at restoring soil quality through the regeneration of leys into arable rotations.

	Plough	Deeper non-inversion	Shallow non-inversion
<b>Crop yield (across rotation)</b>			
Relative yield (% cf. plough) cv Shabras, 2018	100	98	99
Relative yield (% cf. plough) 2006-2018	100	96	95
<b>£ margin (across rotation)</b>			
Relative margin (% cf. plough) 2006-2018	100	104	104
<b>Soil health parameter</b>			
pH	7.2	7.1	7.1
Extractable P (mg/l)	17.1	17.6	17.9
Extractable K (mg/l)	106.2	112.3	110.0
Extractable Mg (mg/l)	57.7	61.1	63.8
Structure, VESS score	2.4	3.0	2.8
Organic matter (%LOI)	3.7	3.9	4.0
CO <sub>2</sub> burst	112	136	130
Earthworm count (total number in a 20 x 20 x 20 cm block)	7.7	4.9	5.9

Traffic light colours were allocated using the framework under test in the AHDB-BBRO Soil Biology and Soil Health Project, Project 2 Report, 2018

The STAR Project is managed by NIAB TAG in conjunction with an independent advisory group and supported by The Felix Thornley Cobbold Trust and, historically The Chadacre Agricultural Trust.

