

THE IMPACT OF ROTATIONS AND CULTIVATIONS ON CROP PERFORMANCE

The Sustainability Trial in Arable Rotations (STAR) project is a long-term large-scale ongoing rotational experiment, managed by NIAB. 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 15 years.

The cultivation system research examines the interaction of:

- rotations – continuous winter wheat, winter wheat with combinable break crops (autumn/spring), winter wheat following combinable cropping with a two or three-year herbal ley on a rotational basis; and
- cultivations – inversion (plough), deep non-inversion (c. 20 cm), shallow non-inversion (c. 10 cm) and a managed approach (guided by field assessment and informed grower decisions).

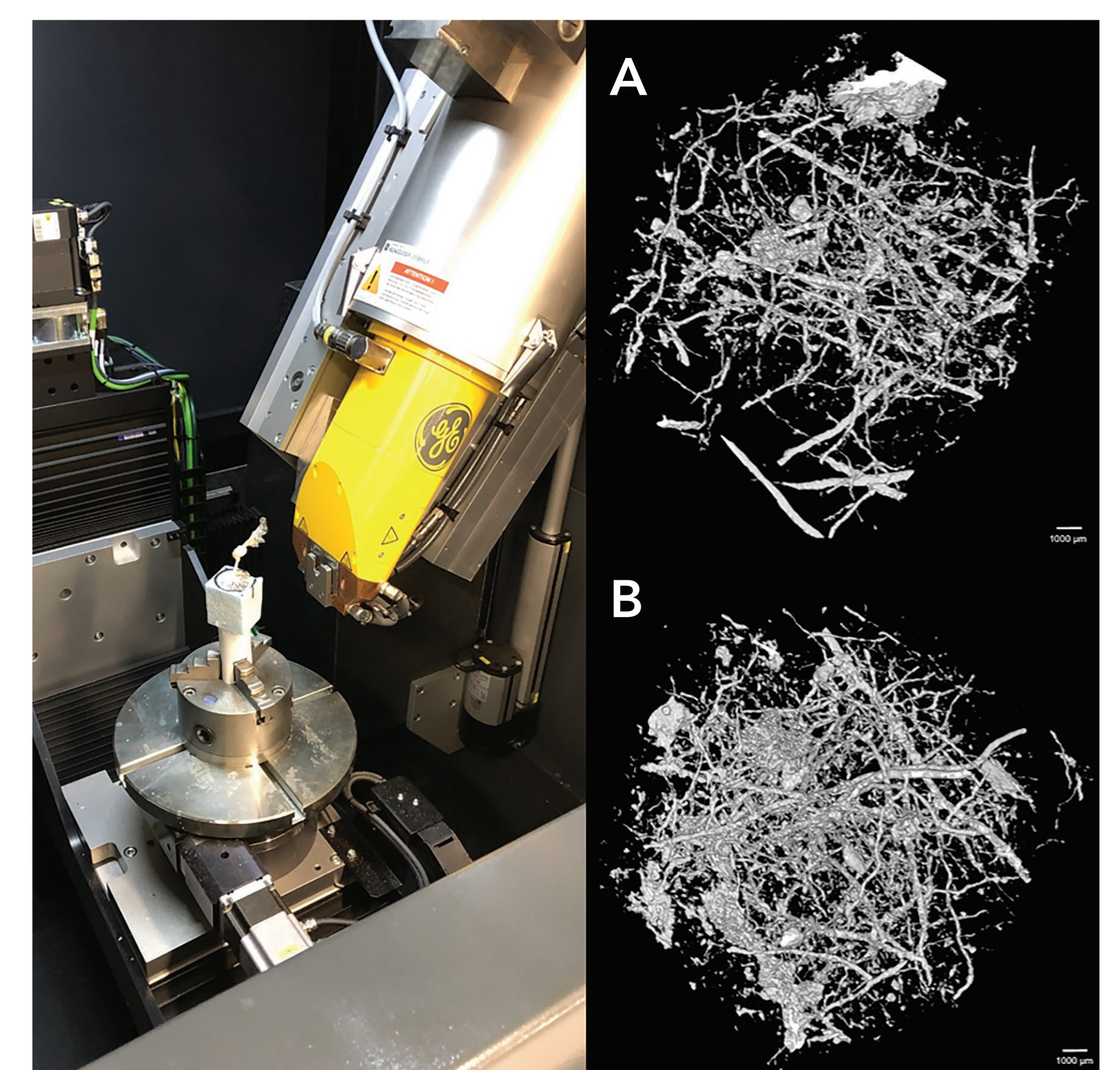
Impacts on yield

Winter wheat yields (across nine seasons) show little difference between cultivation systems. However, with winter or spring break crops included there is a drop off in yield (5-12%) under the non-inversion systems compared to plough. Typically, the managed approach performed as well, or better, than the plough. This underlines the importance of being flexible and adapting the cultivation approach to suit conditions for improved crop performance.

X-ray computed tomography

Undisturbed soil cores (800 (h) x 84 (d) mm) were collected and samples from the 200-400 mm layer were selected for X-ray computed tomography (CT). Figure 1 shows the X-ray CT scanning equipment used to determine subsoil physical structure. Shallow cultivated combinable cropping/ herbal ley rotation had significantly higher pore volume (%) compared to ploughed continuous winter wheat. Reducing the intensity of cultivation (shallow non-inversion) resulted in an improvement in soil pore volume, surface area and frequency.

Figure 1: X-ray CT scanning to determine soil physical structure (left), example X-ray CT images of a plough pan (right) a) continuous winter wheat, b) winter wheat alternated with a brassica cover crop



Key message

Repeated use of seasonal cover cropping combined with shallow non-inversion cultivation resulted in lower penetration resistance and provided the most significant benefits to soil water retention, root morphology and pore characteristics as measured by X-ray CT compared to continuous winter wheat rotation.

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

