FLEXIBLE APPROACH TO SOIL MANAGEMENT LIKELY TO YIELD BEST RESULTS

Are you thinking about changing your soil management approach? If so, what should be considered along the way? AHDB resource management scientist Amanda Bennett explains how long-term experiments are providing answers to the challenge of optimising a crop production system.

The view across the agricultural landscape is shifting: There's an increased diversity of crops in rotations, stubble left standing in the field, cover crops in place of bare soil and various degrees of soil disturbance.

The consequence is a rich tapestry of colour and texture visible across the land, all associated with an ever-expanding array of cultivation approaches. Such approaches, however, often arrive ahead of the know-how needed exploit them to best effect.

And, of course, it's the long-term impact of switching to a new approach that frequently yields the biggest unknowns. Costs and benefits, whether it be economic or environmental, all become a little fuzzier and harder to account for over a longer period. How many times have you looked back on a decision made several years ago and wondered, with hindsight, if it was the right one?

That's why AHDB is investing in the GREATsoils activity to help growers make more informed decisions. But a word of warning before you read further: there are no simple solutions.

LONG-TERM EXPERIMENTS

AHDB-funded work at long-term experimental sites* has provided insight into the effect of cultivation practice on soil physical and chemical conditions, along with the knock-on effect on soil biology.

Trials conducted at some of these sites compared plough (inversion) with deep and shallow non-inversion tillage, as well as with a 'managed' approach – where the annual cultivation decision depended on soil conditions, weather, previous cropping, weed burden and soil assessments.

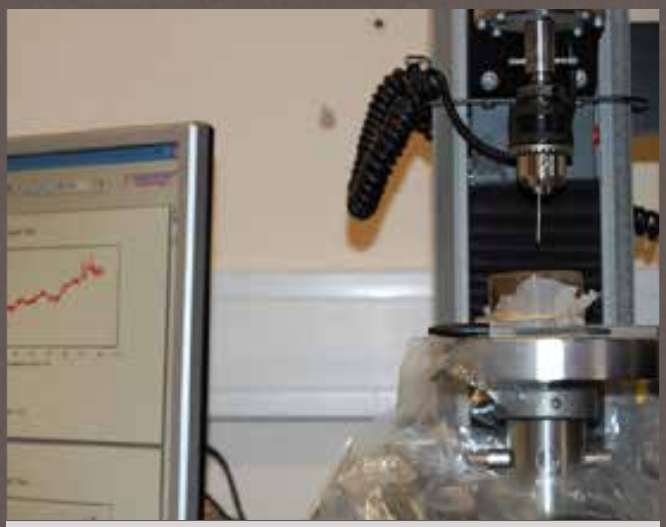
***Long-term experimental sites** are part of The New Farming Systems (NFS) project (Norfolk), the Sustainability Trial for Arable Rotations (STAR) project (Suffolk), which are both supported by agricultural charities and managed by NIAB, and the Mid-Pilmore and Balruddery sites (in Perthshire).

Resource management scientist Amanda Bennett manages soil research at AHDB

A MANAGED APPROACH

Data, collected over several years at the Suffolk-based site (heavy clay loam soils), showed yields were frequently lower in non-inversion systems than in plough-based systems. The former system, however, was associated with more favourable gross margins – due to lower fuel and labour costs. In terms of crop choice, the optimal rotation depended on many factors but the managed approach was more likely to generate higher gross margins.

At the Norfolk site (sandy loam soil), where the rotation focused on winter wheat and spring-sown combinable crops, the deep non-inversion system led to the highest cumulative yields. Once again, the managed approach – where the cultivation system used in any given year was made in response to soil, weather and agronomic factors – resulted in the highest margins. The inclusion of cover crops at this site was also found to reduce variability in performance associated with shallow (10cm) non-inversion techniques in the following crops.



As part of the research, soil cores were extracted at the trial sites throughout the season. These were then analysed to measure the effect of tillage on soil quality and function.

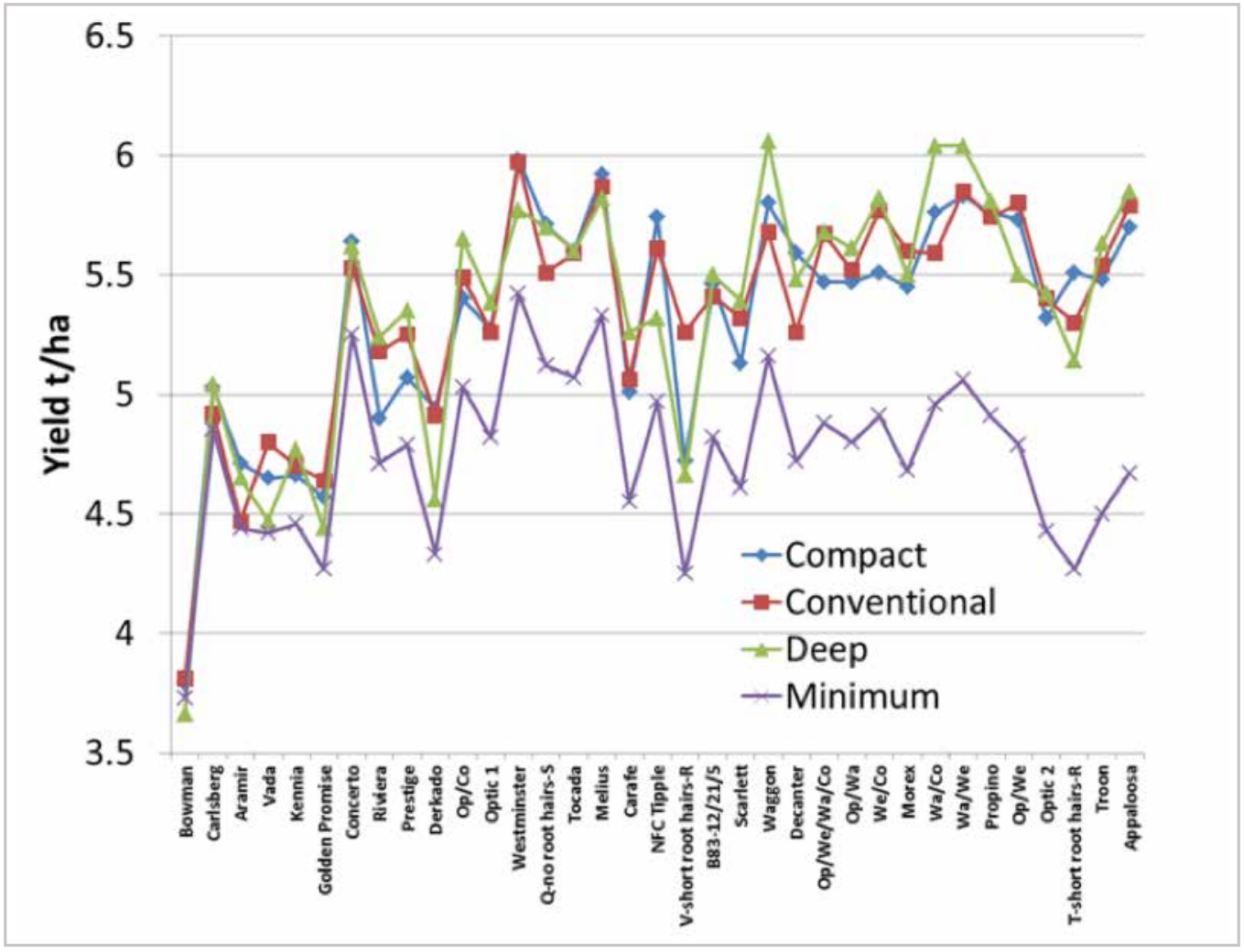
VARIETY-CULTIVATION INTERACTION

The power of a variety to stand up to multiple pressures is detailed in the AHDB Recommended Lists. But growers are hungry to know even more about the potential of genetics to provide a consistency in performance in the field.

Our long-term trials found winter wheat yields were fairly robust across all cultivations systems, whereas a drop-off in yields of some other crops was found. In Perthshire, for example, 35 commercial and experimental cultivars of spring barley were sown in a replicated plot trial and this showed a clear tillage effect. Markedly lower yields were observed frequently under minimum tillage (10cm, non-inversion) compared to other approaches (Figure 1). Some varieties performed more consistently and such findings can be used to develop of more resilient varieties, which could be used to offset the impact of sub-optimal soil conditions.

Lead researcher **Blair Mckenzie** (JHI) conducts a field evaluation at a long-term trial site

Figure 1



IMPACT OF POTATOES IN THE ROTATION

The long-term site at the Centre for Sustainable Cropping at Balruddery is also being used to improve soil management decisions associated with potato production.

SITE FACTS

- Six-year rotation: potatoes, winter wheat, winter oilseed rape, winter barley, spring beans and spring barley
- Fields split into conventional and sustainable (includes compost applications) management regimes
- Soil physical properties assessed at various time points (includes pre-potatoes, post-planting, pre- and post-harvest)

SITE FINDINGS

- Tests of cultivation and bed-forming approaches showed no significant difference between them, in relation to their impact on soil structure and stability
- Analysis of data from a large number of sites showed no significant difference to soil conditions between shallow and deep destoning practices
- More uniform, stable soils, with a better environment for potato root growth and tuber expansion, were found under the sustainable approach
- A decrease in soil quality at the surface (but not at depth) was observed immediately after potato harvest
- Where organic matter (as BSI PAS 100 compost) had been added to the soil for several years, the soil was more stable and better able to resist slumping and raindrop impact
- Soil samples taken up to three years after inclusion of potatoes within the rotation showed, if soil conditions were optimal, there was no detrimental legacy for subsequent crops

FINAL THOUGHTS

The more we know about soil and its interaction with the cultivation system and crop, the more challenging it is to generate one-size-fits-all recommendations. One thing for sure, getting the approach right requires effort, big decisions (eg machinery choice) and a myriad of 'tweaks' along the way (e.g. from crop and variety choice to the use of cover crops and organic matter).

At times, the list of options can seem endless. But the top lesson is to be flexible. Always be willing to change tack and work through your options with likeminded people. On that note, why not attend one of the many Monitor Farm and Strategic Farm meetings? Soil management approaches are discussed frequently and options mulled over with experts on hand to help you cost out the alternatives.

As part of the soil platforms' research, soil cores were extracted throughout the season at the trial sites. These were then analysed to measure the effect of tillage on soil quality and function

CASE STUDY:
LONG-TERM FLEXIBLE APPROACH

Brian Barker, who hosts AHDB's Strategic Farm East for arable growers, places flexibility at the centre of his cultivation decisions and maintains a long-term plan to get the best from his soils and crops.

A 12-year rotation is in place across the 513 hectares at the Suffolk-based family farm partnership, which incorporates winter wheat for feed, herbage grass seed and break crops of spring barley, beans, oilseed rape and linseed. Dual or multiple species cover crops are also incorporated to improve general soil health.

"A long-term flexible approach to low-risk crop production with an eye to diversify is critical now and into the future," says Brian. His strategy is 'to do the best for every field' and to not fixate on one or two cultivation systems but to adapt the approach depending on the season.

MEASURE YOUR NUMBER ONE ASSET

Brian feels soil is the farmer's greatest asset but it is often not fully understood or appreciated by all. Making the best cultivation decisions requires attention to detail, Brian believes. He measures soil physical, chemical and biological properties to improve his understanding of the impact of cultivations across the farm.

AHDB research shows the physical condition of soil can deteriorate over time under intensive tillage and Brian's own findings back this up. For instance, the more intensively his fields are cultivated, the fewer earthworms are found. Assessments, carried out as part of the Strategic Farm programme, found fields established using direct drilling were associated with around one million more earthworms per hectare (around 0.5 metric tonnes) than fields established using ploughing or strip tillage.

CULTIVATION STRATEGIES

To decide on the best cultivation strategy for any given field, in any given season, Brian starts with a spade to unearth the condition of his fields. He then considers previous seasons' weed and pest burdens, crop rooting, water filtration and biological activity.

When appropriate (based on straw, pest and moisture data), direct-drilled or strip-tilled one-pass planting strategies are used.

If soil compaction is limiting crop potential, full disturbance non-inversion cultivations are used. These fields are subsequently lifted and consolidated before drilling with a low-disturbance disc drill. In subsequent years, Brian is usually able to return to strip tillage.

When weed pressures are high, Brian presses the 'reset button' and returns to the plough to bury the seeds for as long as possible – some of his fields have not been ploughed since 2010.

Brian admits his flexible cultivation strategy has not been without its challenges. He says: "Moving to a lower disturbance cultivation system has seen yield become less stable but this is not due to crops, it is due to our mistakes. The margin of error is much smaller when planting in one pass but you learn very quickly."

As a strategic farmer, Brian has a good handle on the full operation costs over the rotation. Overall, on-farm yields under reduced tillage systems are consistent with conventional deep tillage. Establishment costs under a one-pass system, however, average £87/ha and not £235/ha as seen under conventional tillage.

cereals.ahdb.org.uk/strategicfarm