

“We’re talking about learning how to manage a whole new crop.”

**AHDB**  
*from theory  
to field*

**Robust data as well as key lessons have emerged from AHDB’s Maxi-Cover project. CPM seeks guidance and essentials lessons from those involved in the research**

*By Tom Allen-Stevens*

# A clearer course for cover crops

**It’s often said that AHDB-funded research comes into its own where it puts some science behind a relatively new practice — one that’s gaining quite a bit of traction — and when the messages on best practice are in danger of being muddled by competing commercial interests.**

So the Maxi-Cover project on cover crops may be one from which you’re eagerly awaiting results. Three years in, and with just a bit more data to gather and analyse, researchers are ready for it to bear fruit.

“We now have a lot of robust information from the large-plot replicated trials,” says AHDB’s Dr Amanda Bennett. “But the tramline trials from the participating farmers, and the involvement of farmers themselves also bring a valuable insight into this important area.”

Three field experiments, on contrasting soil types, were established in Cambs (loamy sand), Yorks (sandy loam) and Notts (clay loam) to quantify the effect of cover crops on soil properties, crop rooting and

yield. Ten treatments (seven straights and three seed mixtures) were established using a standard cultivation approach.

In addition, cover crop tramline trials have taken place at three contrasting AHDB Monitor Farm sites, and a further trial hosted by Hutchinsons in Cambs, to provide more information on species selection. A range of soil health measurements are being taken on the following cash crops (spring barley or spring beans, as well as the following winter crop in the rotation) and costs and benefits are being quantified.

## Rotational impact

“The project looks at the impact of cover crops through the rotation, so while we have data from the cover crops themselves, the final cash crop is yet to be harvested,” notes Amanda. “At the site in Cambs, BBRO have funded an additional year of cover crop trials that will be followed with sugar beet.”

And it’s across the rotation that the benefits of cover crops become apparent, she continues. “You may take a financial hit in year one, but the project is indicating longer-term benefits for those who persevere — the investment needs to be considered across the rotation. There are rotational conflicts however — take care with using a brassica cover crop in rotation with oilseed rape, and when following a cereal cover crop with a cereal cash crop.”

But to really reap the benefits, the cover crop should be established early, taking the season into account, she says. “Where a good cover was achieved, with good

rooting, the suggestion from initial findings is that this leads to a rooting benefit in the following cash crop,” she reports.

“But a limitation of the study is that we focussed on only seven different species (albeit with differing characteristics), compared with the multitude of options available. The challenge farmers face is the huge variety on offer — we’re talking about learning how to manage a whole new crop.”

Dr Anne Bhogal who co-leads the project with ADAS colleague Dr Charlotte White, reveals the team is “still in the throes” of analysing the data, but echoes Amanda’s comments on early establishment. “It’s so important to establish cover crops early, into a moist seedbed before Sept. Where this wasn’t achieved, the crop struggled.” ▶



*The tramline trials from the participating farmers, and the involvement of farmers themselves bring a valuable insight into cover crops, says Amanda Bennett.*



Anne Bhogal has found it's important to establish cover crops early, into a moist seedbed before Sept.

► Even so, the trials have yielded up some useful measurements on root length density (RLD). This is a metric that gives an indication of how good the growth is underground. For a plant to capture adequate water and nutrients, it needs an RLD of at least 1cm length per cm<sup>3</sup> of soil, she explains, known as the critical RLD. This isn't usually limiting in the top 30-35cm of soil, but it can affect crop resilience and performance if the RLD tails off rapidly below that depth.

"We measured RLD in both the cover crops and following cash crops down to 60cm," says Anne. "Phacelia was the top performer across the sites, and we measured an average RLD of 2cm/cm<sup>3</sup> at the Cambs site (to 60 cm) compared with oats and rye at 1cm/cm<sup>3</sup> and clover and vetch with an average RLD of 0.5cm/cm<sup>3</sup>, although the site was established late — into Sept."

## Early establishment

At the Notts site, established in mid Aug, the RLD average was more than 2cm/cm<sup>3</sup>, with phacelia and rye performing best, at 4cm/cm<sup>3</sup>. Clover and vetch delivered an RLD of 2cm/cm<sup>3</sup>. "So clover and vetch particularly benefit from early establishment to provide good rooting," notes Anne.

Root architecture is also important, with phacelia and radish producing strong tap roots, while oats and rye are examples of plants with a fibrous root. "The jury's out on whether the cover crops have a significant impact on rooting of the following crop. We're still assessing the data, but there does seem to be a tendency for the cover with a higher RLD to result in a cash crop

with improved rooting."

The yield impact on the following crop is by no means certain. "That's not to say you can't improve yield through use of a cover crop, but this depends on many factors, such as how well you establish the cover, and what species you choose. Well established rye and oat cover crops at Notts actually resulted in a yield reduction in the following spring barley, compared with controls, which may be due to disease carryover into the cereal cash crop."

With nitrogen uptake, it's a similar picture of variability that depends largely on how well the cover is established, continues Anne (see charts on p54). "As a ballpark figure, you can recover around 60-80kgN/ha through the use of a cover crop. Well established clover and vetch were the best performers, delivering up to 90kgN/ha, and we believe there's a small N-fixation contribution here from this species."

But a good volunteer crop can deliver almost as much, she notes. "At Cambs and Yorks, the site was sprayed off before the trials were established, and the control plots delivered 0kgN/ha and 10kgN/ha respectively. But at the Notts site, the ►

## On-farm trials provide pointers on cover crops

For several years, cover crops have formed part of the rotation for Blackbird Farming, based at Hempstead Farm, near Sittingbourne, Kent. But farm and estate manager Mark Bowsher-Gibbs has never been entirely sure how much they're contributing.

"We have a flock of 1500 ewes, including 400 ewe lambs that spend 12 months on the farm before being put to the tup," he explains. "We put down about 70-100ha of cover crops every year, sown either with feed oats, rye and vetch or Westerwold ryegrass. They provide an important food source for the lambs and we count the crop towards our EFA area, but we've never really known much about the nutrient capture or difference to soil properties that result."

As an AHDB Monitor farmer, Mark was approached to take part in the tramline trials of the Maxi-Cover project. The business includes 1200ha of arable cropping in a five-year rotation with wheat following oilseed rape then two wheats after peas or beans. "We also bring in spring barley to help with blackgrass, and the field for the trials was one that had been in spring barley in 2016."

Three replicates of mix 1 and mix 3 (see charts on p54 for details) were sown in adjacent strips across about 2ha of the brick earth, deep loamy soil soon after harvest, with volunteer barley

providing the control. "Satellite NDVI imagery in Oct showed distinct differences in crop cover between the three treatments. You could see there was a lot more green biomass in the five-way mix, while the stubble control was virtually bare," reports Mark.

The cover crops were destroyed with glyphosate in the first week of Feb, with another spring barley crop (RGT Planet) planted in the last week of March. "Yield gains of 0.11t/ha for mix 1 and 0.37t/ha for mix 3 were recorded, but these weren't statistically significant."

Winter oilseed rape was sown with assessments made again in spring 2018. There was no effect of the cover crop treatments on topsoil organic matter content, bulk density or visual soil structure (VESS score).

"But there were differences in penetrometer resistance observed in spring 2017 that were still apparent in spring 2018 indicating improved workability where mix 3 had been grown. There were also differences in earthworm populations, with most found following mix 3 and least after the control." Again, there were small yield benefits from the cover crops that weren't statistically significant.

Mark's found the trials have formed a valuable point of conversation with the Kent Monitor farm group. "We all grow cover crops for a variety of different uses, and we've found it's important to



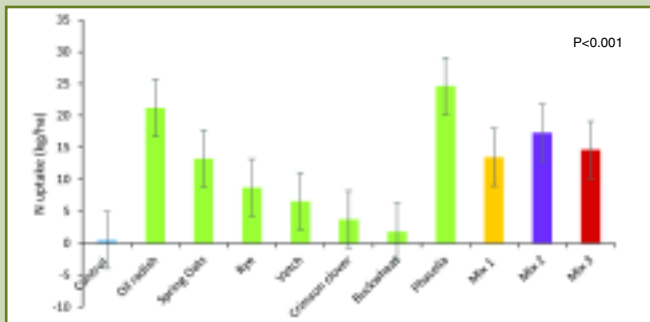
Mark Bowsher-Gibbs has never been entirely sure how much cover crops are contributing.

establish first what your objectives are before you can decide what sort of mix is right. Being involved in the project has helped show the differences you get from the various mixes available, although I still have doubts whether an expensive black oat mix delivers that much more than feed oats, and whether vetch or clover are in the ground long enough to fix nitrogen," he notes.

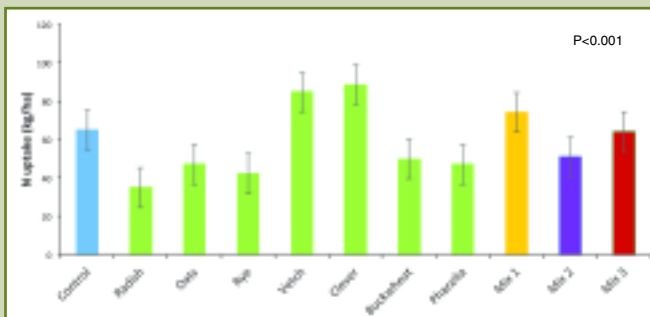
"But we now have some useful metrics to help quantify the benefits and ways of assessing the results. I'm a great believer in all-year-round cover, and holistically it has to be right. It's only the practicalities and justifying the time investment that prevent us from making more use of cover crops."

## Nitrogen uptake by cover crops

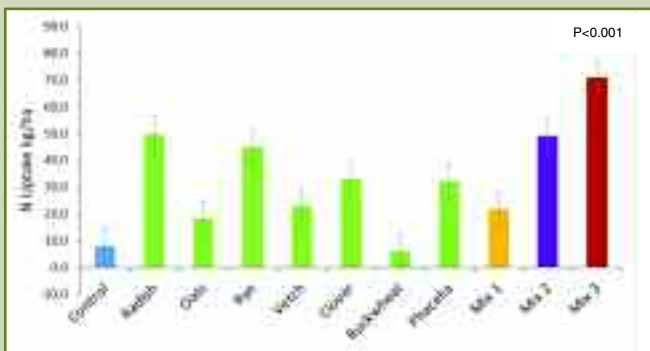
Stetchworth (Cambs), Feb 2017



Kneesall (Notts), Feb 2018



Wilberfoss (Yorks), Feb 2018



Source: ADAS; Mix 1: Spring oats (83%) and crimson clover (17%); mix 2: oilseed radish (30%), phacelia (20%), buckwheat (50%); mix 3: Spring oats (53%), crimson clover (11%), oilseed radish (11%), phacelia (7%), buckwheat (18%). Note the scales of the three charts are different.

► volunteer barley and OSR were left and recovered 60kgN/ha, although both clover and vetch still performed better.”

A key factor is growth over the autumn and winter, she adds. “If temperatures fall below 5°C, N-fixation won’t take place.”

Data on the detailed assessments from the large-plot trials are still being processed.

“We carried out a reduced suite of assessments on the tramline-trial sites. Again, it’s the same story — where there was good establishment, that’s where soil improvements can be seen.” (see panel on p52).

“But at the Yorks tramline-trial

site, we’ve learned some valuable lessons when it comes to cover crops on heavy land. Here, oats and clover were tested, as well as a mix of radish, phacelia and buckwheat. The latter produced the best cover, but resulted in a wet topsoil that was difficult to manage in the spring. It was a soggy mess that brought a significant yield decline in the following spring bean crop, compared with the control which had no cover crop. It shows that on these heavy soils, the cover must be destroyed early — as soon after Christmas as possible.”

It’s in this area of cover-crop

## Research roundup

### AHDB Project No. 21140009

Maximising the benefits from cover crops through species selection and crop management (Maxi-Cover crop) is a three-year project led by ADAS, with NIAB as scientific partner and Hutchinsons, RAGT and Amazone as industry partners. It began in Aug 2016 and is costing AHDB £230,000 (total funding £315,300).

The Maxi-Cover project aims to maximise the potential economic, agronomic and ecological benefits from cover crops through a better understanding of species

effects and crop management technologies, with four objectives: i) quantify the effects of different cover crops on soil properties, crop rooting and yield; ii) validate the effects of different cover crop mixtures and cultivation technologies on AHDB Monitor Farms; iii) update cover crops guidance; iv) transfer knowledge of the project findings to growers, industry and academia.

Project information, as well as the cover crop review, videos and case studies, can be accessed at [ahdb.org.uk/cover-crops](http://ahdb.org.uk/cover-crops)

destruction where further work is needed, reckons Anne. “It’s not just timing — success with cover crops is heavily dependant on the use of glyphosate, so it would be valuable to study alternative destruction methods and how that affects N uptake and following crop yield.”

Amanda concedes that crop destruction was outside the scope of the project, but is nonetheless a key aspect of success with cover crops.

“The practical application of the research work continues at the AHDB Strategic Farm in Suffolk, where much of the methodology applied to cover-crop trials has been drawn from the Maxi-Cover project. This will help refine our understanding as the rest of the data is assessed and brought together,” she notes.

The plan is for AHDB to publish a cover crops guide which will distil all the knowledge gathered and provide essential pointers for growers. There have also been a number of on-farm events at which project updates have been discussed, and Amanda believes participation in these is critical for those looking to gather a real insight into cover crops.

“One of the aspects that makes this project different is how growers have engaged, particularly those involved in the tramline trials. The conversations we’ve had with groups of farmers have been almost as informative as the data from the trials themselves. Learning from each other and sharing experience will be key to getting the best from cover crops,” she concludes. ■



Phacelia was the top performer across the sites, with an RLD of 4cm/cm<sup>3</sup> at the Notts site (left), drilled 23 Aug, and 2cm/cm<sup>3</sup> at the Cambs site, drilled 21 Sept.