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On-farm trials bring a Real Result

Features
On-farm research

Growers from BASF's Real Results Circle gathered recently to receive the results of the first scientifically robust set of on-farm line trials. *CPM* joined them and exclusively reveals what these were.

By Tom Allen-Stevens

Using BASF's Xemium SDHI fungicides at the T1 and T2 spray timings delivers a benefit over competitor products in 71% of cases according to the Real Results from 50 on-farm trials conducted over the past year. But only seven of the trials gave a statistically significant result, following analysis using the ground-breaking Agronõmics technique developed by ADAS.

Fifty growers across the UK took part in the trials in which a T1 spray of Adexar (fluxapyroxad+ epoxiconazole) and a T2 of Librax (fluxapyroxad+ metconazole) were tested against an equivalent competitor programme with new-to-market SDHIs chosen by the individual growers. "Over the past three years, 113 comparisons have shown an average 0.2t/ha advantage for Adexar over Aviator (bixafen+ prothioconazole), with 61% showing a positive result for Adexar," explains BASF's Ben Freer.

"But these were small-plot trials. We wanted to know whether they would translate into real results in the field, in real commercial situations."

Statistically robust

The difficulty with such comparisons, however, is achieving a result that's statistically robust. "There's a lot of background variation in the field that can mask the effect of a fungicide. But Agronõmics turns that on its head and has given us some real results."

The overall results are a draw, reports Ben. "We received harvest data from 40 growers. For 18 of these, the BASF Ad/Lib programme produced a positive result, averaging 0.52t/ha. But 22 growers achieved a better result from the competitor programme, averaging 0.41t/ha difference."

In 22 of the results, yields were measured over a weighbridge. "This gives you just one result per trial. Again it was even Stevens, with 10 favouring Ad/Lib, averaging a 0.64t/ha advantage, and 12 results going the other way, averaging 0.38t/ha. But how much confidence can we have from weighbridge results that the difference is down to the fungicide?"

What's unique about the Real Results trials is the approach taken. The sites were earmarked at the start of the season, with satellite-derived assessments of soil brightness and crop growth undertaken by AgSpace. Assessments were also made of various YEN (Yield Enhancement Network) criteria, such as ear numbers, spikelets, biomass, harvest index and grain N offtake.

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So could these explain the differences? "There was no pattern linking the results to yield components, although using this approach to help explain individual results has proved useful," notes Ben.

In 18 of the trials, yield map results were available, and this is where Agronõmics has stepped in. "Agronõmics is the science of field-scale farming," explains Dr Daniel Kindred of ADAS.

"It's for developing and testing innovations and best practice, and it's a shared endeavour, involving researchers and scientists working with the farmers hosting the trials." ▸

Agronõmics addresses the disconnect between scientific research and on-farm practical tests, explains Daniel Kindred.

Agronõmics analysis of 2017 Real Results trials

Source: ADAS; LSD shown as whiskers, p (confidence)=>90%

New network for farmer-to-farmer approach to innovation

AHDB has launched its first Strategic Farm for the arable sector. EJ Barker and Sons, based at Lodge Farm near Stowmarket in Suffolk and farmed by cousins Brian and Patrick Barker, has provided a base to put levy-funded research findings into the field and for farmers in the East to share and shape innovative ideas.

It's a core part of AHDB's Farm Excellence Platform, rolled out earlier this year in its Research and Knowledge Exchange three-year strategy, explains KE director Dr Susannah Bolton. "We want to accelerate that process of innovation, and do that through active knowledge exchange.

"In this current climate where there's so much change, we need to be looking at the horizon. Strategic Farms are about integrating new knowledge and innovations directly onto farms."

The launch event at the beginning of Nov brought together over 100 science and research practitioners with local farmers to explore the short and longer-term challenges the farm will address. Among issues discussed were soil health, cover crops and farming without glyphosate.

"One of the interesting areas in innovation is how we can measure things in a new and different way to help inform on-farm decisions. That's an area we can explore," notes Susannah.

Science and research practitioners explored short and longer-term challenges with local farmers.

Measurements have been taken across the whole farm to establish baseline conditions, explains AHDB knowledge transfer manager Emily Smith. "The baseline assessments captured the physical, chemical and biological condition of the fields. The information will be used to monitor changes to the soil as the project progresses."

The LEAF Sustainable Farming Review tool will be used as part of the efforts to measure the farm's economic, environmental and social performance. Essex and Suffolk Water will also conduct analyses of rain and drainage water from the farm. A state-of-the art weather station and a soil moisture probe have also been installed.

Research outcomes will be tested in a commercial farm rotation on a field or tramline scale. Each demonstration will have a linked practical message, to facilitate the transfer of knowledge across the wider agricultural industry. Economic analysis of each demonstration is also key to the Strategic Farm programme, continues Emily, using the AHDB Farmbench benchmarking tool.

"The aim is to drive the adoption of innovation. So much research sits in final project reports. There's a disconnect between research undertaken and its application and we want to bridge that gap."

That'll be done through on-farm trials with the support of researchers, experts and new technology. The first demonstrations, which were drilled this autumn, focus on the interaction between rotation and soil quality and ways to boost wheat biomass during the foundation phase.

"We'll measure the direct and indirect values associated with different crops and management techniques. We hope the work will give growers the tools and information they need to help with their rotational planning."

The core element of this new approach is the involvement of growers, and in particular host farmer Brian Barker. He believes there are three

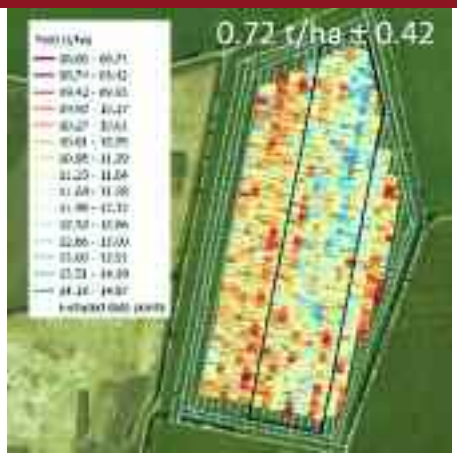
Brian Barker hopes the new Strategic Farm approach will put farmer-led, farmer-driven research into the frame.

fundamental aspects to making it work: the innovations themselves, their assessment and sharing the understanding of them.

"This is either science that's already been demonstrated, or findings from small-scale plot trials brought out into the field. Every time I go out to look at my crops, I take my quadrat to assess plant counts, head counts and other criteria. We can bring in new technology to help us assess in-field variation — there's so much information we can add in that will tell us what's going on."

But it's the farmer-led, farmer-driven approach that brings it real potential, he says. "We need to open our doors and be honest with other. When that happens, you get a real exchange of ideas — farmers like to learn from farmers. It's also about engaging with the wider community — this is sometimes where we fall down and lose our credibility."

- AHDB is establishing around 30 Strategic Farms to inspire industry to improve performance and succeed through knowledge exchange, of which Lodge Farm in Suffolk is the first in the Cereals and Oilseeds sector. There are plans to add two more arable farms to the network, one in 2018 and another in 2019. AHDB is actively looking for the next strategic arable farmer and applications close on 31 Dec — visit *cereals.ahdb.org.uk/strategicfarm* for more.



A yield map provides thousands of datapoints, which are statistically analysed with a model of underlying variation to build a real result.

▸ Field-crop research has guided on-farm decision making ever since the Broadbalk experiment at Rothamsted started in 1843, he notes. "These are small-plot trials with each plot covering around 50m^2. But the results are scaled up for advice over millions of ha."

That puts the focus on the reliability of the data — scientists look for a least significant difference (LSD) to ensure the result from the trial is the effect of the criteria under scrutiny, and not some random variation. Typically, for a single plot trial, this will be 0.3-0.5t/ha or around £50/ha. "But field-based decisions may be based on differences of less than £10/ha. Just because there's no significance, it doesn't mean there's no economic effect," he reasons.

So trials are replicated which has the effect of reducing the LSD and improving the confidence the scientist has in the data. "But this approach is expensive and tells you little about soil effects and interactions."

What's moved the science on is the ability to gather data from multiple sensors and obtain spatial information using GPS. But there's still the challenge of harnessing this big data. "It's estimated there are some 10^{30} decision combinations in arable farming, but the UK has only one million fields. So we can't test every scenario and still need controlled experiments and scientific interpretation."

David Fuller-Shapcott scored the highest difference for the BASF Ad/Lib programme at 0.8t/ha.

Disconnect with science

While both scientific research and on-farm practical tests have similarities in terms of their concepts, metrics and tests, there's a disconnect, Dan explains. "Scientists have laws and models, working on a small scale with biophysical metrics and need 95% certainty for proof of concept. On farm, it comes down to experience, rationalising commercial metrics on a field scale, where greater than 50% certainty is good enough evidence."

On a field scale, on-the-line comparisons are often the most compelling — where two different treatments meet, a visual assessment of the difference can be decisive. But it's qualitative — measurements are rarely made nor can they be analysed statistically. "Can we formalise or digitise this comparison?"

Typical yield maps are often inadequate for scientific comparisons, however, and in-field variation can be huge, he points out. Perhaps the most striking example was the industry-funded Auto-N project in which various N rates were applied in a 'chessboard' trial to study the variation in optimum N. "We saw in-field yield variations of 3-4t/ha — clearly N is not the main driver of yield variation."

This led to the Agronõmics project — an ADAS investment with BASF, AgSpace, British Geological Survey (BGS) as partners and support from Innovate UK — to develop the 'line-trial' experimental technique which takes into account soil variation. Whereas a small plot trial typically has only a few replicates of each treatment, yield map data typically gives over 10,000 data points for a single field. A field-scale line trial therefore produces a vast amount of data that can be statistically analysed to give confidence levels.

Greatest confidence comes from having a dataset with as little underlying variation as possible. For the Real Results sites, that started with site selection, explains Susie Roques from ADAS. "We're looking for a relatively homogenous area of a field, so used soil brightness and NDVI data from AgSpace to choose the treatment areas."

When the yield data comes in, there's a certain amount of cleaning to be done. "We take off headlands and end of runs. Areas that aren't even shouldn't be counted.

Toby Hogsbjerg scored the star result – a very small difference that was real.

The software picks up data points that are dramatically different, and an offset correction is applied."

Combine set-up and practice are also important. "The yield meter should be calibrated, and the combine header kept full — a part-width will skew the result. The combine must also run up to the treatment boundary, not straddle it. We also need to know of any areas of waterlogging or weeds."

Once cleaned, the number-crunching begins, with comparison focused on the treatment boundaries — adjacent combine runs in contrasting treatments.

All growers have received back their data, with information on LSD and confidence. "Confidence gives you a measure of the accuracy of the trial, that the difference is actually a real one and not down to pure chance," explains Ben.

"Traditionally, small-plot trials are assessed with a 95% confidence level — a lot of data can be thrown out, which can be quite depressing! Here, we've discarded all results with a confidence level below 90%."

LSD is a measure of how big the difference between treatments needs to be if it is to be counted as real. Only seven out of the 18 yield-map results had a treatment difference which was significant at a confidence level above 90%, five of which favoured the BASF Ad/Lib programme.

David Fuller-Shapcott near Kelso in Scotland scored the highest difference for the Ad/Lib programme at 0.8t/ha, while for Mike Hambly in Cornwall this resulted in almost a 1t/ha disadvantage over the competitor products. By coincidence, the BASF programme was the farm standard for both growers.

"Statistically, Toby Hogsbjerg in the Cotswolds scored the star result — a very small difference that was real," notes Ben.

The trials will continue next year with the real Results farmers able to choose their fields. "They'll have had the experience of 2017, therefore giving us even more 'Real Results' for 2018, "he concludes. ■