Agronomy technology goes on trial

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Innovation
Digital technology

A network of nine farms across the UK have embarked on a set of on-farm trials that will aim to quantify the benefits from precision farming and digital technology. *CPM* explores what the work aims to achieve.

By Tom Allen-Stevens

Whether you're already using the technology or not yet quite convinced, there's always the niggling doubt that it doesn't live up to its hype. Now there's a new network of Digital Technology Farms that aims to lay to rest the doubts and bring some scientific certainty to what new agronomy technologies really have to offer.

It's an initiative from Agrii, which involves nine growers and their agronomists who are conducting on-farm trials that'll put these digital technologies through their paces. Also involved are digital agronomy specialists from Rhiza, while the results from the trials will be processed through the ADAS Agronomics model which delivers statistical confidence to on-farm trials.

For 2020, there are three main areas on which the trials will focus, in winter wheat, spring barley, wheat and oats:

- Variable rate drilling
- Variable rate nitrogen application
- Tailored nutrition (macronutrient and micronutrient)

"We're all familiar with the idea behind precision farming technologies," says Agrii managing director Jim Rennie. "Conditions vary across a field, and that if growers tailor inputs more closely to crop requirements, guided by that variance, there are cost savings and output gains to be made.

Dynamics of crop growth

"Now with NDVI (normalized difference vegetation index) and satellite technology you can get a much better picture of the dynamics of crop growth in a field, both within a season and between seasons. Each of these individually provide valuable information and potentially a financial return if applied correctly," he maintains.

But there are two fundamental issues with the technology. "Firstly, it takes a significant amount of time to process the data available, pull it together into a format you can understand and quantify the benefits from any changes in management practice. There's also the question of whether what works for one farmer can be replicated everywhere — a variable seed rate plan for a brashy soil in the South West may be totally unsuitable for a clay loam in Lincs. So how do you draw up a plan that will work for you?"

Jim maintains that Agrii has the tools that allow growers to do this. Firstly, there's the investment in agronomic know-how — this amounts to millions being spent annually on technical R&D from small-plot trials at its technology centres to the network of 30 iFarms. "This investment sets us apart from all other distributors," he claims. "It gives us a lot of data, and we have a history of using this to successfully place tested solutions into a local environment. But the limitation of small-plot trials is that the results only apply to that soil type in that year."

Site-specific data comes through Rhiza. This is the digital farming platform, owned by Agrii's parent company Origin, that was launched last year. It takes its heritage from IPF's Contour and AgSpace, that together ▸

Jim Rennie believes Agrii's new Digital Technology Farm network will help growers get greater benefit from precision farming and digital technologies.

The DTF growers are all enthusiastic with an engaged farm team, keen to learn and share what they find, notes Lucy Cottingham.

▸ have been honing precision farming systems and satellite-sourced data since the 1960s. Rhiza also brings in SoilQuest, previously Agrii's precision services provider.

The idea behind the nine new Digital Technology Farms is that they bring all this together, says Jim. "The farms will be conducting a series of on-farm trials, assisted by their Agrii agronomist and a Rhiza specialist. Applying Agronomics to the results ensures that any variance we see is down to one of the three variables we're

The initial DTF network

- Seed and Co, Midlothian
- DC Shelby, Yorks
- Revesby Estate, Lincs
- Bedfordia Farms, Beds
- Flamstone Farm, Wilts
- M Meredith, Hereford
- R Atkin, Staffs
- Lindsay Clark Partners, Somerset
- A S Clark, Essex

There's scope to improve what the technology delivers

Between 5-10% of a field has a crop yield of about half that of the field average, according to aggregated data gathered by Rhiza. "The reality is that crop yields have flatlined for the past 20 years," maintains Jim Rennie.

"Without GM driving yield elevation, we have to find better ways to boost on-farm performance of arable crops, and this comes down to better performance from every part of the field. If we can improve the environmental outcome at the same time, that will deliver on both fronts."

The farms in the DTF network have been chosen for their geographic spread and range of soil types and farming systems on offer, says Agrii digital agronomy development manager, Lucy Cottingham. "We're also working with forward-thinking growers and agronomists — they're digitally literate and can give us informed views on the benefits of precision farming and digital technologies. Importantly they're all enthusiastic growers with an engaged farm team, keen to learn and share what they find."

The farms have their soils mapped into management zones, they also have up-to-date satellite imagery, hyper-local weather data and other digital tools provided through the Contour platform. They're all supported by their local Rhiza specialist.

So what are these growers' priorities? Initial studies have shown that variable rate seeding, variable rate liming and yield mapping are the digital technologies currently considered most valuable (see chart).

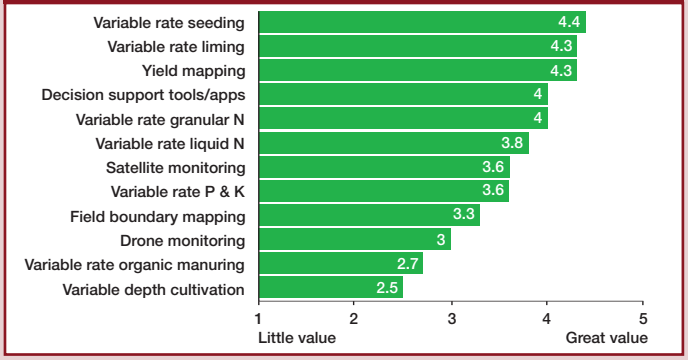
The growers were also asked to share their biggest headaches in applying these technologies. "These revolve around a lack of smooth data transfer between different systems and equipment, having to input the same data more than once and not being able to get the right data and imagery when it's needed," notes Lucy.

"Ensuring the whole farm team understands what the technologies are aiming to achieve and knowing the extent to which they are repaying their investment — in time as well as money — are also highlighted as concerns."

But improving performance from every part of the field is one important area highlighted as offering the greatest potential for precision farming and digital agronomy. Others include:

- Saving costs through better targeted inputs
- Understanding crop yield potential earlier in the season
- Identifying agronomy issues earlier than with the naked eye
- Taking more human error out of the equation
- Having better tools to support decision-making
- Reducing time spent managing field operations
- Providing cost of production and gross margin maps.

How valuable do you find key precision farming/digital agronomy technologies?



Source: Agrii, 2020.

Technical manager with Rhiza Sam Fordham is also a farmer himself and echoes some these concerns and hopes for the technology. "My biggest frustration is the lack of robust trials data on precision farming — a lot of its application is just based on gut feeling," he says.

It was this that struck him when he visited Agrii's technology centre at Stow Longa, where much of the company's research into blackgrass management and cultivations is carried out. "In order to get the most from this work it needs to be rolled out into an on-farm scenario. But this should be scientific and replicated."

On the farm itself, he believes many growers aren't making best use of the data they have. "As growers, we should be asking ourselves fundamental questions, such as why we're varying inputs — on the farm at home we vary many inputs through the sprayer, but couldn't quantify the benefit."

Better use of yield maps is another area with great potential, he notes. "Much of current use of technology is geared towards producing an even yield map, but is that necessarily what we should aim for? If you compare an even yield map with a gross margin map, the results can be frightening. Perhaps we should learn to deal better with the in-field variance we have," Sam concludes.

testing, rather than in-field factors, and gives us an idea of the confidence we should have in the results."

But what value will the data have in a year where the odds are stacked against the arable farmer? "You could view this as the Doomsday scenario — we do have 27 fields of winter wheat already established in which trials are taking place which should give us meaningful results for at least a worst-case situation," he says.

Feedback from Rhiza users suggests variable rate seed is the number one area of interest, which explains why this forms one of the areas explored. "Growers are also keen to understand more about how nitrogen applications can be varied, both to optimise its use and reduce environmental impact," notes Jim.

"The nutrition side really comes from Jim Carswell's work looking at soil samples and leaf-tissue analyses gathered from iFarms," he explains. "He's established the relationship between good performance on the iFarms and the ideal nutrition level. These trials are about verifying and quantifying this relationship."

A more accurate picture of what AD digestate applications are delivering to the crop may be one of the outcomes from the DTF trials.

Potential for synergies

The trials will be run separately with data overlaid to identify potential for synergies. "So where you apply variable rate seed and nitrogen, for example, in what circumstances can this bring extra benefit, and are there situations where they conflict?"

The farms will also provide the test bed for outcomes of the CONSUS project, a €17.6M (£16M) five-year programme jointly funded by Science Foundation Ireland and Origin Enterprises, carried out by University College Dublin.

"The project is evaluating a number of sensors for how they can be usefully applied in agriculture. The DTFs will be using between 5-15 sensors to get some practical feedback on tools such as nutrient sensors, in-field weather stations and leaf-tissue testers," says Jim.

"The things we're testing this year are very much the starting point, though. Around 20% of UK farmers are making variable-rate applications, with little science behind them, and our primary aim with DTFs is to provide this.

"Looking ahead, we're moving into next-generation satellite technology and a new level of sensors. You look at any industry that embraces these advances and progress just accelerates. Couple these technologies with some of the knowledge we're gaining from our small-plot trials in weed control, nutrient management and pests and diseases, and that represents real potential to lift productivity off the yield plateau — we know the right treatments, it's just a question of applying them in exactly the right situation," concludes Jim. ■

One of Sam Fordham's biggest frustrations is the lack of robust trials data on precision farming.

Technologies on trial

CPM is partnering with Agrii through a series of articles, starting next month, which will profile the farms in its DTF network. We'll be looking in detail at the issues each grower faces with the technology, the trials they're undertaking and how these are informing their digital journey.

Precision technology comes under scrutiny

The programme of trials for this first season is focussed on variable rate drilling, variable rate nitrogen application and optimised nutrient application for winter wheat. There are also variable rate drilling trials with spring barley, wheat and oats.

"In each case, we are comparing the technologies with standard farm-based regimes alongside one another in fields with similar ranges of soil type and condition," explains Lucy. This is achieved by alternating tramlines of flat-rate with variably applied inputs in the field. The aim is to achieve a degree of replication — the Agronomics analysis is applied to the boundary between the different treatments, so the more boundaries, the greater the chance of achieving a statistically significant result.

Underlying variation of the fields has been taken into account through the management zones, which have been determined following an electrical conductivity (EC) scan, and through NDVI images collected through the season.

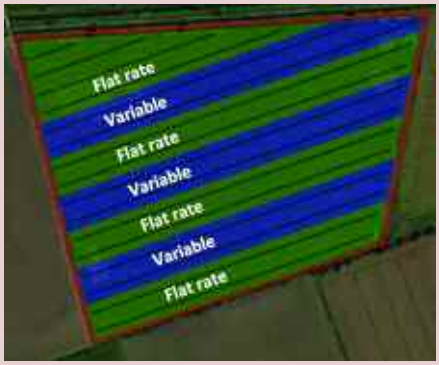
"We are monitoring as many crop parameters as we can from our tramline-scale plots, together with local weather data, satellite imagery and other observations," adds Lucy.

Seed and nitrogen are the only variables in each trial, done to agreed protocols and compared with farm standard rates. In the nutrition trials, this will be tailored to crop need, based on comprehensive soil and tissue testing. Crops will then be monitored with plant and ear counts taken, leaves tested for nutrients at key timings and disease, pests and weeds assessed. Along with satellite imagery, soil moisture measurements will be taken and N content of leaves monitored with a Yara N-Tester.

Grain samples will be retained for quality and nutrient analyses and yields of the plots will be measured over a weighbridge. "Yield data from the combine monitor will be processed using the Agronomics model to reliably 'prove' yield effects."

The DTF network growers, their agronomists and Rhiza specialists will be continually reviewing their experiences from the trials to fine-tune, develop and extend the scope of work for future seasons, Lucy points out.

"We'll also be sharing our progress and findings as widely as we can through an extended programme of grower meetings and demonstrations."



Alternating tramlines of flat-rate with variably applied inputs in the field brings a degree of replication to on-farm trials.