

A window on a complex world

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Innovation Meeting tomorrow's challenge

Work at Syngenta's Innovation Centres revolves around gaining a better understanding of the interaction of the natural environment with the management growers apply. CPM gains an insight.

By Tom Allen-Stevens

Georgina Wood leads the way through the vast network of plots at Syngenta's Barton Innovation Centre blackgrass demonstration in Cambs. Except they're not just trial plots, but a matrix of different cultivation regimes and cropping that have built up over four years.

She stops at one plot and consults the map. Even though it's close to harvest you can see it suffered a heavy burden of blackgrass. "Over three years, we found the worst blackgrass in areas that had been continuously min-tilled," she explains.

"This last season has been different, however, and the best and worst performers aren't necessarily what you'd expect. What we've learned is that the key to getting the cultivations correct is to understand how the seed is distributed

through the soil profile. But it's a very complex picture."

High level of curiosity

Barton is one of six Innovation Centres run by Syngenta across England, which include Rougham in Suffolk; Newark; Notts, Doncaster, Yorks; Stamford, Lincs and a site in Shrops. "It's easy to view them as trials sites, and in a sense they are," says David King, head of technical for Syngenta UK and Nordics.

"But the real interest lies in looking at the detail, using a high level of curiosity to try to unpick the complex biological systems farmers manage and understand the challenges they face. The focus is to learn and present findings back in a way that's



David King believes the Innovation Centres help build an understanding of the complexity of farming real and future challenges.

meaningful for our customers, ensuring we answer the question 'so what?'"

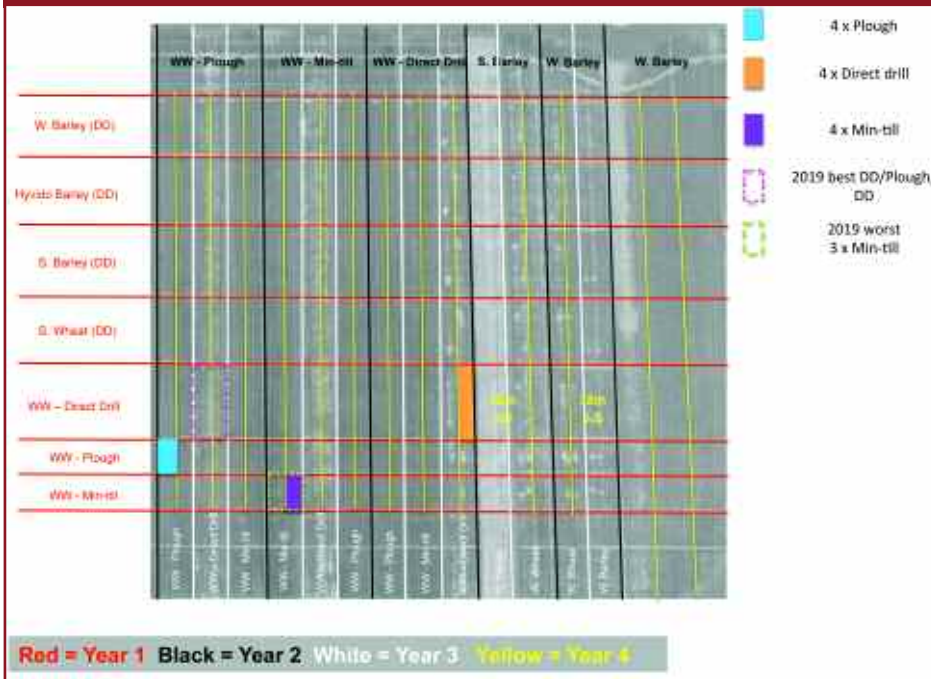
There are some key challenges the Innovation Centres aim to address, he explains:

1. Registration of products and supporting their ongoing use. This encompasses gathering field data to support registrations as well as practical guidance on managing withdrawals.
2. Weed, pest and disease resistance. Agriculture's complex biological systems make it one of the most challenging of all industries, so the aim is a greater understanding of the dynamics involved.
3. Economics of crop production. Not just getting the best from current systems, but also anticipating regulatory changes and understanding the impact these will have on integrated farming systems.
4. Sustainability. Gathering data on soils and carbon, while also recognising that efficient crop production is based on effective management of pests, weeds and diseases.

These complement the company's traditional R&D that focuses on bringing high impact solutions to market, notes David. "Growers know there are no silver bullets for the challenges they face. We don't have all the answers, but take a long view at how our solutions fit within the jigsaw of sustainable farming solutions.

"The Syngenta R&D facility at Jealott's Hill in Berks is a global lead site for grassweed herbicides, as well as

Cultivation matrix map at Barton



2017-18	Plough						Min Till				DD								
2018-19	Plough		WW DD		WW Min till		Min Till		DD		Plough		Plough		Min Till		DD		
2019-20	Plough	DD	DD	Plough	Plough	DD	DD	Min Till	Plough	DD	DD	Plough	Plough	DD	DD	Min Till	Plough	DD	
2016-17	DD	0.8	38.8	9.6	2	2	54.4	97.2	50.4	0	49.6	77.6	2.8	0	14	62.8	17.2	9.2	85.2
	Plough	1.2	40.8	14.8	4.8	2.8	56	66	51.6	0.8	27.6	72.8	2.4	0	14.4	44	18	5.2	55.2
	Min Till	1.6	32	14	2.4	6.8	59.6	56	43.2	0.8	90	61.6	1.2	2	11.2	70.4	26.8	4	88.8

Source: Syngenta, 2020. Results indicate no. heads/m². Pre-em treatment Defy (propriflufenacet) 3.0 l/ha + Crystal (flufenacet + pendimethalin) 4.0 l/ha + diflufenican 60g/ha.

developments in fungicides and hybrid wheat. The Innovation Centres offer growers a window on some of the fundamental science and revolutionary developments we're making right here in the UK. And for our scientists, it's the opportunity to take their ideas into the

field and develop their knowledge."

It's why there's an emphasis on cultivation practice, for example, across much of the work carried out at the centres. "Syngenta doesn't manufacture machinery, but we look to address the wider issue of how cultivation practice



Discussing application efficacy with growers at open days is one of the most enjoyable aspects of the job for Harry Fordham.

interacts with seed and crop protection products. When it comes to greenhouse gas emissions, farming is both victim and villain and we have a part to play in helping farmers mitigate their emissions and understand how to capture carbon."

Good illustration

The blackgrass matrix at Barton is a good illustration of a long-term demonstration project that delves into the detail of the interaction between cultivation, cropping and chemistry, Georgina explains. In each of four years, the 5ha heavy clay field has been cropped with strips of winter wheat, spring and winter barley, and either ploughed, direct-drilled or established using deep, non-inversion tillage. This has then been applied crossways the next year to end up with ▶

Novel nozzle reaches new low

As much as 50% of the efficacy of what you spray comes down to how you spray it. "In my experience, that's the element of the job growers want to talk about, and it's one of the most enjoyable aspects of my job," says Harry Fordham, new farming technologies lead with Syngenta.

He notes that the company has a long history in application technology, using good science to ensure good practice, and the resulting data represent robust evidence on how to ensure good efficacy. "We carry out dedicated application trials work across all six Innovation Centres. We now have a dataset of 400 points that show best results from the pre-em spray in almost every situation come from applying it at 200 l/ha, for example."

This has been one of the key points drummed home in Syngenta's 'Go low, go slow, get covered' campaign, that also advises a boom height of 50cm or less and forward speed of 12km/h or less.

"Using 90% drift-reduction technology (DRT) nozzles helps to keep a pre-em spray on target, and we've now developed our own DRT nozzle," says Harry.

Developed in conjunction with application specialists at Jealott's Hill, the 3D90 nozzle follows in the footsteps of the Defy nozzle and the award-winning Defy 3D, launched five years ago. Work at Innovation Centres has perfected the new design, he explains.

"We dubbed it the Frankenstein nozzle — our prototype that allowed you to adjust the angle from 0-65°. Our trials showed 55° is the perfect pitch — a little closer to horizontal than the previous 3D nozzle because the droplets are heavier. We've also worked with our application club members — 30-40 sprayer operators at the top of their game — who have tried it on farm and confirm the results we received."



The new nozzle combines the award-winning Defy 3D nozzle with drift-reduction technology.

Sadly, production delays on account of COVID-19 mean the new nozzle won't be ready in time for this autumn spray season, but Harry's planning a launch for early next year. "We've also had really good results on spring broadleaf weeds and in potatoes, so I'm keen to get the 3D90 out there and to discuss the benefits of good application technique with growers," he says.

New tool to tell the fungal threat

Pioneering work at three Innovation Centres has been honing a new decision-support tool that'll help growers make better fungicide decisions, says Syngenta specialist Kiera Holland.

"The initiative has been seed-funded and backed by huge global investment. For the past two years we've been appraising and validating disease models under UK conditions and practical farm situations," she says.

The tool combines local weather data with knowledge of key diseases to give growers an indication of risk. These include septoria, yellow and brown rust in wheat, ramularia, rhynchosporium, mildew and rust in barley.

"As fungicides are best applied before disease sets in, this helps you choose the appropriate dose and product and justify the application."

Based on powerful algorithms, the tool is very much tailored to UK conditions, she notes, honed with expertise from Jealott's Hill and ground-truthed at Rougham, Doncaster and Shrops. It's also been tested this season by



The decision-support tool will help growers choose the appropriate dose and product and justify fungicide applications, says Kiera Holland.

Syngenta's Future Farming Club group of growers.

"We're planning to launch the initial core elements of the tool next year, but it's functionality will build as its user base expands and grows the datasets that feed the disease-prediction models," explains Kiera.

► a matrix of some 200 plots, 6m wide, encompassing nearly every combination of cultivation and cropping (see panel on p81).

"We had real difficulties getting it established for 2020 harvest, however. We eventually drilled on 25 March with Mulika spring wheat and Laureate spring barley. The emergence was very patchy and we wondered whether we had spoiled the demonstration. But the idea is to explore true in-field challenges faced by farmers."

As well as a greater understanding of how the weed seed-bank influences blackgrass burden, Georgina notes the matrix has shone a light on the role of dormancy. "In a high dormancy year, if all the seed is on the surface it just keeps on coming. That has implications where you've direct-drilled.

"It's a similar problem where crops are min-tilled — the seed that germinates from depth comes through later. In both these scenarios, a sequenced approach to

chemical control tends to work best, where an initial pre-emergence herbicide is followed with a top-up. In low dormancy years, a robust pre-em stack gets best results, especially where crops are direct-drilled. Timing is key, and applications made within 48 hours of drilling typically bring 6% better control than those delayed for 10 days. We'll be looking in more detail at stacks and sequences this coming season."

Huge effect

The plough, used rotationally has a "huge effect" on reducing blackgrass burden. "This result has been consistent and works especially well if following crops are then direct-drilled. We're now aiming to combine what we've learned with ploughing for blackgrass control with work at other centres on soil health and carbon emissions — knowing when to use the reset tool for best effect will likely become a key skill as carbon losses come under the spotlight," she notes.

While spring cropping tends to result in a lower blackgrass burden, Georgina's found it's no panacea. "The trade-off is often a less competitive crop, especially if conditions turn dry, and the blackgrass still comes through. Cultivation trials have shown it's best to plough in the autumn and move the soil as little as possible at drilling for blackgrass reduction. We've used light meters to assess all crops for competitiveness, along with taking head counts, and consistently the best performer of all crops is hybrid winter barley."

While previously continuous min-till gave the poorest results, it's the

Testing times for tea bags

While blackgrass has been the focus at Barton, work at the Doncaster Innovation Centre has rounded on ryegrass. "For growers in the North, problems with ryegrass rival blackgrass, and tip the balance in places," says Syngenta trials manager and grassweed expert Andy Cunningham.

For more than ten years, Syngenta's carried out trials work and demonstrations to help growers grapple with the grassweed, he points out. He's now taken the work in a new direction, involving citizen science.

"As part of work on cultivations, I've been looking at the effect of tillage technique on soil health," Andy explains. This brought him to the Tea Bag Test, a method of assessing microbial activity of a soil.

"You bury two tea bags — one containing

green tea and the other Rooibos — for 90 days and then assess the decomposition. Because the teas break down at different rates, this gives you two key factors you can use to benchmark the health of your soil against hundreds of others tested by farmers and gardeners."

Andy's produced a video explaining the technique in detail and has used it to compare a reduced non-inversion establishment system with the plough. Along with Dr Jenny Bussell of the Game and Wildlife Conservation Trust, this work has been further investigated and evaluated as part of the Syngenta Conservation Agriculture initiative (see *CPM*, May issue).

"The Tea Bag Test is a simple, inexpensive test you can try yourself. We found the reduced tillage soil had slightly better microbial activity," he reports. For more on the test and to see



Andy Cunningham has been using tea bags to test soil health at the Doncaster Innovation Centre.

Andy's video, go to www.syngenta.co.uk/news/stewardship/soil-health-down-tea

direct-drilled plots, with a history of min-till or direct-drilling that have come out worst in 2020. "This year hasn't favoured direct-drilling, while the plough has fared best overall," reports Georgina.

As well as the weather, COVID-19 has brought its own set of challenges this year with open days cancelled, notes David. "These are the highlights of the year for us — we've really missed the interaction with growers. But it's encouraged us to develop new ways to prise out what's interesting and present results in an engaging way, such as through virtual meetings and making better use of social media — we have individuals who have brought previously hidden talents to how they present."

The work at the centres is also helping Syngenta develop digital tools. "We're getting a better understanding of soil and crop biology and its interaction with varieties and crop protection. We're developing platform approaches that will allow growers to harness this information in decision support tools. The aim is to make sustainable solutions as easy to implement on farm as traditional crop production inputs, and with the robust level of science and R&D behind them growers have come to expect from us," concludes David. ■



A history of min-till or direct drilling produced worst results this year (left) while the plough in the right combination with direct-drilling came out best (right).

Meeting tomorrow's challenge

Farming faces some major challenges. It's not just about the products and practices applied today, but exploring what will shape the farming of tomorrow.

In this series of articles, *CPM* has teamed up with Syngenta to investigate latest developments in sustainable farming, agronomic innovation and digital technology, with the aim to embrace tomorrow's opportunities.

Syngenta is uniquely placed to address the increasing challenges faced by UK farmers and the changing views of society. From the discoveries made at Jealott's Hill in Berks,

the company's largest global site for new agrochemical R&D and product support, to its network of Innovation Centres, it has dedicated resources to bring applied science and sustainable solutions to UK growers. Through the company's collaborations with farmers, academia and environmental groups, it's on track to accelerate innovation in a changing world.



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