



Evolution solution to crop protection conundrum

A ground-breaking high-level research conference has not only revealed science may have the answers to growers' challenges, but that there's also a renewed zest among scientists to pursue them. CPM followed the discussions.

By Tom Allen-Stevens

Delegates at AHDB's first ever Crop Research conference, held in Westminster and delivered by HGCA, could almost feel Charles Darwin himself stir in his grave. The challenges that arable science is now facing, and the realms in which it's moving were summed up by Dr Paul Neve of Warwick University, taking a recent quote from US evolutionary biologist Prof Andrew Read:

"When we attack agricultural pests with pesticides, we're picking a fight with natural selection. Going into a fight like that without Darwin is like going to the moon without Newton."

The conference brought together the brightest minds in arable research and the latest advances in crop protection to discuss and theorise how to address such issues as

pesticide resistance, using tools such as genomics and computational biology.

The scene was set by Prof Peter Gregory of East Malling Research, who pointed out that between sowing a seed and harvesting it, around 30% of the potential yield is lost to weeds, pests and diseases.

Pathogen adapts

Few diseases do this more effectively than potato blight, noted Prof Paul Birch of Dundee University, at an estimated annual cost of €6.7 billion (£5.6 billion).

"For 160 years breeders have been trying to address the issue, but ultimately the pathogen adapts and wins out. How does it do that, and how does it do it so rapidly?" he asked.

The pathogen, *Phytophthora infestans*, delivers effector proteins that suppress immunity, he said. Breeders' efforts to recognise them and develop a response had always been overcome through *P. infestans* evolving.

Through delving into the pathogen DNA, scientists have discovered 450 of these effectors, known as AVR3a, 60 of which have been identified as high priority. What's more they've also pinpointed the resistance protein in potatoes, CMPG1, that should trigger a response.

"Can we modify CMPG1, and how many changes would it take to turn potatoes from

Paul Birch addresses the conference, looked on by (L to R) Lin Field, Peter Gregory and Rick Mumford.

a host into a non-host?" Work is underway to identify more durable resistance, using the Commonwealth potato collection that has more than 1800 accessions, said Paul Birch.

Similarly, researchers at Rothamsted Research have closely studied the sensillum — an insect's receptors used to detect pheromones and other chemical signals — to understand how chemicals trigger a response in aphids.

"We've mapped the odorant-binding proteins (OBP), sequenced them and developed an algorithm, so you don't have to laboriously test to identify it every time — you can predict whether the OBP is there," maintained Prof Lin Field of Rothamsted.

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The work is being used to develop plants that repel aphids, she said.

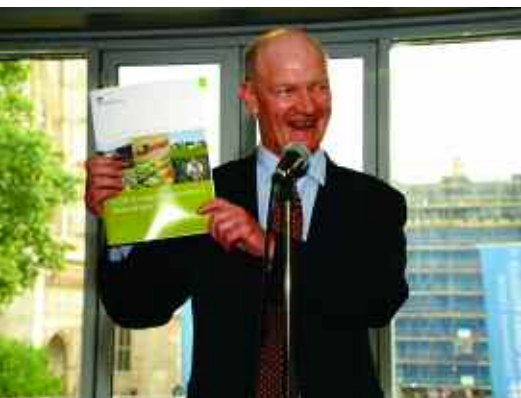
In the US, mathematical modelling has been used to predict the incidence of Huanglongbing disease in Florida, that sours citrus fruit, Dr Stephen Parnell of Rothamsted told delegates. Using a combination of mathematics with a knowledge of the biology of the disease, complex 'what-if' scenarios can be run through powerful computers to give a risk weighting, and inform researchers where to target sampling, he said.

"It's resulted in a 30% improvement in detection, compared with random sampling. Could we use the same approach to target sampling for septoria in the UK, for example? It may also help us monitor for invading pathogen species and strains," he said.

Altogether there were 10 papers delivered to an audience consisting mainly of fellow scientists, that included PhD students. AHDB chief scientist Prof Ian Crute said there had been a naïve view of crop protection issues in the past.

"Evolution is an extremely powerful force. We need genetic tools to counter it and the diversity of expertise and

David Willetts said £160 million of extra funding through the Agritech Strategy should recreate the links between upstream research and what happens in the field.



approach required to think in a more holistic way about how we tackle pests and diseases.

"The Agritech Strategy has stimulated and motivated scientists to come together and direct efforts towards farmers and growers. It's very much the key focus of AHDB to take that science and turn it into practice."

Speaking at the conference, science minister David Willetts admitted that previous governments had eroded the institutions that used to do that. But he said the £160 million of extra funding should reverse that trend.

Government obligation

"The Agritech Strategy aims to recreate the links between upstream research and what happens in the field. Government has an obligation to make that happen."

But would the conference actually make any difference towards the goal of more research in crop protection actually reaching the field? "It's a new departure for AHDB, putting on an event for research and academia, rather than for growers and agronomists," admitted Dr Susannah Bolton of HGCA.

"But this is an area that's hungry for new science, and we want to present AHDB and the agricultural industry as the routes for it. The same researchers put in applications for funding year on year. We need to encourage applications from a wider circle of researchers and explore how powerful tools, such as computational biology, can solve some of the challenges facing growers."

She said it was important to raise awareness of the importance of the science of crop protection in the wake of the launch of the Agritech Strategy. "There are research organisations that'll be bidding for that money. So the ideal outcome of the conference is that we see an increase in research projects benefiting



Ian Crute called on a diversity of expertise and a holistic approach to harness the genetic tools to counter evolution.

growers, but funded from outside the industry."

There wasn't much of the science, high-level discussion and theory that was directly relevant to the few farmers in the audience, but most were encouraged by the level of interest and depth of involvement shown by researchers.

"As growers, we need to get much more involved with the science of producing crops and engage with the scientists who'll give us the means to fight the challenges we'll have with resistance, disease and pest control," said Rutland grower Andrew Brown.

"Getting this research from the laboratory to the field needs practical farmers who understand the issues and are prepared to learn new techniques and put them into practice on farm."

As someone who feeds off the "bottom-end" of research, Essex grower Guy Smith recognised that new ideas, products and techniques that arrive on his farm, first needed to go through a system of pure research, applied science and extension. "This conference was very much at the top end of R&D and it gave me an insight into the start of a process from which farmers like me are the ultimate beneficiaries." ■

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