

Regulation, Research, Response

solutions

3



Knocking Down Mites

World first in bee health

[Fera IN FOCUS]

- Rob Edwards talks science
- Stretching the limits of detection
- Stable isotope testing

welcome

Welcome to the third edition of The Food and Environment Research Agency's partner newsletter – *Solutions.*

There has been much in the mainstream press about the impacts of the Government's spending review. Whilst we can anticipate, along with other Government Agencies, being called on to do less work for Government, it is too early to tell exactly how this might affect us. However, what is clear is that Fera's work remains well aligned with the new Government's policies focussing as it does on promoting farming and protecting the natural environment. Fera also benefits from a strong multiple customer-base, operating across multiple markets and countries. Demand for our services and the solutions we provide remains high.

It is against this backdrop of financial uncertainty that Fera welcomes Professor Rob Edwards as our new Chief Scientist. Rob has responsibility for maintaining and growing Fera's scientific reputation, both nationally and internationally, and leading the development of our scientific capability whilst ensuring its integrity and quality. Fera plays an important role in applied research, working alongside academia and industry, which is why I am particularly pleased that Rob has also been appointed Chair in Crop Protection at the University of York – this provides a wealth of opportunity to develop Fera's internal and external science networks. You can read more about Rob and how he sees the challenges of his new role on page three.

On this page I have taken the opportunity to share with you Fera's vision. I would welcome your comments or observations on this and any other aspects of our work. Please use the 'contact us' facility on the website to provide any feedback you may have.



Adrian Belton
Chief Executive

www.defra.gov.uk/fera

Cover photo:

This is a mite free honey bee worker. See page 9 to find out how Fera is helping to keep bees this way.



'To be the long term partner of choice to governments, industries and academia, in applied research, incident response and impartial advice, based on our trusted science, to secure the food chain and protect the environment from global threats.'

Adrian Belton introduces his thoughts on Fera's vision:

We have taken Fera's role and purpose, as defined when we were launched in April 2009, and combined this with what we've learned from working with our customers throughout the private and public sectors, to articulate a coherent vision for Fera's future.

I would like to share that vision with you, and by breaking it down, show what it means to us and how it drives us to serve and work with you as our customers, partners and suppliers.

To be the long term partner of choice to governments, industries and academia,

Our aspiration is to create partnerships based on exchanging knowledge and building learning, not just transactional relationships, across three defined sectors.

in applied research, incident response and impartial advice,

As an applied research organisation we bridge the gap between pure research and industrial application, and play a vital role in the nation's rapid response capability. Very importantly this also states our ethos of impartiality in all we do.

based on our trusted science,

In this we recognise that all we deliver is founded on the international reputation we have gained for the strength and application of our scientific knowledge in our areas of expertise.

to secure the food chain and protect the environment from global threats.

Here we are stating that, not only do we have an internationally respected science base, we also address problems of global concern in areas that impact all our lives. In essence, this is about why we do what we do.

I would welcome any thoughts or comments you may have on the vision we have set out for Fera and what this means for how we work with you to help you meet your future challenges.

For further information please contact: info@fera.gsi.gov.uk

chief scientist ...



After taking up the position of Chief Scientist at Fera, it took me over three months to get to grips with the breadth and depth of the science activity within the agency. With a brief to safeguard both the food chain and environment through the provision of response, regulatory and research services, we have a lot of ground to cover. It is now my brief to develop a clear and coherent science strategy to take the agency forward into a changing and uncertain world.

... rob edwards

While the strategy development exercise is still at an early stage, the science strengths in the organisation relating to our 'high end'

traditional roles in risk mitigation. Thus, by using our existing resources in new ways, we can effectively accelerate the move from

relate to the development of new capability in ecosystem services, novel field diagnostics technologies and the joining up of our analytical capability in genomics, proteins and metabolites. In addition to improving our responsiveness to the strategic needs of Defra and government, these networks will help us provide a better

ecosystem services

offerings in analysis, diagnostics, wildlife management, ecotoxicology and modelling can be readily identified. The application of the associated skills has underpinned our international reputation in wildlife science, plant and bee health and the monitoring of chemicals in food and the environment. Through a strategy of building on these core capabilities and extending their applications through partnering, or making strategic appointments within, we are now moving to a position where we can offer services in product development as well as delivering our more

monitoring, to directly addressing, the global challenges facing agriculture and the environment such as

analytical capabilities

maintaining biodiversity, combating climate change and ensuring the sustainability, safety and security of our food supply.

To drive these changes we have established three directed networks to develop innovation within Fera and ultimately further develop their offering in partnership with Universities and other agencies. The networks

level of joined up service to our customers and allow us to develop broader and more strategic alliances with both the public and private sectors in the future.

novel field diagnostic technologies

For further information please contact: robert.edwards@fera.gsi.gov.uk



decisions, decisions

- experts and risk analysts working towards a new tool to help protect human health and environment

Suppose you developed a product using a new technology, and you needed to assess its safety to people's health and the environment.



The technology is so novel there is no data available to base a risk assessment on. If you're a policy maker or manufacturer itching to get your new product to market you could turn to the advice of experts in the field. But in such a new area even the experts' opinions vary. Which opinion deserves to be given the most weight, and how do the experts themselves arrive at their conclusions, and possibly an agreement? A new mathematical tool being developed by Fera and Delft University of Technology is aiming to assist capturing and understanding this decision-making process.

Nanomaterials are tiny manufactured materials whose small size means they exhibit many novel properties. This makes them useful in a range of products from food packaging to cosmetics, but the newness of the technology means they

are an unknown quantity. Work on Fera's decision making support tool, partially funded by MoniQA, has focussed on nanomaterial uses in the food area, such as packaging and adding vitamin D to milk. A team of scientists, led by Fera's Dr Villie Flari and Dr Qasim Chaudhry, are working with Delft University of Technology in the Netherlands and Resources for the Future in the USA to develop a mathematical model that makes it easier for decision-makers to screen new nanomaterial products and determine those posing a significant risk to human health. Products which are not a concern can be released straight to market, saving industry time and money, and

those of possible risk withheld for further scientific analysis. Villie and Qasim explain: 'We collected opinion from a variety of experts in the field on 26 hypothetical nanoproducts and developed mathematical models to identify trends in their thinking and assess which combination of traits in a product would indicate higher risks.' Experts' opinions were validated and refined at an international workshop held at Fera in May 2010.

As Villie says: 'This initial tool deals with direct, deliberate exposure to nanomaterials – further tools would need to be developed to address things such as accidental exposure, and we intend to do that. During the workshop participants agreed that modelling expert opinion is the way forward in such novel and highly uncertain areas – this approach may help develop tools that could significantly benefit manufacturers across a wide range of industry.'

For further information please contact:
villie.flari@fera.gsi.gov.uk

infield diagnostics in Ghana



In Ghana a lethal disease known as Cape St. Paul Wilt is spreading across the country, devastating coconut palms which are a staple food and economic crop for the people who live there.

Diagnosis of the disease is difficult before symptoms become visible, and is currently done using traditional molecular techniques based on the Polymerase Chain Reaction (PCR) which are slow and time consuming. But help is at hand - Fera scientists have recently returned from the area where they have been trialling a novel technique which can be used in the field to help local scientists identify infected plants more quickly and easily, assisting research into the disease.

The work is part of a collaboration with the University of Nottingham and Ghana's Oil Palm Research Institute (OPRI). Fera's Jenny Tomlinson explains: 'OPRI are

researching the disease to understand its transmission and find resistant varieties to help farmers. They have a high level of expertise but minimal resources to maintain their equipment. It's time consuming and impractical to transport the kit required out into the fields, so we've developed a method which can be used easily and quickly, based around an assay similar in size to a pregnancy test kit.'

Fera scientists designed the assay to detect the relevant pathogen using a method developed and patented by the laboratory and previously used for the in-field detection of phytophthora by Fera's Plant Health and Seeds Inspectors. The coconut tests, developed for use on wood rather than leaves, work in a three stage process: pathogenic DNA must be extracted from the sample plant-matter, it must be 'amplified', and then detected. The kits were initially tested in the laboratory by Nottingham University, and then out in the field by OPRI in Ghana. Trials were very successful and demonstrated near perfect identification of infected plants. Fera is supporting OPRI to ensure their staff are fully trained in methods needed for best practice. As Jenny says: 'This work demonstrates our ability to deploy the methods that we're developing in a low-resource setting. This gives it relevance to any Fera customers interested in performing diagnostics outside the laboratory.'

For further information please contact:
jenny.tomlinson@fera.gsi.gov.uk

analytical renaissance

- stable isotope testing branching out



There's a revival underway in food authenticity testing. Stable isotope analysis is an established technique finding an increasing range of exciting uses, from forensics to wildlife, insect and migration studies. Fera senior scientist Simon Kelly thinks it's time he said more about how this important part of the laboratory's capabilities can help solve complex analytical problems across business.

The adulteration and mis-description of premium commodities such as honey, fruit juice and wine has long been an issue for consumers, regulators and supply chain management. Consumer preferences and legislation have driven the confirmation of geographical and production origin for premium foods, such as olive oil, cheese, meats and organic food to the fore. The commercial possibilities of the technique are endless, it can even be used to investigate the origin of house flies.

Stable isotopes are intrinsic markers providing traceability beyond what can be written (or miswritten) on food packaging. They can tell us where in the world a food was produced, and how. Studying levels of hydrogen, deuterium, and different types of carbon present in foods gives clues to its origin, because levels of these

isotopes differ across the globe due to different processes in the water cycle. When water from a particular region enters a plant or animal, it leaves a chemical 'fingerprint', which can be traced to that location. Use of the technology is now being written into legislation for certain protected foods such as parmesan cheese.

Following a successful project funded by the Food Standards Agency on identifying isotopic and elemental fingerprints distinguishing English, Welsh and Scottish beef, Fera scientists are now involved in tracking its origins using the new method developed at the laboratory. To produce a working analysis which can be implemented successfully Fera is working closely with industry and meat organisations such as EBLEX,

part of the Agriculture and Horticulture Development Board, Quality Meat Scotland (QMS), and Meat Promotion Wales (HCC).

Simon explains: 'Fera is the leading UK organisation in food authentication within industry. The technique is a comparative one, and Fera's expertise in stable isotope analysis is highly effective because we have databases other organisations don't have.'

'In the last five years the technology has branched out into archaeology and criminal/environmental forensics. At Fera we're studying badger populations, bat migration, and insect food webs, but we're building on our existing expertise to utilise it more and expand its application for our public and private sector customers'.

For further information please contact:
simon.kelly@fera.gsi.gov.uk

how low can you go?

stretching the limits of detection, dioxin experts assist doctors

Measuring chemicals at extremely low levels is technically demanding, requiring high levels of skill and expensive instrumentation. It's an area of expertise Fera specialises in, making their services valuable throughout industry in the areas of food authenticity, ecotoxicology, risk assessment and contingency response.

Now the laboratory will be providing health professionals with information to make the best possible decisions. Dr. Martin Rose is leading a team which has recently won a contract from the Food Standards Agency to investigate how certain toxic chemicals called dioxins behave within the body following rapid weight loss. The project will verify whether or not current risk assessments for dioxins will still be relevant for an increasingly obese population. Their findings could prove important to those involved with gastric surgery or those who experience rapid weight loss for other reasons, such as dieting or some medical conditions.

As Martin says: 'When someone loses a lot of weight over a short period of time, are dioxins lost along with the fat or do they concentrate in the smaller remaining amount, meaning the concentration is, in effect, higher? This is the question we'll be answering.' The project will be a collaboration between Fera's environmental contaminant experts, Hull and York Medical School (HYMS), and Summit Toxicology. Dioxins are a class of highly toxic chemicals formed as by-

products during the manufacture of organochlorine compounds - eg some pesticides - or during incineration at sub-optimal temperatures. They work their way into the food chain and accumulate in the fat stores of animal tissues with a variety of effects, some carcinogenic.

Fera scientists will need to measure very low concentrations, typically a few parts per quadrillion, a concentration Martin compares to: 'A single measure of gin in a mile long train of tankers filled with tonic.' It is further complicated by the fact that 'dioxins' refers to a class of related chemicals which all have to be measured

individually and multiplied by a factor known as a 'TEF' to give their toxicity. In addition, there is little background data on dioxin in human tissue available to use as a reference.

Martin explains: 'HYMS will provide tissue samples from volunteer patients. Blood samples will be taken throughout the year following their surgery, during which time it's expected they'll undergo dramatic weight loss.'

Further help from Summit Toxicology, and a partner from the European Chemicals Agency in Helsinki, will help with understanding the effects of dioxins on liver function.



For further information please contact:
martin.rose@fera.gsi.gov.uk

Fera develops regulatory guidance for pesticide risk assessment

Protecting the environment from the more negative effects of pesticide use is vital. Chemical companies provide evidence of their pesticide product's safety, and the Chemicals Regulation Directorate (CRD) is responsible for granting approval for use in the UK. Safety is determined by a range of tests, but sorption – or how effectively a pesticide 'sticks to soil' – is an important consideration. More effective sorption means a safer pesticide, less likely to enter ground- or surface water and affect non-target organisms.

Safety testing for pesticides follows standardised guidelines. Fera's Wendy van Beinum, senior environmental scientist in the EcoChemistry Team, explains: 'Current testing measures pesticide adsorption to soil, covering different soil types, with the data computer modelled to predict how much will end up in water. This assumes the sorption rate is constant, but in reality it increases over time. Industry wants this fact represented in the risk assessment, which means carrying out experiments over a longer period.'

But this aspect is not covered by existing regulatory guidance. Current scientific tests are non-standardised, and hard for CRD to use in risk assessment. Fera combines a knowledge of industry's requirements, regulation and science - a

skill-set unusual amongst laboratories - but one that's ideal for resolving this tricky issue.

CRD asked Fera's EcoChemistry Team to develop standardised guidelines for laboratory tests and how to interpret them with computer modelling to provide data for the risk assessment. Wendy explains: 'We tested different methods and models and have produced a standard protocol that's easy for everyone to use. This was discussed at a workshop held at Fera involving industry and regulators from across the EU. Industry has commissioned a third party to independently test the guidance, and CRD has asked Fera to be involved in peer reviewing the process.'

It's quite unique to find industry, regulators and researchers working so closely together like this, and there's been great interest in adopting the guidelines at European level, where most regulatory decisions are now made. This is the first time a member state (the UK) has proposed a guidance framework in this way, and the European Food Safety Authority are considering the guidance for adoption at European level. Wendy concludes: 'The project shows CRD's faith in Fera, that we understand the regulatory side of things and we have the contacts within industry too. We're not purely scientists, and they really appreciate that. It means we can find solutions that work for everyone.'

For further information please contact:
wendy.vanbeinum@fera.gsi.gov.uk



knocking down mites

– world first in bee health

Nothing has caused more destruction to honey bee colonies than the mite *Varroa destructor*, responsible for losses across the globe. The mite sucks 'blood' from honey bees whilst injecting viruses and suppressing their immune system. They have become more of a problem over the last decade due to resistance to medication beekeepers use to control them.



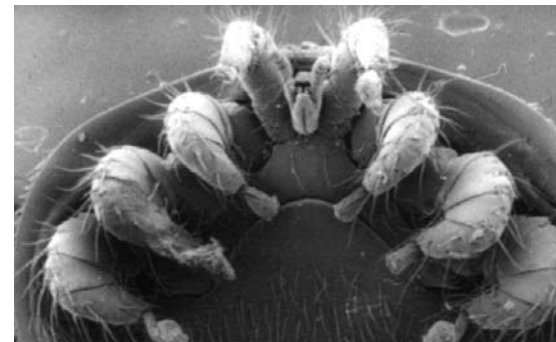
It is vital that new approaches for control are explored. Fera's National Bee Unit, working in collaboration with the University of Aberdeen's School of Biological Sciences, have a world first in the journey towards pesticide free *Varroa* control.

This collaborative project has developed a way of preventing specific genes within *Varroa* expressing themselves by using a laboratory based technique called RNAi mediated gene-knockdown. This method could be used to block essential gene function in mites, which would inhibit essential functions such as respiration, and ultimately lead to the death of the mite. It would be a way of gaining complete control over mites, without the need to use chemical treatments in the hive which are less specific and can affect non-target organisms such as the honey bees themselves.

Dr. Giles Budge from Fera explains: 'This is an important first step to developing a chemical free approach to *Varroa* control with no detriment to the honey bee. Our colleagues at Aberdeen introduced 'rogue' RNA, a type of genetic code, into the mites and it encouraged their immune response to prevent gene expression.'

This 'rogue' RNA can enter the mites via the honey bee brood food, as Giles explains: 'The mites' life cycle involves them burrowing into the honey bee brood food. Aberdeen have demonstrated that contact by immersion is sufficient to enable the transfer of

rogue RNA into the mites. Therefore future medicines could simply be added to the honey bee food with no risk to bee health. The mites will be immersed in the feed, in contact with the RNA which will then work on the targeted pathways, but honey bees consuming their food will remain unaffected by it as the effect would be specific to the mites. With further funding products to this effect could be available on the market in 5-10 years.'



For further information please contact:
giles.budge@fera.gsi.gov.uk

Top award for pioneering nano PhD at Fera

The Society of Environmental Toxicology and Chemistry (SETAC) has awarded Fera scientist Karen Tiede the Young Scientist Award. SETAC's German language branch gave the annual award in recognition of the contribution Karen's work on detection and fate of engineered nanoparticles in aquatic systems is making to the novel area of nanotechnology research.

Her work, sponsored by Unilever and carried out in the EcoChemistry Team at Fera, represents the cutting edge of nanotechnology analysis. Karen explains: 'The original method I developed at Fera is recognised as having huge potential and has won further funding for development at the University of Manchester, where it will be improved and

refined.' The work has produced numerous scientific publications and strengthened Fera's expertise in the analysis of particles in complex matrices, a skill which can be transferred to food analysis. It has helped the laboratory win further projects and maintain its leading role in the nanotechnology area.

Fera's Ethical Review Team win wild animal welfare award

Fera's Ethical Review Team were presented with the UFAW (Universities Federation for Animal Welfare) 2010 Wild Animal Welfare Award at a UFAW conference in York. The award was in recognition of the development of a new wild mammal and bird training course by Dr Julie Lane and her colleagues at Fera and the University of York.

The course provides training to improve best practice in the capture, handling, marking and release of mammals and birds.

Dr Lane commented: 'It's a wonderful recognition of the quality of the work we're doing in this important area.'



Insect pollination - a vital ecosystem service

Pollinator power – National Bee Unit investigates

Insect pollination plays a vital role in the continuation of plant life, and of all those that depend on it. Loss of pollinators would have significant economic and environmental impacts, and recent declining numbers have sparked concerns.

Fortunately, pollination is the focus of three new projects after Fera secured funding from the Biotechnology and Biological Sciences Research Council (BBSRC), Department for Environment, Food and Rural Affairs (Defra), National Environment Research Council (NERC), The Scottish Government and The Wellcome Trust.

Dr Giles Budge from Fera's National Bee Unit explains: 'There will be three distinct projects - the first looking at disease transmission and how it moves through colonies and landscapes, the second will help us understand how land-use change is affecting pollinator populations, and the third will clarify interactions between pollinators and crops, an area which is not fully understood.'

The initial project will be led by Fera and involves collaborations with the

Universities of Warwick, Newcastle and Bath. Fera will play a significant role in the second and third projects, led by the University of Leeds.

Sustainability champions

Fera's One A Day campaign has been so successful that large commercial companies are now looking to Fera to help them implement similar initiatives. When Nestle's York Product Technology Centre site wanted to learn more about sustainability and how to embed it into every day thinking, they recruited Fera experts to share their experience and help them form their own ideas.

Fera account manager for Nestle Simon Baty says 'It is a great complement to the Site Empowerment Program and Fera colleagues that Nestle see what we have achieved and are working towards, and want us to help them build a path to follow in their own business.

Fera's One A Day campaign is part of a behavioural change programme piloted successfully across Fera's York site.

For further information please contact Simon Baty: simon.baty@fera.gsi.gov.uk



Wood mouse in a longworth trap – Fera's new wildlife course covers training in all wild mammals and birds

Fera joins forces with police for 'operation scorpion'

When a two-inch long scorpion turned up in Harrogate it wasn't long before the police and Fera's entomologists and DNA barcoders got involved. The scorpion needed identifying to help determine where it came from and if it was dangerous. This was challenging as it had already been stood on to make sure it was dead.

The entomologists identified the scorpion to the genus level working purely on morphology, but as it had been squashed, that was as far as they could go. So from there Fera's DNA barcoding specialists identified the species: *Mesobuthus martensii*, 'The Eastern Chinese Armour Tailed Scorpion'.

Harrogate and District Wildlife Crime Officer, PC Gareth Jones, said: 'In the past Fera has carried out analysis of samples from animals and birds suspected of being poisoned, particularly through pesticide abuse, and this incident has helped to forge new links with Fera.'

The life aquatic, with Fera

Fera's Chemical Safety programme is developing a commercial aquatic ecotoxicity service to complement its existing areas for chemical risk assessment. Substances enter waterways from pesticidal and veterinary products, and Fera's new-to-

market service will quantify the effects of these on sediment dwelling macrophytes and invertebrates. The Advisory Committee on Pesticides has indicated current macrophyte testing using floating duckweed (*Lemna* sp.) may not be representative for other aquatic plant species, nor quantify the risks posed through exposure from sediment, so new study types are required.

Fera's Ian Cox explains: 'As a leading UK organisation for environmental risk services throughout Europe and the world, we already have expertise in risk assessment, environmental fate and terrestrial ecotoxicity. This new service moves the laboratory into a third area of aquatic ecotoxicity. Fera will be part of the 'ring test' - developing the new study using the sediment dwelling aquatic macrophyte *Myriophyllum* sp.

The effects on macrophytes need to be considered for pesticides seeking regulatory approval, as novel active ingredients or as part of the 10-year industry regulatory review programme for currently approved pesticides.

Watch the birdie

Fera and industry partner NBC Bird and Pest Solutions are evaluating the impact of Norway rats (*Rattus norvegicus*) on the breeding success of Manx shearwaters (*Puffinus puffinus*) on the Scottish island of Rùm. The island supports one of the largest Manx shearwater breeding populations in the UK, around a fifth of the global population. However, predation by rats and other species could be causing long-term colony decline. The project, funded by Scottish



Fera provides support for international seabird projects, such as conservation of Masked Boobies on Ascension Island, South Atlantic

Natural Heritage, will underpin future decisions on the management of Manx shearwaters on Rùm.

Wildlife Biologist Mark Lambert says: 'Fera has an extensive track record in the ecology and management of rodent populations, including refining existing strategies, and developing and evaluating novel approaches'.

Fera also provides support to the RSPB and JNCC for seabird conservation projects in UK Overseas Territories, including Ascension Island.

Mycotoxin training

The first in a series of training courses on Food Testing and Sanitary and Phytosanitary (SPS) issues for Third Countries has taken place at Fera. Part of the Better Training for Safer Food (BTSF) programme, they are helping Developing Countries improve their food safety systems to ensure compliance with EU regulations.

Aimed at laboratory staff responsible for export controls on food destined for the EU, the training aids their familiarisation with EU standards and import requirements.

The first course, attended by fifteen participants from the Middle East, Asia, Africa and South America, was on mycotoxins. The tutors came from Fera, the EU-Reference Laboratory, the European Commission, RIKILT and rapid test kit manufacturers.

Graduates' gain is Fera's too

Helping graduates gain important work experience is the aim of The University of York's new Graduate Intern Programme. With the facilities and leading scientists based at Sand Hutton it was natural for Fera to extend its already broad areas of collaboration with the University and offer seven students intern placements.

Fera's Dr. Sarah Oehlschlager says: 'This is a new initiative which is mutually beneficial in terms of knowledge transfer and expertise, and one which we hope will become an annual event. Fera has so many other links with the university in terms of joint projects that it seemed the next logical step that we should help train their graduates.'

solutions 3

Regulation,
Research,
Response