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Crop protection: advances and challenges

Monday 8th December 2014, 1pm to 5pm

Purpose:

For farmers around the world, tackling crop pest problems in a safe and sustainable way is a major challenge. Currently between 30-40% of crops are lost to pests, which exacerbates the problem of food insecurity and hunger. The food system is under pressure from climate change, environmental degradation, population growth, rising energy prices, rising demand for meat and dairy products, competition for land from biofuels, and urbanization. We cannot afford for these losses to continue, but can we do about it?

Programme:

14.00 – 14.10	John Gowing: Welcome and introduction
14.10 – 14.50	Professor Rob Edwards: Current Challenges for Herbicides and Weed Control
14.50 – 15.30	Professor Angharad Gatehouse: Role of Biotechnology in Sustainable Crop Protection
15.40 – 16.10	Nicholas J Evans: Experiences with Fruit Fly Control on Mango in Ghana
16.10 – 16.40	Dr Phil Taylor (CABI): Plantwise - the global plant health knowledge bank.
16.40 – 17.00	Panel discussion chaired by Dr Gordon Port

Short abstracts

Current Challenges for Herbicides and Weed Control

Professor Rob Edwards, School of Agriculture, Food and Rural Development, Newcastle University.

Herbicides remain a key component of integrated crop protection programmes in the majority of our major crops, but are now challenged in their sustainable usage by a combination of regulatory issues, a lack of new active ingredients and the steady rise of resistance in weed populations. Set against the UK context of yield gaps in arable agriculture, the issues surrounding the current use of herbicides in cereals will be the focus of this presentation, with the emerging strategy of using preventative rather than curative control measures discussed at a global level.

Role of Biotechnology in Sustainable Crop Protection

Professor Angharad Gatehouse, School of Biology, Newcastle University

With a projected increase in world population to 10 billion over the next four decades, an immediate priority for agriculture is to achieve increased crop yields in a sustainable and cost effective way. The concept of utilising a transgenic approach to this end was realised in the mid 1990s with the commercial introduction of genetically modified insect-resistant crops and herbicide tolerant crops. Based on current trends, it is predicted that by 2015 there will be some 40 countries growing biotech crops with a global acreage in the region of 200 million ha.

In recent years it has become evident that crops expressing genes encoding the entomocidal endotoxin from Bacillus thuringiensis (Bt) have made a significant beneficial impact on global agriculture. However, because of the potential for pest populations to evolve resistance, and due to lack of effective control of homopteran pests, alternative biotechnological strategies are being developed based on the use of plant-derived or animal-derived genes, including the use of molecules produced by parasitoids to disrupt the host immune response. The use of

fusion proteins, for example to provide additional receptors for Bt, or carrier molecules fused to insecticidal molecules, is showing significant promise. Studies investigating the potential of these fusion-based proteins as biopesticides will also be presented. However, if such approaches are to play a useful role in crop protection, it is important that their effects on beneficial insects (pollinators and natural enemies) is evaluated; examples of such studies will also be presented.

Plantwise - the global plant health knowledge bank.

Dr Phil Taylor, CABI, Bakeham Lane, Egham, Surrey, TW20 9TY

Plantwise is a multimillion pound development program focusing on plant health systems. In 2014 Plantwise was working in 33 countries with CABI-UK staff working closely with regional staff in 15 countries. Plantwise works with local extension and crop protection services, NGOs and other key actors in plant health to provide smallholder farmers with better access to advisory services and at the same time to provide a system of vigilance for emerging plant health problems. It supports countries in developing a network of plant clinics that are the starting point for developing and reinforcing the links that help create a functioning plant health system. These clinics are based on the model of human health clinics, a practitioner will travel to a remote location, where farmers often gather, and set up a small, temporary clinic. This is often no more than a plastic table, plastic chairs and an umbrella for shade. The farmer brings a sample of the crop to the clinic and will receive a written diagnosis and recommendation as to the course of action they should take.

The information is provided to the farmer but also retained by Plantwise. These data are incorporated into the Plantwise knowledge bank and gradually a huge database of the prevalence and location of various diseases and pests is being built up. The KB also provides online and off-line diagnostic capacity.

Experiences with Fruit Fly Control on Mango in Ghana

Nick Evans, nicholasjevans@gmail.com

Fruit fly (*B.Invadens*) was first officially identified in Ghana in 2008 and has become the principal pest in the Mango industry. Successful management of this pest at farm level requires a combined approach using orchard hygiene, male annihilation as well as protein baiting which in combination disrupt the life cycle and prevent the build up of a large population. Although the farm level system for control is widely accepted and mirrors the advice from the African Fruit Fly program the implementation of the system has required the formation of partnerships. These are between the key stakeholders in the industry, including farmer organisations, input dealers to import the products in sufficient quantities to meet the demand, crop buyers/processors who have provided credit to farmers and training together with quality feedback from consignments to the factory. Evidence shows that farmers having adopted the multiple strategy have held down reject rate due to fruit fly below 10% bringing down the seasonal average to under 20%. Farmers who do not effectively control commonly receive reject levels of 40-60%. For every $1 a farmer spends on the control (including labour) a net $4 increase in sellable yield is achieved.

Short bio-blogs for our speakers:

Phil Taylor

I work in Plantwise receiving samples and dealing with enquiries. I am also responsible for teaching Plant Clinic courses overseas. I have experience in plant path, molecular biology and tissue culture. I have worked in the universities of Durham, Ilinois and Hull. I have also run a farm for several years and have grown GM and organic crops. Whilst running a business I wore many hats. I had to be finance director, property manager, health and safety manager, HR manager, salesman, security, surveyor and sometimes mechanic and driver and cleaner too. My teaching experiences (as a lecturer) have been recently supplemented by my MSc in Science Communication where my eyes were opened to the social science aspects of science. I am assistant editor for the journal World Agriculture.

Nicholas Evans

After studying Plant Sciences at Newcastle University I have worked with tree crops across Africa on behalf of farmer organisations, processors and trading companies. As a technical advisor in Malawi supported in part by the TAA fund, I provided support to the smallholder macadamia industry, developed extension capacity and built a stable value chain to pave the way for exports. Working for Equal Exchange Trading from 2005-2010 to develop the origin and establish a viable supply chain developed and managed several projects. After a long involvement in the

macadamia industry I moved on to other forestry and fruit crops working in sustainable forestry plantations for energy and then in establishment of a new processing facility Malawi Mangoes developing their out grower model and training field technicians. I am presently working as an independent consultant based in Spain travelling to Ethiopia on the use of digital technologies to support value chain function and in Ghana to develop a new generation of technicians to take the industry forward.

Rob Edwards

I qualified with a BSc in Biochemistry (Bath University) and a PhD in Environmental Toxicology (St. Mary's Hospital Medical School, University of London).

My interests are focussed on the biotransformation of synthetic compounds and natural products in plants and the manipulation of these pathways for applications in crop protection and biorefining using technologies including synthetic biology. In 1990 I established an independent research group in the Biology Department at the University of Durham. In 2010 I took up a joint position as Chief Scientist at the UK's Food and Environment Research Agency (Fera; www.defra.gov.uk/fera) and a chair in Crop Protection in CNAP, University of York. To further consolidate my interests in basic and applied agri-food research, in March 2014, I joined Newcastle University as the Head of the School of Agriculture, Food and Rural Development where I continue to focus my research activities on crop protection.

Professor Angharad MR Gatehouse

I am Professor of Invertebrate Molecular Biology at Newcastle University. My research interests embrace (i) molecular and biochemical responses in plant/pest interactions (ii) genetic engineering of crops for resistance to pests and assessment of their impact in the environment and (iii) safety of GM crops and novel foods to consumers (development of quantitative methodology based on genomics, transcriptomics, proteomics). All three research areas are underpinned by platform technologies in genomics and proteomics. The group is recognised as a world leader in the genetic modification of crops for enhanced levels of resistance to pests and the impact of such crops on beneficial insects. It was the first to produce insect resistant crops expressing plant-derived transgenes.