# BCPC CONFERENCE 2000 – PESTS AND DISEASES

Hamish Kidd and Len Copping describe the recent BCPC Conference, held at Brighton, UK, which focused on pests and diseases

About 1400 delegates attended the conference again this year – perhaps surprising considering the number and scale of the mergers and reorganisations going on in the industry in 2000. Many more unregistered people were present as usual 'networking' on the fringes with delegates and company representatives.

The following is a selection of the sessions that took place at the conference.

## Bawden Lecture

The year's Bawden Lecture entitled '*New era, new challenges, new solutions*' was given by David Evans, recently confirmed as Head of Research and Technology at Syngenta. He started with an overview of the current situation in world agriculture where crop protection and crop management have made a vital contribution to food provision for a growing world population. For the future there was a need to increase food production, while maintaining the delicate balance between sustainability and adequate economic return for the various contributors.

There is much dissatisfaction with the current status of agri-business with two seminal components. The first is economics where the situation spans market maturity in crop protection through to weak farm economies which have led to a situation of low industry profitability and less-than-satisfactory returns on R&D expenditure. Secondly the industry has failed to illustrate to the public the benefits of its work, leading to damaging and often misinformed debates on environmental affairs and food safety.

Dr Evans looked forward with confidence saying that new technologies, especially biotechnology, show the way forward both for crop protection and crop enhancement. He did, however, temper his enthusiasm by agreeing that up until now the industry had failed to convince the consumer in the public debate on GM crops of the benefits of such new technologies.

Dr Evans felt that chemical pesticides would remain a vital component of crop protection in the new millennium, through the resourcefulness of chemists to invent superlative molecules along with careful and novel application regimes. Far from being replaced by gene-based technologies, there would always be a place in crop protection for a safe, flexible and effective molecule.

Dr Evans proceeded to outline the new technologies on offer:

- Genomics can now be used as a supplement to traditional methods for identifying biological targets.
- High-throughput automated screening for lead detection – today's miniaturised screens can handle several hundred thousand compounds per annum with automation being employed from sample retrieval right through to assessment of biological effect.
- Combinatorial libraries obtained by robotic synthesis on polymer beads, to feed screens and optimise leads. It is now possible to employ computational chemistry to select a representative subset from such combinatorial libraries for screening.
- Gene expression analysis can be used to establish the mode of action of new molecules.
- Toxicogenomics can be included in high-throughput screens to provide early alerts for toxicity.

Dr Evans then stated that in his view the major impact of biotechnology on agriculture in the next two decades will be in the area of improvement in crop quality, *i.e.* enhanced composition of nutrients, oils, proteins *etc*. There is also, he said, great potential for the introduction of agronomic effects (*e.g.* cold tolerance, drought tolerance) so that crops may be raised in environments hitherto too hostile. Post-harvest benefits such as anti-sprouting and anti-bruising would be advantageous to producers and food processors alike. Finally there is considerable interest in the production of new plant varieties which enhance the dietary component of health.

Scientists are at least partly responsible for the current public view of GM crops, especially in Europe, due to their exaggerated claims, confusing oppositions, premature publication and vocal rancour amongst scientific opponents. The situation has, of course, been exacerbated by unwarranted scaremongering and exaggeration by pressure groups. What the future holds is uncertain but clarity of information, statements of benefits to stakeholders and provision of choice would all help.

New formulation and application techniques will be important in the future, *e.g.* the use of microencapsulated formulations for slow release. The application of global positioning systems (GPS), geographic information systems (GIS) and precision agriculture through the use of robotics are all finding application in the drive to apply the minimum of crop protection chemicals directly to the target site.

Dr Evans ended by saying that for the last half century, we have placed strong reliance in crop protection upon organic chemicals. With the arrival of biotechnology-based solutions, growers now enjoy the complementary benefits of


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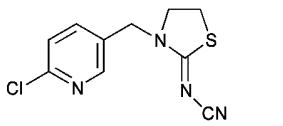
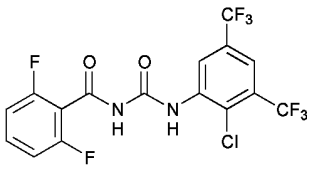
crops which are self-protected from attack by insects and diseases, and which tolerate specific herbicides. Biotechnology also holds great promise for increasing harvested yield and for beneficial enhancement of the constituents of crops.

## New compounds and uses for pest control

The following are some of the new insecticides and acaricides which were reported at Brighton:




thiacloprid




DBI-3204

Figure 1. **Some insecticides announced at Brighton.**

- Thiacloprid (Bayer AG), a neonicotinoid shown to have broad-spectrum activity against biting and sucking insects.
- ANS-118 (proposed common name chromafenozide) being developed jointly by Nippon Kayaku and Sankyo with good activity against caterpillar pests with a mode of action as an ecdysone agonist.
- DBI-3204 (proposed common name bistrufluron), a new benzoylphenylurea insect growth regulator from Dongbu Hannong Chemical Company (Korea) reported to show good activity against whiteflies and caterpillar pests.
- BAJ2740 (proposed common name spirodiclofen) a tetronic acid acaricide from Bayer AG, effective against a range of important mite pests and, as yet, showing no cross resistance to currently available acaricides.
- *Bacillus firmus* from Minrav Infrastructures is a new bacterium with activity against nematodes.

## Cereal stem-base disease: economic target or academic challenge?

A new technique, quantitative PCR, allows assessment of stem-base pathogens in cereal crops, even when symptoms may be obscure and difficult to identify. The method was developed for this purpose by Dr Nicholson's group in Norwich and his talk described how it has been used to understand the effects of individual pathogens in crops and the responses of stem-base diseases to fungicides. Quantitative PCR has also confirmed that amounts of the two pathogens (W-type and R-type) of eyespot present at stem extension often have little relationship to the amounts of disease that develop subsequently, as explained by Dr Burnett. There is, therefore, little promise for using a threshold as a basis for decision making.

Eyespot remains the most important stem-base disease of cereals, causing economically significant losses. Even the most active fungicides, however, have sometimes not increased yields significantly in trials in England, as Dr Bateman of IACR-Rothamsted, explained. He suggested that this may be partly because of the prevalence of the R-type form of the pathogen, which develops more slowly in the crop than the W-type and so is likely to cause smaller yield losses. The predominance of the R-type may be maintained partly by the continued use of fungicides that are slightly less active against it than against the W-type.

## Who controls crop protection programmes?

UK food retailers feel their credibility is under threat from the Government's 'name and shame' policy on pesticide residues. They have responded by setting tough rules for growers on how they manage their crop protection programmes. The retailers are also driven by the need to meet consumer demands and the increasingly stringent European regulations on maximum Residue Levels which governments are starting to implement across the member states. To address the residue issue and other areas of concern over food production, many of the European retailers have joined together to devise management protocols to which they expect their suppliers to adhere rigidly.

Nigel Garbutt of Safeway in the UK is the chairman of the European group of retailers, EUREP. He explained the pressures on food retailers and the current and future intentions of EUREP. The supply chain's efforts, however, are being complicated by other European legislation, notably the review process of all pesticide active ingredients. This has grave implications for the ability of the fresh produce trade to meet rapidly changing Maximum Residue Levels for different crops. The implications for the fresh produce supplier were described by David Kennedy of Bourne Salads, a division of the global food traders Geest.

## Pest and disease management in organic production systems

This was the first time that a platform session at Brighton has been devoted to organic farming, which may explain why the session was well attended. David Atkinson of the Scottish Agricultural College in Edinburgh outlined the research currently being carried out in organic production systems, and how it differs from research being carried out within conventional systems – he stressed that the key areas for organic agriculture are rotations and soil microorganisms; *i.e.* ecological processes should be considered for crop protection rather than targeted interventions. Lucius Tamm (Research Institute of Organic Agriculture, Frick, Switzerland) discussed the impact of pests and disease in organic productions and, admitting that it would be difficult to do without copper compounds for disease protection, stressed the need for new crop protection agents suitable for organic farming. Chris Stopes spoke on the potential use of biocides in organic agriculture; their regulation varies from country to country and they should really be used "only in cases of immediate threat to the crop". The session was in many ways disappointing and those attending became well aware

of the weaknesses which exist in the armoury of organic defences and organic systems as a whole.

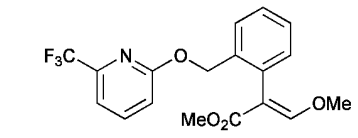
## ICM in cotton: a success story?

Insecticide use in cotton is very high and this has led to the rapid onset of resistance of most pest insects to all available products and a loss of the beneficial arthropods within the crop. A number of schemes have been introduced in the major cotton producing countries to reduce reliance and input of insecticides whilst maintaining productivity of and return from the crop. FAO has started a scheme in China, India and Pakistan that was funded by the EU and was an attempt to move growers away from an over-dependence on chemicals. It is early and education and maintenance of yield are going to be key to its continued success. Companies are increasingly supporting ICM strategies and an example of the type of input from commercial groups was described by Aventis. It is in the best interests of all primary agrochemical producers to control the use of newer compounds within a crop that is sprayed often if their effective life is to be extended. The other papers described methods to integrate chemical and non-chemical crop protection strategies in the cotton crop and how the intelligent use of inputs delays the onset of insect resistance within the crop. Is ICM in cotton a success story? Not yet but we are well on the way.

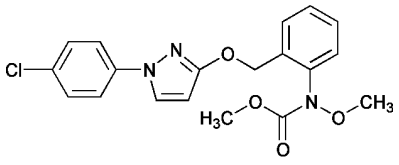
## New compounds, formulations and uses for disease management

In this new fungicide session, the two major chemicals which were announced were strobilurins:

Jeremy Godwin of Zeneca Agrochemicals reported on picoxystrobin, a new broad-spectrum strobilurin fungicide for use on cereals with good activity against *Septoria* spp., brown rust and tan spot in wheat, net blotch, brown rust on barley and *Rhynchosporium*. It had shown greater curative activity than azoxystrobin, and is unique amongst strobilurins in being both systemic and vapour-active.




picoxystrobin




BAS 500F

Figure 2. **Some fungicides announced at Brighton.**

Eberhard Ammermann of BASF AG described BAS 500 F (proposed common name pyraclostrobin) a new strobilurin with strong translaminar activity. It showed good activity against all four major groups of fungi, e.g. on cereals (*Septoria* spp., rusts and tan spot on wheat, net blotch and brown rust in barley), vegetables, grapes, peanuts, citrus and turf grass.

The other new products presented in this session were disappointing being a new azole (simeconazole F-155) for use as a seed treatment from Sankyo, a derivative of dimethomorph (SYP-L190) from the Shenyang Research Institute and a paper on *Brevibacillus brevis* with claims that the bacterium is a broad spectrum biofungicide.

## Formulation and application technology

The keynote presentation by Ian Shirley (Zeneca Agrochemicals) dealt with microencapsulation technology (see *Pesticide Outlook*….) which minimises toxic impact to users by facilitating triggered release of capsule contents by the environment of the insect gut. Safe, rather than specifically controlled delivery, formulation methodologies was the theme in the associated poster session, via contributions from David Marris and Rene Pollak in regard to new formulation technology for reducing operator and consumer impact of alpha-cypermethrin and chlorpyrifos, respectively. The paper by Marris also highlighted the benefits that can be obtained by using polymeric formulations to produce stable deposits with smoother, more consistent deposit surfaces.

On the biological side, Graham Matthews and Simon Piggott (IPARC) showed the importance of the interaction between chemical formulants and living biological control agents for effective delivery of control agents.

The importance of formulation/application interactions was illustrated in the presentation by Robyn Gaskin who demonstrated the potential to modify application efficiency and minimise environmental impact by use of tank-mix additives. In the concluding presentation of the session David Salt illustrated the complexity of formulation-application interactions and the benefits of models to permit a holistic approach.

## Mycotoxins: control and food safety

The presence of mycotoxins in food is becoming increasingly important particularly in commodity crops such as cereals. However, monitoring is difficult as they are rarely uniform in distribution within the crop in storage and, although the techniques for detection are rapid, analyses to produce definitive results are slow taking days – a time scale that is not compatible with the economics of modern commodity processing. Hence, it is better to develop techniques that prevent the accumulation of mycotoxins in the growing or stored crop rather than to check for their presence once in store. Campden and Chorleywood Food Research Association has developed a hazard analysis system that identifies the critical aspects of food storage and processing and the associated risk of mycotoxin production. Following these guidelines should prevent the production of mycotoxins within good manufacturing practice, commercial and processing constraints.

Fusarium ear blight is common in the UK and 1998 saw very high incidences of the disease. Two different pathogens (*F. culmorum* and *F. graminearum*) are the primary organisms and relatively high levels of toxins such as deoxynivalenol

and nivalenol were found in grain. Different fungicides had different effects on these toxin producing species with tebuconazole, metconazole and carbendazim giving good control but azoxystrobin (although giving good control of the non-toxin producers) had little effect on the producing organisms.

## Strobilurins and relatives: a critical appraisal

The introduction of the strobilurin fungicides has been one of the biggest success stories in crop disease control history. Much is claimed for these products but how much is true? Four papers assessed the value of these new compounds, the threat of resistance and claims for yield responses as well as disease control. It has been shown that not all varieties of winter wheat and barley respond to the same degree as response is associated with the variety's disease resistance. This was found to be true of strobilurin based products as well and as such will affect the economics of their use in particular situations.

Work from ADAS suggested that the addition of kresoxim-methyl to epoxiconazole increased green leaf area by delaying leaf senescence. Unfortunately, the experiments included only three treatments, untreated control, epoxiconazole and epoxiconazole plus kresoxim-methyl making an assessment of the effect of the strobilurin alone impossible.

Work from Italy showed both azoxystrobin and trifloxystrobin to be very effective at controlling a wide range of different fungal pathogens in various vegetable and ornamental crops.

The resistance to stribilurin fungicides has been demonstrated and FRAC has now introduced a new resistance category designated Qo1-STAR. The fungicides included in this group include the strobilurins, famoxadone and fenamidone. Resistance in powdery mildews is the result of a single point mutation in the cytochrome b gene but a different mechanism, as yet undetermined, is found in apple scab.

## Resistance risk assessment and its impact on EU product registration

In spite of all the EU directives for the registration of crop protection products, they seem to be lacking in detail concerning data requirements on pest resistance risk, and how country registration authorities should evaluate it. Ian Smith of EPPO presented the recently published guideline on 'Resistance Risk Analysis'. This guideline sets a new standard for companies and regulatory authorities for providing and evaluating data regarding development of pest resistance. Despite the new guideline, individual countries can and will place their own interpretations on it. Representatives from the registration authorities in the UK PSD (Chris Furk) and German BBA (Udo Heimbach) described how resistance risk is assessed in each country and how the guideline will be used.

Crop protection companies will be most affected by the guideline. Paul Leonard (BASF) described the need to provide a comprehensive package of data and monitor pest populations for resistance for years after product launch. Also the requirement to put in place resistance management plans and continue to communicate with and educate growers and farmers on resistance management. This will all mean extra cost for the development of new products

Ultimately resistance risk analysis seeks to ensure that products are used in a way that discourages the development of resistance. In turn this will ensure that product life is maintained and that farmers and growers continue to have a range of effective products available for their needs.

## Transgenics: the solution for pest and disease management?

Four papers in this session gave good overviews and insights into the future for GM crops in terms of insect and disease management. The Sainsbury Laboratory described the interactions of plant resistance and pathogen encoded avirulence genes as a strategy for the introduction of pathogen resistance into crops. A different approach was described by Pioneer Hi-Bred who have reduced the effect of pathogens by inactivating the toxins that are produced during crop invasion. The example cited was the introduction of resistance to *Sclerotinia* in sunflower by the transgenic expression of oxalate oxidase. The pathogen produces oxalate as it invades but the enzyme breaks it down as fast as it is produced and thereby prevents cell death. These transgenic sunflowers are close to commercialisation.

IACR-Rothamsted has produced a three-tiered testing system for the assessment of side effects of GM plants on non-target organisms. The first tier involves small scale bioassays designed to represent a worst case scenario and if effects are noticed additional tests are conducted taking into account animal behaviour, choice and realistic levels of exposure. These tests are conducted in the laboratory or as a small scale field trial. The third tier is the most realistic and also the most costly and involves large scale field trials.

Work at IACR-Broom's Barn has shown that late treatment with glyphosate in glyphosate-tolerant sugar beet allowed aphid populations to build up on the weed population and with this aphid build up there was an accumulation of natural aphid predators so when the weeds were controlled with a herbicide spray the *Myzus persicae* populations on the transgenic sugar beet were markedly reduced. An additional benefit of the use of glyphosate in the GM sugar beet was the removal of volunteer potatoes and, with them, a reduction in the levels of potato cyst nematodes in the soil.

*Proceedings for the conference are available from BCPC Publication Sales (email: publications@bcpc.org; web: www.bcpc.org)*