HUMAN EXPOSURE TO PESTICIDE RESIDUES, NATURAL TOXINS AND GMOs – REAL AND PERCEIVED RISKS

Hamish Kidd reports on this year's Monday Symposium at the Brighton Conference, held at the Hilton Brighton Metropole Hotel

This year's symposium sought to answer the questions – are the hazards and risks of exposure to pesticide residues, natural toxins and GMOs well understood and regulated? And is any public concern justified?

Pesticide residues

The symposium started with an overview by Neil Carmichael of Aventis CropScience in France on the philosophy of hazard assessment, showing how pesticide regulation developed, and how risks versus benefits have been assessed. The testing of very high doses, as required by regulators, can lead to anomalous results, as can an incorrect use of statistics. The risks are therefore often overestimated – a message repeated by many of the later speakers. Dr Carmichael stressed the need for newer *in-vitro* methods (skin penetration, kinetic modelling, transgenic mice, genomics and proteomics) to become more generally accepted to reduce the present almost prohibitive cost of new compound development and the exaggeration of risk.

Bob Tomerlin of Novigen Sciences, Washington, USA, emphasised that initial worst-case dietary risk assessments often indicate that risk levels are unacceptably high, and that refined procedures are necessary to develop more realistic estimates of risk. Such refinements can take the form of more sophisticated methods for estimating exposure, such as probabilistic modelling. However, the most prevalent types of refinements have to do with better data for food consumption and residue concentration. Using such refinements residues are usually not found, or are quite low, not reaching Maximum Residue Limit levels.

Natural toxins

Joel Mattsson of Dow AgroSciences, Indianapolis, USA, told the audience that although mots fruit and vegetables contain natural toxicants at part of their natural defences, few people want to hear about them, assuming that if they are indeed natural they must be beneficial, or at least not harmful. But these so-called "natural" chemicals can cause mutagenicity, carcinogenicity, teratogenicity, neurotoxicity and visceral organ toxicity. There is evidence Dr Mattsson claimed that the levels of these toxicants can increase greatly in plants under stress, *e.g.* from disease or insect attack. Crop protection chemicals, by tacking the disease and predation levels causing the plant stress levels, can actually reduced the levels of natural toxicants. There should therefore be food safety benefits from an approach to risk management that considers the use of crop protection chemicals to limit the expression of natural toxicants.

Frank Ellner from the Federal Biological Research Centre for Agriculture and Forestry in Berlin, Germany, outlined one group of natural toxins – the mycotoxins (*e.g.* aflatoxins, ochratoxins and trichothecenes) derived from *Fusarium*, *Aspergillus* and *Penicillium*; these toxins are among the most harmful contaminants in food in terms of both acute and chronic effects. Pre-harvest management (*e.g.* with fungicides) and post-harvest management (*e.g.* optimal storage conditions, insect control *etc.*). A number of countries already have specific regulations on mycotoxins (especially aflatoxins), but there is a need for their regulation in foodstuffs in the European Union. Dr Ellner concluded with a plea for further research into the toxicological effects of mycotoxins on humans, and for measures to reduce their concentration in diets including all steps of food production, storage and processing.

Genetically modified organisms (GMOs)

The potential hazards which can occur as a result of the introduction of new genetic material in a plant are

- toxicity and allergenicity of the introduced gene products (proteins)
- influence of gene products on plant metabolism leading to a change of nutritional value or a change in the concentration of toxic constituents
- unintended insertional effects (*e.g.* knock-out of essential genes, activation of latent genes)

(all these hazards can occur not only in GM plants but also in plants obtained using conventional breeding techniques)

Current testing of GM foods is based on the principle of substantial equivalence, accepted by OECD and the EU; in other words the GM food should be "as safe as" the parent. The substantial equivalence testing consists of acute toxicity tests in rodents via the oral route, comparison of the amino acid sequence with that of known toxins, degradation in simulated gastric and intestinal fluid in vitro and degradation during food processing.

The last presentation of the seminar was given by Joyce Tait of the Scottish Universities Policy Reasearch and Advice Network, University of Edinburgh, Scotland, in which she explored the causes of the current crisis of public confidence in GM crops. She particularly emphasised the need to distinguish between arguments based on self-interest, which will be amenable to persuasion on scientific evidence, from

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those based on fundamental values, which will not. Although the risk assessment process involves the concept of substantial equivalence for food-related hazards and farm-level crop trials for environmental hazards should be considered separately, from the perspective of public perception and communication these two aspects are intimately connected. There is a need in the future, if we are to get out of the current impasse, to adopt a more balanced precautionary approach to the risks of GM crops, with scientists recognising the appropriateness of different domains of scientific expertise in dealing with different issues. We should also recognise that all groups have their own reasons for exaggerating or attenuating particular points, based on personal or group interests and/or values. In such a complex area, with numerous stakeholder perspectives (and even entrenched positions), we should not expect to reach consensus through adoption of a single policy approach. An important component of a balanced precautionary approach will be the need to devise a more complex and pluralistic set of policies to allow a range of interests and values to co-exist with a reasonable degree of harmony, but without having the luxury of one group unreasonably imposing its perspective on others.

Summing up

Sir Colin Berry of the London Hospital summed up the presentations given during the symposium and ended by saying that not only may our estimates of risk be numerically exaggerated, but they may also be looking in the wrong direction – we pick endpoints which may not even be the most serious potential problems. Post-market surveillance would be of particular value in relation to GM food.

For the first time in the history of Brighton Conferences there were demonstrations during the symposium, wires to the platform microphones were cut, and a police presence was required to ensure the continued smooth running of proceedings. This provided an illustration, if one was needed, of the current entrenched positions based on values, as discussed by Joyce Tait.

The proceedings of the symposium are available from the British Crop Protection Council as BCPC Symposium Proceedings No. 75 (ISBN 1 901396 75 4).