

Conference Call

linking statistical tables to publications, and the potentially difficult issues of tracking time-variable data sets were being tackled initially by detailed versioning.

The after-lunch session on Global Initiatives began with a description by Michael Diepenbroek of the ICSU World Data System, the federation of data centers largely in the earth sciences. Much of the impetus behind this system is the establishment of common norms of quality and interoperability across a very diverse spread of activities, and early attention is focusing on organizational aspects, including the establishment in Japan of a coordinating International Program Office. Among the technical aspects of the new system are the orderly registration of DOIs and linking to associated publications in a way that will give due credit to those collecting and curating the data.

Jan Brase, Managing Agent of DataCite, and overall Chair of the Workshop, explained how DataCite acted to register data DOIs across the sciences.

Geoffrey Boulton previewed the forthcoming Royal Society policy report "Science as an open enterprise", which would discuss the major policy issues surrounding research data management, drawing on recent cases such as the "Climategate" affair and on the perception that the data deluge offers both challenges, in terms of handling vast quantities of data, and opportunities to involve a wider research community, and indeed the citizen scientist.

Françoise Genova closed this session with an account of the Astronomical Virtual Observatory, a good example of a discipline-wide and international approach to data handling and linking to publications.

In the final session, Publishers and Data, three academic publishers gave their perspectives on the integration of data management and archiving with the much longer-established business of learned journals.

Eefke Smit of the International Association of STM Publishers (representing over 100 publisher members) described some individual journal initiatives to enhance scientific articles through linking to associated data sets, and spoke also of the PARSE-Insight survey ("Permanent Access to the Records of Science in Europe") that had identified the current patchy distribution of scientific data archived in orderly and accessible ways. Fred Dylla of the American Institute of Physics (AIP) preferred to emphasise the traditional added value of the publishing enterprise and see integration with supporting data as a simple extension of the existing paradigm. Alicia Wise of Elsevier described some initiatives within the Elsevier stable of journals to enhance linking between articles and data sets.)

Overall, this workshop provided a helpful snapshot of the state of play in making research data available within the framework of the record of science. There are encouraging signs that public policy is well informed and is moving towards encouraging orderly curation of data across many disciplines. Within this framework, public funding is available for well-defined data management activities, and this may provide some resources for individual disciplines to address any needs they have that cannot be met by existing academic funding. There is, of course, huge disparity both in the types of data across different disciplines, and in the sophistication of different communities with the management of their data. This does provide a continuing challenge to publishers, especially large organisations publishing across many different scientific fields. As yet, the ability of publishers to take advantage of specific data handling opportunities seems rather limited. Initiatives such as DOI, which now provides persistent unique identifiers in both the publishing and data worlds, do of course facilitate linking and citation, which are important first steps. But there is still a great deal to do before there is routine validation, visualisation and reuse of data across the whole field of science. It is very beneficial that organisations such as CODATA and ICSTI are both aware of the problems, and well placed to work together with the many relevant stakeholders to bring this vision closer to reality. Full report and workshop presentations are available online.

 www.icsti.org/spip.php?rubrique42

Agrochemicals

by J.B. Unsworth, N.A. Shakil, J. Kumar, G.A. Kleter and J.B.H.J. Linders

The global population is predicted to grow from about 7 billion today to 9 billion in 2050, with a corresponding need to increase the food supply, which is one of the greatest challenges of our time. Today, there is an urgent need to review advances made in crop protection research and formulate future strategies to achieve a secure food supply and at the same time ensure that this is done in a sustainable way.

The **Second International Conference on Agrochemicals Protecting Crops, Health and Natural Environment—The Role of Chemistry for Sustainable Agriculture** was held on 15–18 February 2012 at the Indian Agricultural Research Institute (IARI), in New Delhi, India, the practical conference arrangements



The opening ceremony. From left: Dr. Pankaj, Dr. J.B. Unsworth, Dr. N.A. Shakil, Shri Harish Rawat, Prof. V.L. Chopra and Dr. J. Kumar.

and invitations were organised by Dr. N.A. Shakil and Dr. J. Kumar (senior scientists at IARI) and the National Organising Committee was chaired by Dr. H.S. Gupta (Director, IARI). The conference, which was sponsored by IUPAC, together with IARI, the Indian Council of Agricultural Research (ICAR) and the Society for the Promotion of Sustainable Agriculture (SPSA), attracted 415 delegates including a significant number of international delegates and it was pleasing to note the presence of a large number of young scientists. The scientific program was organised with 20 technical sessions consisting of 17 plenary lectures, 28 invited lectures, 82 oral presentations and 176 poster presentations, of which the three judged to be the most meritorious received awards.

The opening ceremony was chaired by Dr. V.L. Chopra (former President, National Academy of Agricultural Sciences) and, after a traditional welcome, the inaugural address was given by the Chief Guest Shri Harish Rawat (Union Minister of State for Agriculture, Food Processing Industries and Parliamentary Affairs). In his address he emphasised the need for an increase in food production and that the approach taken would include many of the issues to be addressed by the conference, particularly in the plenary lectures.

Plenary lectures given by Dr. C.D. Mayee (former chairman of the Agricultural Scientists Recruitment Board) and Dr. S. Singhal (PI Industries Ltd.) focused on pest management and food security in India. Today Indian agriculture needs major reforms which will allow increased productivity and at the same time contribute to the farmers' wealth; a "Second Green Revolution". Significant crop losses still occur but pesticides are not always used effectively to combat these losses. In addition, new pesticides can take a significant time to reach the market. Integrated Pest Management (IPM) strategies are being strongly promoted and have been developed for all major crops, but so far uptake has been limited as they need to be tailored to local conditions and require a high level of expertise. Interestingly IPM, when used appropriately with lower pesticide inputs, can also help in reducing the carbon footprint as was outlined by Dr. K.R. Chauhan (US Dept. of Agriculture), for example, by the use of pheromones to either attract beneficial insects for biocontrol or for mating disruption of insect pests.

The search for new crop protection products is an ongoing challenge as was explained by Dr. K.J. Divakar (Syngenta) and Dr. A. Klausener (Bayer CropScience). The number of new pesticides is decreasing and their development is becoming increasingly more expensive and time-intensive, with a higher risk of

failure. An example of a recently introduced insecticide, Cyazapyr™, with a novel mode of action was given by Dr. I. B. Annan (DuPont Crop Protection). Research into novel pesticides was described by Professor K. Matsuda (Kinki University, Nara, Japan) who concentrated on the neonicotinoid family of insecticides and the possibility of designing insecticides that are safe for mammals and beneficial insects. Another approach was given by Dr. R.J. Nachman (US Dept. of Agriculture) who discussed the role of insect neuropeptides and the use of biostable mimetics as a possible new strategy for pest control. Dr. M.J. Kennedy (Dept. of Employment, Economic Development and Innovation, Queensland, Australia) described a research program to extract bioactive compounds from the hardwood of the white cypress (*Calitris glaucophylla*) and the development of delivery systems based on nanoparticles.

Methods for risk assessment are essential to ensure that pesticides can be used safely. An example of environmental risk assessment was described by Dr. J.B.H.J. Linders (formerly RIVM, Bilthoven, the Netherlands). The aim of this IUPAC funded project is to harmonize approaches to risk assessment between nations. It was concluded that methods based on a tiered approach and adapted to the local region and growing conditions are preferred over a strictly hazard approach, as fewer pesticides would be discontinued. In ensuring the safe use of pesticides it is necessary to be able to quantify trace levels in various substrates. Dr. S.K. Raza (Institute of Pesticide Formulation Technology, Gurgaon, Haryana, India) described current chromatographic methods, coupled with mass-spectrometry, which are highly selective and have excellent sensitivity. Dr. D.B.G. Williams (University of Johannesburg, South Africa) explained a novel technique for the analysis of pesticide residues using bubble-in-drop single-drop micro-extraction (BID-SDME) for which sensitivity in the ng/L range was achieved for triazines in water.

Biotechnology is increasing in importance in agriculture and Dr. S.M.P. Khurana (Amity Institute of Biotechnology, Haryana, India) explained how traits introduced by genetic modification can help increase food production, whilst other types of modification can help fight malnutrition; a good example is Golden Rice engineered to biosynthesize beta-carotene, a precursor of pro-vitamin A. When crops have been modified to be resistant to a given pesticide it is important to verify that the residue definition, initially proposed for the non-GM crop, is still valid. This is the basis of an IUPAC funded project led by Dr. G.A.

Kleter (RIKILT-Institute of Food Safety, Wageningen University and Research Center, Wageningen, the Netherlands). The project team investigated data on residue levels for herbicides applied to GM herbicide-resistant crops. The outcome was that no generalized inferences could be made about the nature or level of the residues of either the herbicide active ingredients or their metabolites. Each case, therefore, must be examined separately.

Registration of pesticides is mandatory before pesticides can be commercialized. The Organization for Economic Cooperation and Development (OECD) plays a key role in harmonizing regulations. Dr. S. Poret (OECD, Paris, France) explained that the current aim is mutual acceptance of data and that by 2014 governments will routinely accept dossiers and monographs in OECD format. In addition, OECD is working on "best practices" for topics such as IPM, risk assessment, and reduction in animal testing.

There is a great deal of information available about pesticides online and Dr. J.B. Unsworth (Consultant, UK) described an IUPAC-funded project that was set up to highlight sites that are reliable and objective. A "Pesticide Portal" has been developed to give access to publicly available information on pesticides and provide links to relevant documents (see <http://pesticides.iupac.org>).

It is also important that stakeholders understand current thinking on pesticides and agricultural policy. This was the subject of the plenary lecture delivered by Prof. E. Capri (Research Centre on Sustainable Agriculture, Piacenza, Italy) who described how policy recommendations or detailed studies and suggestions for national implementation are developed. Current examples are the outcome of discussions on the EU common agriculture policy and work on the Directive on the Sustainable Use of Pesticides.

Based on the presentations the following recommendations were formally adopted during the closing ceremony:

Pesticides: chemical pesticides are extremely important for ensuring a secure food supply but in some areas there is a reluctance to use them, in these cases extension services should educate farmers in the safe use of appropriate pesticides in order to increase their crop yields. If crops are destined for export it is essential that the pesticides used are acceptable to the importing country.

Regulations: In order to ensure that new pesticides are registered with a minimum of delay increased

resources from government should be made available for this task. In addition, the safety assessment of pesticides should be based on actual risk under local conditions, rather than on the inherent hazard of the pesticide. Support should be given by government to the OECD initiative on the harmonisation of regulatory requirements.

Public awareness: The media give the impression that chemical pesticides are inherently unsafe. Industry, academia, and government, together with the help of international organizations, should increase the awareness of the public that chemical pesticides can be used safely and pose no problem to human health or the environment. In addition, in order to ensure public confidence, industry must ensure that products are clearly and accurately labelled and have instructions for use in an understandable manner.

Integrated pest management: The importance of integrated pest management should be stressed and training of farmers by qualified experts should be carried out to ensure that this technique is used appropriately and effectively in controlling target pests.

Biotechnology: New techniques are being enabled by biotechnology. These techniques should be built on to develop not only herbicide resistance or insecticidal properties but also, for example, new traits in crops such as adding health benefits (golden rice) or other benefits such as drought resistance and increased storage times (increased shelf life). Along these lines, a program should be initiated for identifying those naturally occurring metabolites responsible for repelling insect pests of plants, and crop plants should be engineered, through both molecular breeding and GM technology, to produce these biochemicals for plant defence.

Biopesticides: Although biopesticides derived from natural products have a role to play in crop protection, their sometimes suboptimal efficacy, and consequent lower crop yields, means that their use should be limited to crops where a higher price premium can be demanded (i.e. where there is a demand for organic produce). Organic farming on its own will not ensure a secure food supply.

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