GMOs in Horticulture: Past, Present and Future: Outcomes of the CRP- sponsored conference held in Brisbane, Australia, 20 August , 2014

Bart Panis, 1 December, 2016, OECD, Paris

Conference part of the IHC meeting in Brisbane organized by (ISHS International Society for Horticultural Science)

ISHS

ISHS membership

- Thousands of Individual Members in over 150 countries
- 60 Country/Region Members
- >150 Institutional Members

Scientific Programme:

- each year ~45 meetings

International Horticultural Congress

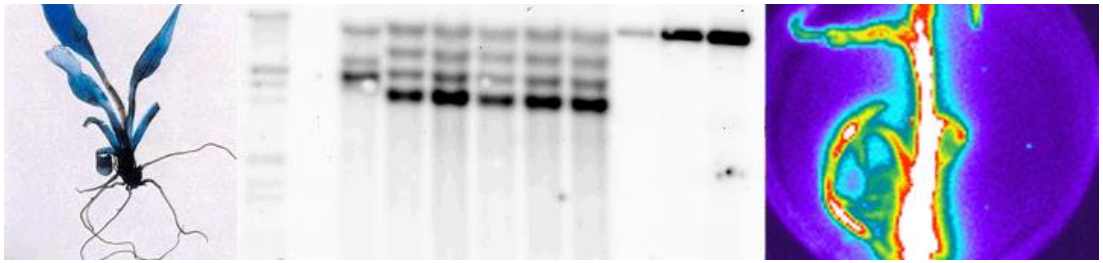
- IHC2002 Toronto: 2500 delegates
- IHC2006 Seoul: 2000 delegates
- IHC2010 Lisbon: 3600 delegates
- IHC2014 in Brisbane: 3290 delegates (40 symposia)
- IHC2018 in Istanbul, Turkey

GMOs in Horticulture - Past, Present and Future

Facts

- More than **1 billion hectares** of genetically modified (GM) crops have been planted by **millions of farmers in 28 countries worldwide**
- More than 90% of GMO farmers are **small farmers in developing countries**
- The vast **majority** of GM plantings have been modified to increase productivity through improved **insect resistant** and/or **herbicide tolerance**
- **Novel GM crops** have the **potential** to contribute to **food safety, increase health benefits, prevent diseases and address malnutrition**. Furthermore, complex traits may assist in overcoming environmental challenges such as **drought and climate change**.
- To date **development and adoption of GMOs in horticulture has been low**.
- Despite that the biosafety regulations are in place, the. **benefits and risks of genetically modified (GM) crops continue to be disputed**

GMOs in Horticulture - Past, Present and Future:



AIM of the conference: To provide a cross-disciplinary forum for policy makers, scientists and industry from around the world to consider policy issues relevant to the use of Genetically Modified Organisms (GMOs) in horticulture.

Symposium was set up to examine the pros and cons of genetic technologies so more informed decisions about the use of GMOs in horticulture can be taken in future.

GMOs in Horticulture - Past, Present and Future

We contacted speakers to cover a range of topics/concerns linked to the development and use of transgenic crops including:

- Impacts of biotech on biodiversity
- Transgene flow in genetically engineered crops
- New developments in GMO science
- Biosafety regulation systems
- GMO regulation and food equity
- Are GMOs safe to eat?
- Consumer attitudes towards biotechnology
- Nutritional implications of GMOs

GMOs in Horticulture - Past, Present and Future

Plenary Session **Chair: John Chapman**		
8:30-8:40	Welcome	
8:40-9:15	Acceptance of GMO technology as an element of sustainable food production	Prof Marc Van Montagu
9:15-9:50	The Rainbow Papaya experience	Dr Dennis Gonsalves
9:50-10:00	Introduction to the OECD's Co-operative Research Programme	Dr Gary Fitt
Session 1: GMOs in Horticulture: Past, Present and Future **Chair: Dr Gary Fitt**		
10:30-12:30	• Impacts of biotech on biodiversity and benefits of GMOs to growers (Janet Carpenter) • GM crops and damage to country image: much ado about nothing? (John Knight) • Transgene Flow in Genetically Engineered Papaya (Richard Manshardt) • New developments in GMO science (Renata Muller) • GMOs in horticulture – exciting opportunities or a dead end? A case study in bananas (Dr Bart Panis)	

GMOs in Horticulture - Past, Present and Future

Session 2: Regulation and Biosafety **Chair: Prof Trine Hvoslef-Eide**	
13:30-15:30	• Biosafety regulation systems – a straightjacket to progress or necessary caution? (Jeff Stein) • Biotechnology & biosafety activities at OECD – a policy development perspective (Peter Kearns) • Exploring the dichotomies between GMO regulation and food equity in developing regions (Rebecca Ford) • Are GMOs safe to eat? Current, inadequate requirements for feeding studies and what happens when you exceed them (Judy Carman) • GMO Policy in Australia (Lynda Graf)
Session 3: GMOs and the Consumer **Chair: Dr Bart Panis**	
16:00-17:00	• Consumer attitudes towards biotechnology (Dr Craig Cormick) • Acceptance of disease resistant GM rootstocks for non-GM fruit (Neena Mitter) • Nutritional implications of GMOs (Thierry Vrain)
Workshop 17:00-18:30	• Panel Debate – Exploitation and progress of GMOs – exciting opportunities or a dead end? (Chair – Dr Bart Panis)

GMOs in Horticulture - Past, Present and Future

- Approximately 200 participants from many countries (including OECD and non-OECD countries)
- Participants included researchers, academics, policy makers from governments, experts from international organisations, economists and communications professionals
- Different views (pro- and anti-GMO) as well as different aspects (scientific, ethical and policy) were covered
- Many invited speakers that are considered to be anti-GMO declined our invitations to speak.

GMOs in Horticulture - Past, Present and Future

Marc Van Montagu

- pioneer in plant molecular biology, discoverer of the Ti-plasmid and the inventor of *Agrobacterium tumefaciens* transformation technology,
- founding Member and Member of the Board of Directors of two biotech companies,
- won numerous prizes amongst which are the Japan Prize (1998) and the World Food Prize (2013).
- chairman of the Institute of Plant Biotechnology Outreach (IPBO)

Statements

- The regulatory framework for researching and adopting GMOs is too complex, too slow and too expensive; only big companies can go into the business, crops and treats beneficial for developing countries are under-researched
- It is not about technology it is all about the product.
- Humanity is suffering from diseases, malnutrition and poverty; do we really have the luxury not to use them

GMOs in Horticulture - Past, Present and Future

Dennis Gonsalves

- led the team that developed the virus-resistant transgenic papaya that saved the papaya industry from devastation by the by the papaya ringspot virus
- led the successful effort to deregulate the transgenic papaya in Japan.

Statements

- Today, genetically engineered papaya represents about 80% of Hawaii's papaya production. The Rainbow papaya was developed by public sector scientists and still is the only commercialized transgenic fruit crop in the US.
- In 2000, these same scientists started efforts to deregulate the transgenic papaya in Japan, and in December 2011 the first Rainbow papaya was imported by Japan.
- In recent years, controversies over GMOs have escalated in Hawaii.

GMOs in Horticulture - Past, Present and Future

Gary Fitt

- joined CSIRO as an Experimental Scientist in 1977.
- Chief Executive Officer of the Australian Cotton Cooperative Research Centre (CRC) in 1999
- In 2008 he became the Deputy Chief of the CSIRO Ecosystem Sciences in Brisbane,
- extensive research experience in agricultural sustainability and has focussed on the study of Helicoverpa moth
- Board Director of the Cotton Catchment Communities CRC
- Chair of the Science Advisory Body of the OECD Cooperative Research Program.
- Adjunct Professor at both the University of New England and the University of Sydney.

Introduction to the OECD's Co-operative Research Programme

GMOs in Horticulture - Past, Present and Future

Janet Carpenter

- Studied policy issues related to genetically engineered crops, including socio-economic impacts, impacts on biodiversity, and US and international regulatory frameworks.
- has held positions with the US Agency for International Development, overseeing the agency's biosafety capacity building programs, and USDA Animal and Plant Health Inspection Service Biotechnology Regulatory Services, working primarily on international negotiations on the regulation of agricultural biotechnology.

Statements based on 3 literature reviews

- Economic performance. In most cases, GM crops have benefitted farmers, particularly those in developing countries.
- Biodiversity impacts. Currently commercialized GM crops have reduced the impacts of agriculture on biodiversity.
- Socioeconomic effects. Farmers receive a substantial share of overall benefits; consumers benefit from lower prices; small farmers in developing countries benefit from GM crops; and adopters report improvements in health, education, debt repayment, maternal care services and food security.

GMOs in Horticulture - Past, Present and Future

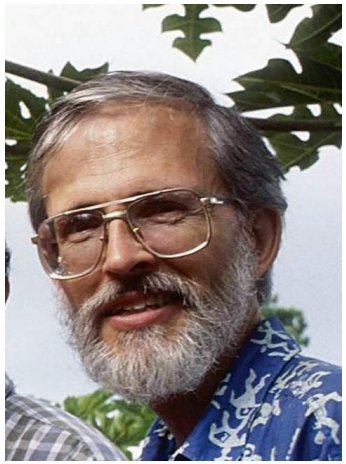
John Knight

- Professor in Marketing at the University of Otago, Dunedin, New Zealand.
- teaches innovation and new product development and also branding.
- conducted research on country image and factors that enhance or damage it. He has investigated potential impact of genetic modification in regard to New Zealand's country image in overseas markets.

Statements

- Gatekeepers in the food distribution channels of diverse countries do not regard whether or not a country produces GM crops as an important consideration when making food purchase decisions
- A substantial percentage of consumers show willingness to actually purchase GM food products, provided there is a consumer benefit such as absence of spray residues or lower price.
- Tourist destination choice is scarcely affected at all by controversial technologies that are in use in a particular country

GMOs in Horticulture - Past, Present and Future



Richard Manshardt

- tropical fruit crops breeder/geneticist in the Tropical Plant & Soil Sciences Dept. at the University of Hawaii Manoa Campus.
- co-developer of 'SunUp' and 'Rainbow' papaya varieties with genetically engineered resistance to papaya ringspot virus.

Statements

- Investigated gene flow from GM papaya to feral papaya plants (i.e. plants that establish and grow without human assistance). It was found that 22% of all feral plants were transgenic and incidence of gene flow was greatest among feral plants in regions growing genetically engineered papayas commercially.
- Future investigations will examine the relative importance of pollen and seed as gene flow pathways in solo papayas in Hawaii.

GMOs in Horticulture - Past, Present and Future

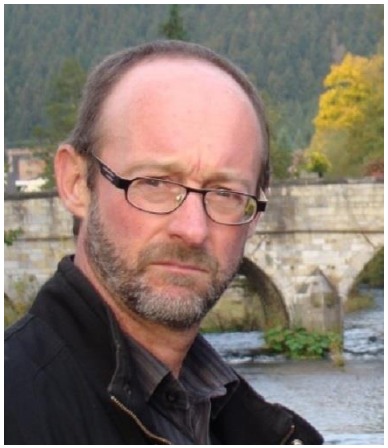
Renate Müller

- Professor of Floriculture and Translational Plant Science at Copenhagen University, Denmark.
- explores genetic and physiological factors, which determine plant quality.
- Studies genetic transformation and alternative biotechnological tools aiming in plant quality improvement

Statements

- The first wave of GM crops addressed yield and productivity challenges. They focused on characteristics such as resistance to pests and diseases, and herbicide resistance. These traits mainly provide benefits for growers and do not add value for the consumer.
- The focus of the second generation of GM crops will/should be on health benefits, nutritional value and sustainability. It seems probable that consumer oriented traits may contribute to an increased acceptance of GM plants and their derived products.

GMOs in Horticulture - Past, Present and Future



Bart Panis

- Research focuses on plant tissues culture with all its possible applications; cryopreservation, somatic embryogenesis, protoplast culture and transformation
- co-developed the worlds first transgenic banana
- co-ordinated many international projects dealing with conservation of plant genetic resources

Statements

- Despite being an ideal candidate for genetic engineering, there are no transgenic bananas on the market to date. There are technical and financial and legal hindrances that prevent the development and widespread application of transgenic bananas.
- The most important requirement for acceptance and uptake of GMOs will be the development of cheaper and/or superior products that are acceptable to consumers
- Problematic are often the lack of transparency in the GMO research:field trials and the creation of unrealistic expectations about GMOs

GMOs in Horticulture - Past, Present and Future

Jeff Stein

- Asia Coordinator and Biosafety Advisor for the USAID funded Program for Biosafety Systems.
- 25+ years of global biosafety experience with national agricultural research centers and academic institutions to build in-country scientific capacity to set guidelines for and comply with confined field trial guidelines.
- Biosafety Advisor associated with the Donald Danforth Plant Science Center, in St Louis, MO.

Statements

- Prior to commercial deployment, GM crops undergo rigorous biosafety assessments. This assessment is based on the recommendations of expert panels of among others FAO, OECD, ILSI, US FDA, EFSA
- Guidance documents published from OECD and Codex
- Since 1996, more than one billion acres of GMO crops expressing numerous novel traits have been planted by millions of farmers in 30 countries but there are no proven adverse effects of GM crops
- Over regulation.

GMOs in Horticulture - Past, Present and Future

Peter Kearns

- Principal Administrator at the Organisation for Economic Co-operation and Development (OECD)
- head of OECD's biosafety programme and is responsible for the OECD's Working Group for the Harmonisation of Regulatory Oversight in Biotechnology and the Task Force for the Safety of Novel Foods and Feeds.
- mainly focused on promoting international harmonisation in the regulation of biotechnology, nanotechnology, as well as other emerging and converging technologies.

Statements

- Regulatory harmonisation can lead to countries recognising or even accepting information from one another's assessments.
- In recent decades, innovative biotechnologies on the border between conventional breeding and genetic transformation have emerged (such as cisgenesis, reverse breeding, agro-infiltration and grafting). There is a debate currently underway as to whether some or all of these techniques will be considered as 'genetic modification' in a regulatory context in jurisdictions around the world .

GMOs in Horticulture - Past, Present and Future

Rebecca Ford

- Associate Professor between The University of Melbourne's Faculty of Veterinary and Agricultural Sciences and Griffith University's School of Environment
- Development of novel tools to improve the sustainability and security of plant-derived food production systems
- expertise is in applied molecular plant breeding
- collaborative partnership with national and international Agricultural industries and institutes to address key issues retarding productivity

Statements

- There are many examples of the potential for GMOs to improve horticultural productivity, food quality and availability.
- However, there is far less discussion regarding how the regulatory requirements surrounding GMO application and protection may perversely affect Food Equity. This includes IP ownership, licencing and protection, as well as the associated costs, and the impositions these may have on the ability to grow and supply food types in certain regions.

GMOs in Horticulture - Past, Present and Future

Judy Carman

- adjunct associate professor at Flinders University in Adelaide, Australia.
- Bachelor of Science,
- Honours Degree in Organic Chemistry
- PhD in Medicine in the field of nutritional biochemistry and metabolic regulation
- Master of Public Health specializing in epidemiology and biostatistics. .

Statements

- Long-term toxicology studies on animals relevant to human health are uncommon. Such studies are generally animal production studies, where farmed animals that are not physiologically comparable to humans are fed GM feed
- Found evidence of reproductive and digestive problems in pigs after eating a mixed diet containing three GM genes
- When feeding people in developing countries with GMOs you need to understand that those people come with a poorer health to start with

GMOs in Horticulture - Past, Present and Future

Lynda Graf

- extensive experience in the scientific research environment, having worked in the fields of clinical pharmacology, biochemistry and cell biology in university departments, and plant molecular biology at CSIRO in Canberra.
- Senior Scientist and co-leader of the GM team at Food Standards Australia New Zealand (FSANZ).
- Australian delegate to the OECD Task Force for the Safety of Novel Foods and Feeds from 2007 to 2014.

Statements

- The utility of toxicity studies or animal feeding studies in the assessment of GM crops remains one of the more controversial issues.
- States that animal feeding studies using whole GM food do not contribute to a safety assessment, alternatives study methods need to be developed

GMOs in Horticulture - Past, Present and Future

Neena Mitter

- one of Queensland's leading biotechnologists, having been involved in molecular biology and biotechnology in Australia and India for over 15 years
- developed novel and innovative RNA silencing based biotechnological approaches towards management of pests and diseases.

Statements

- Discuss gene silencing technologies (including use of double stranded RNA) and their place in agricultural food production.
- This workshop concluded the majority of foods produced from GM rootstocks will not contain any novel genetic material or have altered characteristics and therefore should only be subjected to simplified food safety assessments

GMOs in Horticulture - Past, Present and Future

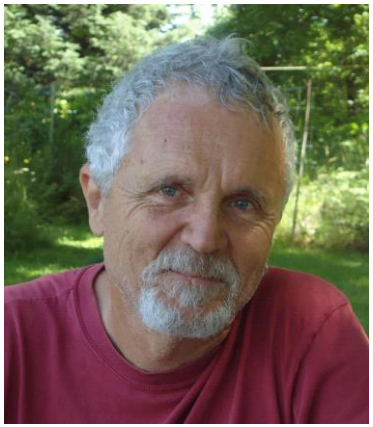
Dr Craig Cormick

- social researcher and science communicator/educator.
- has worked for the Innovation Department and CSIRO, and is widely published on drivers of attitudes towards new technologies.
- conducted public attitude research into attitudes towards genetically modified organisms over 15 years,
- has taken part in OECD and APEC working groups on methods of better engaging the public on contentious technologies.

Statements

- Public attitudes to biotechnology, including GMOs, are complex and broad-ranging. Those most concerned about GM foods were also concerned about foods grown with pesticides, and those most willing to eat GM foods were also most willing to eat foods grown with pesticides. This indicates a commonality of concerns, or acceptance, about industrialized processing of foods.
- Messages and communication strategies that appeal to GMO advocates have had little impact on people in other segments of the population.

GMOs in Horticulture - Past, Present and Future



Thierry Vrain

- was the head of a research group of 40 professionals in Biotechnology, Department of Agriculture in Canada
- Vice President and President of national and international associations of soil biologists
- His research covered biological control, chemical control and resistance breeding, biochemistry, genetic engineering, and molecular taxonomy of nematodes

Statements

- Roundup Ready crops are engineered to be sprayed with the herbicide Roundup and this technology has become so successful that Roundup (active ingredient glyphosate) has become a major pollutant
- Roundup Ready GMOs sprayed with Roundup contain residues of glyphosate. Foods made from crops containing residues of glyphosate are depleted of minerals and toxic to human health
- We need to be careful to distinguish between GMOs and Roundup Ready technology

GMOs in Horticulture - Past, Present and Future

Selection of further issues that came up during panel discussion

- We could also say that non-GM foods are not safe because they have not been adequately tested. For example potatoes
- As a result of classical breeding and natural mutations various metabolic pathways are switched on that were not switched on before. Yet, we take for granted that what comes out from the classical breeder can be immediately used for consumption. What is the logic?
- Perception of the public towards GMOs is very similar to the perception of the public towards nuclear pollution and based on fear
- Consumers need to see the value before they will by GMO products. The FLAVR SAVR tomato did not make it, not because it was a GMO, but because it was a lousy product. People could get better tomatoes, grown in a greenhouse, far cheaper.

GMOs in Horticulture - Past, Present and Future

Key issues of the meeting/conclusions

- **Compliance costs.** Today only a handful of companies with global experience in regulation have the capability (and resources) to develop and launch a new GM plant product.
- **Meeting the needs of smallholder farmers.** Market forces are unlikely to drive research on those crops that are of importance to vulnerable farmers. Public sector intervention will be necessary
- **Embargoes on field trials.** This effectively means an embargo on agricultural research with GM-plants, as field trials are essential in the development of improved crops.
- **Gene flow.** Gene flow occurs from GE populations into non-GE populations. This is an acknowledged fact. Research to understand the pathways and mechanisms of gene movement is needed.
- **Animal studies**. The utility of toxicity studies or animal feeding studies in safety assessment remains one of the more controversial issues.
- **RNA Silencing**. Is it to be considered as other GMOs

GMOs in Horticulture - Past, Present and Future

Key issues of the meeting/conclusions (Cont'd)

- **GMOs and Food Equity.** The issue of Food Equity needs to be considered as part of the GM debate. It is increasingly a community concern in developing countries.
- **Consumer acceptance of GMOs.** The most important requirement for acceptance and uptake of GMOs will the development of cheaper and/or superior products with a relative advantage compared to the non GMO crop.
- **Building consumer confidence.** Transparency will help build the confidence of putative consumers. This means open communication of field trial results avoid to create unrealistic expectations about GMOs.
- **Communication strategies.** Messages and communication strategies that appeal to GMO advocates have had such little impact on people in other segments of the population.
- **GMO technology vs resultant product.** There is a need to separate the technology from the end product.

IHC meeting in Brisbane organized by (ISHS International Society for Horticultural Science)

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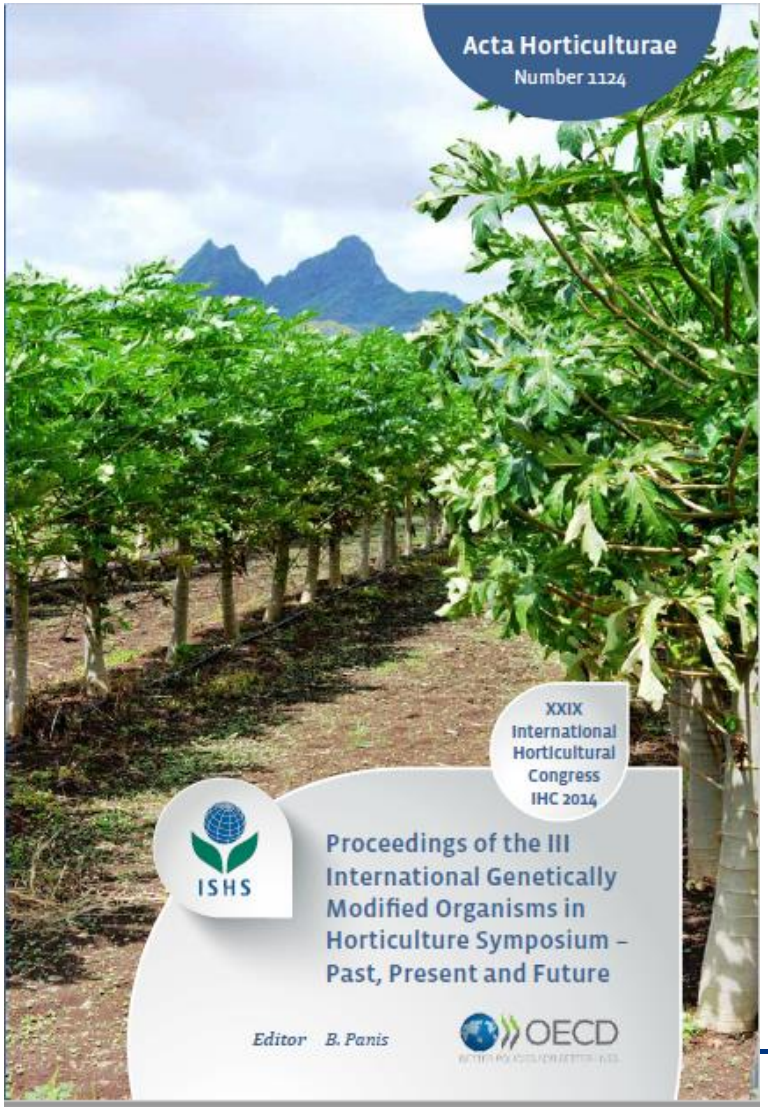

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Thank you

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