All messages from the FAO 2012 e-mail conference on "GMOs in the pipeline: Looking to the next five years in the crop, forestry, livestock, aquaculture and agro-industry sectors in developing countries"

[This document contains all of the 109 messages that were posted during the FAO moderated e-mail conference on "GMOs in the pipeline: Looking to the next five years in the crop, forestry, livestock, aquaculture and agro-industry sectors in developing countries" that took place from 5 November to 2 December 2012. The goal of the conference was to look into the near future in order to inform the debate about genetically modified organisms (GMOs) in the pipeline. Specifically, people were asked to address two main topics in the conference. First, what new GMOs are likely to be commercialized in developing countries within the next five years (i.e. before the end of 2017) in the crop, forestry, livestock, aquaculture and agro-industry sectors? Second, what are the likely implications of these new GMOs for developing countries?

A total of 770 people subscribed themselves to the conference and, of these, 59 (i.e. 8%) submitted at least one message. Of the 109 messages that were posted, 36% came from people living in Asia; 26% from Europe; 24% from North America; 10% from Latin America and the Caribbean; and 5% from Africa. The messages came from people living in 24 different countries, the greatest number coming from India (31 messages) followed by the United States (25 messages). A total of 55 messages (i.e. 50%) were posted by people living in developing countries. A total of 30% of messages came from people working in universities; 18% from participants from non-governmental organisations; 17% from people working in research centres; 12% from people working in the private sector; 11% from people working as independent consultants and 8% from people in Governments. NB: People posting messages are assumed to be speaking on their own behalf and not on behalf of their employers (unless they indicate otherwise).

The conference was hosted by the FAO Biotechnology Forum and was the 18th e-mail conference hosted by the Forum since it was launched in the year 2000. The Background Document to the conference is available from the website of the Forum (http://www.fao.org/biotech/biotech-forum/). A Summary Document will also be prepared and made available from the Forum website. For further information on agricultural biotechnology, see http://www.fao.org/biotech/ (in Arabic, Chinese, English, French, Russian and Spanish).]

The Messages

Messages are numbered in order of their posting during the conference. The few messages without a number are from the Moderator.

Subject of Messages:

14: What GM crops are in the pipeline in India?
15: Re: GE animals for human health applications internationally
16: Bt brinjal in India
17: Re: GE animals for human health applications internationally
18: Re: GE animals for human health applications internationally
19: Re: Bt brinjal in India

20: Re: Potential GE livestock and fish (& ornamental fluorescent fish)
21: Quality improved GM crops in the pipeline
22: Research on subsistence crops for marginal farmers?
23: Re: Bt brinjal in India
24: Private sector, WEMA and PPPs
25: Re: Bt Brinjal
26: Re: Bt Brinjal
27: Re: Bt Brinjal
28: Re: Bt Brinjal
29: Re: Bt Brinjal

30: Re: Bt brinjal
31: Re: Bt Brinjal
32: Re: Potential GE livestock and fish
33: Re: Bt Brinjal
34: GM crop pipeline in India
35: Re: Bt Brinjal
36: GMO pipeline in India - crops, pharma
37: Re: Bt Brinjal
38: GMOs in pipeline - Iran
39: GM livestock pipeline in China

40: Re: Bt Brinjal
41: GM fish in China
42: Re: Bt brinjal
43: AquAdvantage Salmon
44: Re: Bt brinjal
45: Re: Bt Brinjal
46: Re: Bt brinjal
47: Re: Quality improved GM crops in the pipeline
48: Genetic modification of insects for pest control
49: Regulatory pipeline for Africa - crops

50: Re: Bt Brinjal
51: Re: Bt Brinjal
52: Re: AquAdvantage Salmon
53: Re: Bt Brinjal
54: Re: AquAdvantage Salmon
55: Re: AquAdvantage Salmon
: More than halfway through this FAO e-conference on 'GMOs in the Pipeline'
56: New GM crops for developing markets
57: Re: Bt brinjal
58: Re: Bt Brinjal
59: Re: Bt brinjal

60: Re: Bt brinjal
61: Re: Potential GE livestock and fish
62: GM crop pipeline in Pakistan

Date: Tue, 30 Oct 2012 15:55:18 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: Background document to the FAO e-conference on GMOs in the pipeline

Dear Colleagues,

Thank you for subscribing to this FAO e-mail conference on "GMOs in the pipeline: Looking to the next five years in the crop, forestry, livestock, aquaculture and agro-industry sectors in developing countries".

I am now sending you the Background Document to the conference.

It aims to provide information that you, as participants, will find useful for the e-mail conference. The first Section of this 9-page document provides some background to the hosting of this conference. Section 2 of the document provides an overview of GM crops, trees, livestock, fish and micro-organisms that are currently commercialized. Section 3, on the GMO pipeline, briefly discusses the research-to-commercialization pathway; the choice of a 5-year time horizon for the e-mail conference; and some GMOs that are in the pipeline in the different sectors. Section 4 presents some specific guidance about the topics that are to be discussed in the conference. Section 5 provides references of articles mentioned in the document, abbreviations and acknowledgements.

The document is provided below, and is also available on the FAO website at http://www.fao.org/docrep/016/ap109e/ap109e00.pdf (60 KB).

I particularly encourage people to read Section 4 of the document before they begin preparing a message.

The conference begins on Monday 5 November. If any of your colleagues wish to subscribe, they should send an e-mail to listserv@listserv.fao.org with the following one line in the body of the message (leave the subject line blank):
subscribe biotech-room2-L firstname lastname

Where firstname and lastname refer to the person's first and last name. For example, if the subscriber's name is John Smith, then the line should be:
subscribe biotech-room2-L John Smith

Finally, in case you do not know about it, I want to inform you that FAO also produces a free e-mail newsletter called FAO-BiotechNews. It is prepared in all six official UN languages and its main focus is on the activities of FAO (such as this e-mail conference), of other UN agencies/bodies and of the 15 CGIAR research centres. News items about new documents are included in the newsletter if the documents are freely available on the web, and for each item an e-mail contact is also provided. The newsletter was launched in January 2002 and all news items (over 850) posted since then are available at http://www.fao.org/biotech/biotech-news/en/ while all events are available at http://www.fao.org/biotech/biotech-events/en/

If you and/or your colleagues wish to subscribe to the English-language newsletter, just send an e-mail message to listserv@listserv.fao.org with only the following one line in the body of the message (i.e. leave the subject line blank and have no other text, such as an e-mail signature, in the message):
subscribe FAO-BiotechNews-L firstname lastname

To subscribe to FAO-BiotechNews-Ar (i.e. the Arabic language version of FAO-BiotechNews), do the same as for FAO-BiotechNews above except the message should read:

subscribe FAO-BiotechNews-Ar-L firstname lastname

To subscribe to FAO-BiotechNews-Cn (the Chinese version), do the same except the message should read:
subscribe FAO-BiotechNews-Cn-L firstname lastname

To subscribe to FAO-BiotechNews-Fr (the French version), do the same except the message should read:
subscribe FAO-BiotechNews-Fr-L firstname lastname

To subscribe to FAO-BiotechNews-Ru (the Russian version), do the same except the message should read:
subscribe FAO-BiotechNews-Ru-L firstname lastname

To subscribe to FAO-BiotechNews-Esp (the Spanish version), do the same except the message should read:
subscribe FAO-BiotechNews-Esp-L firstname lastname

Best regards

John

John Ruane, PhD
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Background document to the FAO e-mail conference on "GMOs in the pipeline: Looking to the next five years in the crop, forestry, livestock, aquaculture and agro-industry sectors in developing countries"

1. Background

The FAO international technical conference on "Agricultural biotechnologies in developing countries: Options and opportunities in crops, forestry, livestock, fisheries and agro-industry to face the challenges of food insecurity and climate change" (ABDC-10, http://www.fao.org/biotech/abdc/) took place in Guadalajara, Mexico in March 2010. A major objective of the conference was to take stock of the application of biotechnologies across the different food and agricultural sectors in developing countries, in order to learn from the past and to identify options for the future to face the challenges of food insecurity, climate change and natural resource degradation. It brought together about 300 policy-makers, scientists and representatives of intergovernmental and international non-governmental organizations. This included delegations from 42 FAO Member Nations.

At the end of ABDC-10, the Member Nations reached a number of key conclusions (FAO, 2011a). Among these, they acknowledged that "Agricultural biotechnologies encompass a wide-range of tools and methodologies that are being applied to an increasing extent in crops, livestock, forestry, fisheries and aquaculture, and agro-industries, to help alleviate hunger and poverty, assist in adaptation to climate change and maintain the natural resource base, in both developing and developed countries"; that "The various applications of agricultural biotechnologies have not been widely used in many developing countries, and have not sufficiently benefited smallholder farmers and producers and consumers"; and that "More research and development of agricultural biotechnologies should be focused on the needs of smallholder farmers and producers".

ABDC-10 was dedicated to "agricultural biotechnologies", a term representing a broad range of technologies used in crops, livestock, forestry, fisheries and aquaculture, and agro-industry [see Ruane and Sonnino (2011) for more details]. They are used for a variety of different purposes such as the improvement of plant varieties and animal populations to increase their yields or efficiency; characterization and conservation of genetic resources; plant or animal disease diagnosis; vaccine development; and production of fermented foods.

One of these biotechnologies is genetic modification and it is used to produce genetically modified organisms (GMOs), which are organisms in which one or more genes (called transgenes) have been introduced into their genetic material from another organism using recombinant DNA technology, i.e. a set of techniques for manipulating DNA, including the identification and cloning of genes; the study of the expression of cloned genes; and the production of large quantities of gene product (FAO, 2001). The genes may be from a different kingdom (e.g. a bacterial gene introduced into plant genetic material), a different species within the same kingdom or even from the same species. For example, so-called "Bt crops" are crops containing genes derived from the soil bacterium Bacillus thuriengensis coding for proteins that are toxic to insect pests that feed on the crops.

While there has been little controversy about any of the other biotechnologies, there has been considerable debate about the current and potential implications that genetic modification and GMOs have for food security, the environment, biodiversity, human health, farmers income, the global food system and other issues. This often-polarized debate began in the 1990s and it still continues today without showing significant signs of abating. Issues related to GMOs tend to be widely reported in the media and policy-makers often have to specifically address them at the national level and also at the international level where they have come together to draw up internationally binding agreements on the subject. For example, some 163 countries and the European Union have ratified or acceded to the Cartagena Protocol on Biosafety to the Convention on Biological Diversity, an international agreement whose objective is to contribute to ensuring the safe transfer, handling and use of GMOs that "may have adverse effects on the conservation and sustainable use of biological diversity, taking also into account risks to human health, and specifically focusing on transboundary movements" (see http://bch.cbd.int/mop6/ for details of its latest meeting, held on 1-5 October 2012 and attended by some 1500 delegates from over 100 countries).

Among the many agricultural biotechnologies discussed at ABDC-10, genetic modification is therefore much more in the public spotlight and it demands far more attention from policy-makers than all the other biotechnologies. It is also an area of major R&D investment and it is predicted that the range of modified traits and species that will be commercially available to farmers in developing countries in the future will be far wider than it is today. For this reason, the FAO Biotechnology Forum is hosting this e-mail conference on "GMOs in the pipeline: Looking to the next five years in the crop, forestry, livestock, aquaculture and agro-industry sectors in developing countries" to look into the near future in order to inform the debate about GMOs in the pipeline, considering the specific kind of GMOs that are likely to be commercialized in developing countries over the next five years and to discuss their potential implications.

This Background Document aims to provide information that participants will find useful for the e-mail conference. In Section 2 an overview of GMOs that are currently commercialized in food and agriculture is given. Section 3, on the GMO pipeline, briefly discusses the research-to-commercialization pathway; the choice of a 5-year time horizon for the e-mail conference; and some GMOs that are in the pipeline in the different sectors. Section 4 presents some specific guidance about the topics that are to be discussed in the conference. Section 5 provides references of articles mentioned in the document, abbreviations and acknowledgements.

2. Commercially available GMOs in food and agriculture

In this section, the kinds of GMOs that are actually released and commercially available are summarized. Note, it does not include GMOs at the research level or that are awaiting commercial approval.

2.1 GM crops

GM crops were first grown commercially in the mid 1990s. While the vast majority was grown in developed countries in the past, this is changing and almost half of the global GM crop area is now estimated to be in developing countries (James, 2011). These estimates indicate that 13 developing countries planted over 50,000 hectares of GM crops in 2011, i.e. Brazil (30.3 million hectares), Argentina (23.7), India (10.6), China (3.9), Paraguay (2.8), Pakistan (2.6), South Africa (2.3), Uruguay (1.3), Bolivia (0.9), the Philippines (0.6), Myanmar (0.3), Burkina Faso (0.3) and Mexico (0.2). For comparison, in 1997 the only developing countries reported were China (1.8 million hectares), Argentina (1.4) and Mexico (less than 0.1). Among the economically developed countries, almost all GM crops are in North America, with an estimated 69.0 and 10.4 million hectares cultivated in the United States and Canada respectively in 2011 (James, 2011).

Almost all GM crops grown commercially worldwide are genetically modified for one or both of two main traits: herbicide tolerance (an estimated 59% of GM crops planted in 2011) or insect resistance, i.e. Bt crops, (15%) while 26% have both traits. Four crops are responsible for virtually all the area cultivated worldwide with GM varieties, namely soybean (47%), maize (32%), cotton (15%) and canola (5%). It is estimated that 75% of the global soybean area is cultivated with GM varieties. For maize, cotton and canola, these proportions are 32%, 82% and 26% respectively (James, 2011). Soybean and maize, apart from human consumption, are also used in livestock and fish feeds and GM varieties are extensively traded internationally for this purpose (e.g. Nowicki et al., 2010).

2.2 GM trees

Commercial release of GM forest trees has been reported in one country, China. In 2002, approval was granted for the environmental release of two kinds of Bt trees, the European black poplar (Populus nigra) and the hybrid white poplar clone GM 741, together representing about 1.4 million plants on 300-500 hectares (FAO, 2011b).

2.3 GM livestock

No GM livestock have been commercially released for agricultural purposes.

Outside the field of agriculture, GM animals have been approved to produce a small number of pharmaceutical proteins that are commercially available (EMA, 2012; Vàzquez-Salat and Houdebine, 2012). These include the use of GM rabbits to produce conestat alfa, the active substance in Ruconest (a medicine used to treat attacks of hereditary angioedema in adults) and the use of GM goats to produce antithrombin alfa, the active substance in Atryn (used to treat patients who have congenital antithrombin deficiency). The pharmaceutical proteins are extracted from the animals' milk. GM animals, mainly mice, are also used extensively in biomedical research.

2.4 GM fish

No GM fish have been commercially released for food purposes.

A number of ornamental GM flourescent fish have been commercialized in some countries, including the United States, Malaysia and Taiwan Province of China (Hallerman, 2004). These aquarium pets, of the zebrafish and tetra fish species, express fluorescent colour proteins encoded by genes from jellyfish and sea anemone so that they can glow at night.

2.5 GM micro-organisms

Micro-organisms (or microbes) are living organisms which are microscopic in size, and include bacteria, fungi and viruses. Although documentation is generally quite poor, use of genetically modified micro-organisms (GMMs) in food processing and the animal feed sector is routine in developed countries and is also a reality in many developing countries.

In the agro-industry sector, enzymes (i.e. proteins that catalyse specific chemical reactions) are commonly used in food processing and in the production of food ingredients and many of them are commonly produced using GMMs. For example, since the early 1990s, preparations containing chymosin (an enzyme used to curdle milk in the preliminary steps of cheese manufacture) derived from GM bacteria have been available commercially. Developing countries which currently produce enzymes using GM micro-organisms include Argentina, Brazil, China, Cuba and India (FAO, 2011c). Similarly, many colours, vitamins and essential amino acids used in the food industry are also from GMMs.

In animal nutrition, feed additives such as amino acids and enzymes are widely used in developing countries. The greatest use is in pig and poultry production where, over the last decade, intensification has increased, further accelerating the demand for feed additives. For example, most grain-based livestock feeds are deficient in essential amino acids such as lysine, methionine and tryptophan and for high producing monogastric animals (pigs and poultry) these amino acids are added to diets to increase productivity. The use of enzymes such as phytase in pig and

poultry feeds in intensive production systems in developing countries is also significant. Phytase addition can reduce phosphorus excretion and increase profitability (by decreasing the amount of phosphorus that needs to be added to the diet). These amino acids and enzymes are produced in some cases by GMMs (FAO, 2011d).

Metabolic modifiers are a group of compounds that alter the physiology and metabolism of animals to improve efficiency of meat and milk production. One of these is somatotropin (also known as growth hormone) and GM bacteria are used to produce recombinant bovine somatotropin (rBST), to increase feed conversion efficiency and milk yield and decrease milk fat in dairy cows, and recombinant porcine somatotropin (rpST), to increase muscle growth, reduce body fat and improve carcass composition in pigs. The hormone is administered by injection and has been approved since the 1990s in several developed and developing countries (FAO, 2011d).

Poor animal health is a major factor that impacts negatively on productivity in developing countries. Animal disease control can be improved through vaccination, where a host organism is exposed (usually by injection) to biological material (antigen) that allows it to mount a specific immune reaction giving it better capability to fight subsequent infections of a specific pathogen. Recombinant DNA technology is now used to develop different kinds of vaccines to manage diseases in livestock and fish. Some of these vaccines offer advantages over conventional vaccines, such as safe and cheaper production; earlier administration and immunity of the animal; more protective immunity; and the possibility to differentiate vaccinated from infected animals. These include gene-deleted vaccines, where pathogens (bacteria or viruses) with deletions in genes associated with virulence or involved in key metabolic pathways are used as live vaccines; recombinant vaccines based on vectors, where avirulent viruses or bacteria containing foreign genes coding for antigens are used for delivery of these antigens to the host animal; subunit vaccines, composed of semi-pure or purified pathogen proteins produced by recombinant DNA technology; or DNA vaccines, where bacterial plasmids (i.e. self-replicating non-chromosomal DNA molecules found in many bacteria) encode protein(s) of an infectious agent (OIE, 2012).

Several of these new kinds of vaccines are commercially available, such as a gene-deleted bovine herpesvirus 1 (BoHV-1) for cattle or viral vector vaccines against poultry diseases such as Marek's Disease, Fowl Pox and Gumboro or against West Nile virus (WNV) in horses. Several influenza vaccines for poultry (and humans) are produced from reverse genetic systems (which make it possible to introduce designed mutations, insertions and deletions into the viral genome of live viruses) and are produced and applied in developing countries against H5N1 (the highly pathogenic avian influenza virus currently circulating in a number of countries) in poultry. For DNA vaccines, the main commercialized product is a WNV vaccine for horses, which contains genes for two WNV proteins and does not contain any whole WNV, live or killed. DNA vaccines are also commercially available against infectious haematopoietic necrosis virus for salmon. Further details about these kinds of vaccines, including examples of their commercial application, are provided in OIE (2012).

3. GMOs in the near pipeline

The pathway leading from research to the eventual commercial release of GMOs is typically long and complex. For example, in crops this process has been recently described by Phillips McDougall (2011), who break it into seven 'activity stages', some of which overlap in time. The first stage is 'early discovery', involving preliminary screening and identification of genetic sequences with the potential to deliver the trait of interest. The second is 'late discovery', where the candidate genetic sequences are evaluated in model plant systems (such as the much-studied Arabidopsis thaliana). The third is 'construct optimization', where the candidate genetic sequences are combined with different promoter sequences to develop the most suitable genetic construct. The fourth is 'commercial event production and selection', where the optimized genetic constructs are introduced into the target crop species for subsequent evaluation under greenhouse and/or field conditions. The fifth is 'introgression, breeding and wide-area testing', where a number of genetic events are identified or selected on the basis of their biological activity for introgression into the most elite germplasm. The sixth is 'regulatory science', which involves conducting regulatory science studies and generating data in the field, greenhouse, growth chambers and laboratories. The seventh and final stage is 'registration and regulatory affairs', where results of the regulatory studies are submitted to the relevant regulatory bodies to seek approval for cultivation or for import. If approval is granted, commercialization can then begin. Phillips McDougall (2011) analyzed the experiences of six major multinational companies and reported that, for a single GM event, it took them on average 11.7, 12.0, 12.7 and 16.3 years to go from early discovery of the new trait to commercial sale in canola, maize, cotton and soybean respectively.

Apart from the particular target species used, the length of time required for commercialization is also affected by the sector involved (e.g. field trials of GM trees will take longer than those involving annual crops), and the strictness and requirements of the national regulatory framework.

While looking to the future will always involve a certain degree of speculation, a short time period has deliberately been chosen in this e-mail conference to try and keep the discussion firmly anchored on those products that already are at an advanced stage of development and thus are real candidates to be commercially released in developing countries within the next five years, i.e. before the end of 2017.

Choice of a short time period is also supported by the report of a session on GM crops in the pipeline held during a workshop organized in November 2011 by the European Commission Joint Research Centre, Institute for Prospective Technological Studies (JRC-IPTS) and FAO (Lusser et al., 2012). In discussing the accuracy of the commercial pipeline of GM crops, experts noted big discrepancies in the past between the announced and actual dates of release for certain GM events and concluded that commercial pipelines are not very reliable when dealing with the longer term, and should instead be focused on events in the later stages of R&D.

This was the approach used by JRC-IPTS recently when they brought together national regulators, industry representatives, experts from national and international research institutes and actors from the global food and feed supply chain to a workshop in November 2008 and, building on this, they predicted what GM crops might be commercially available by 2015 (Stein and Rodríguez-Cerezo, 2009). Compared to 2008, they predicted that the total number of commercial GM varieties cultivated worldwide by 2015 would be far higher for those species where GMOs were already approved (such as soybean, maize and cotton) and would also include those from species that were not yet approved, such as potatoes and rice. They also predicted that a wider range of traits would be commercially available by 2015, with herbicide tolerance and insect resistance continuing to dominate but with new traits such as crop composition (mostly type/proportion of oil and starch content), virus resistance, abiotic stress tolerance and disease resistance featuring prominently among the new approvals. They also predicted that substantial numbers of the new GM crops commercialized by 2015 would be developed in Asia (mostly India and China). For some of the crops, it seems now that the number of new approvals may be lower than predicted (Emilio Rodríguez-Cerezo, personal communication).

Comparable comprehensive and detailed studies of the GMO pipeline are not available for the other food and agricultural sectors. Nevertheless, we know that, compared to crops, investments in development of GMOs are modest in livestock and fish (Vàzquez-Salat and Houdebine, 2012) and in trees (Kanowski, 2012), but that there is substantial research ongoing worldwide in these areas. For example, for forestry, Kanowski (2012) reported that over 700 field trials with GM trees of 30 genera have been carried out, most of them in the United States, of which over 70% involved Populus, Pinus and Eucalyptus species; 84 field trials have been approved in China, most with Populus and Robinia; and 18 trials of GM eucalyptus have been approved in Brazil.

In livestock, Vàzquez-Salat and Houdebine (2012) reported that a small number of countries, particularly Argentina and China, have invested heavily in GM animals for food production while more have focused on GM animals for medical purposes. In China, it is reported that nearly 800 million US dollars were invested in GM pigs, cattle, sheep and crops between 2008 and 2012 and that over 20 GM food animals are being developed, including a fast-growing carp (Maxmen, 2012). Another fast-growing GM fish, the AquAdvantage Atlantic salmon, which has been modified by the addition of a Chinook salmon growth hormone gene under an ocean pout antifreeze protein promoter, is currently awaiting commercial approval in the United States (FDA, 2010; Maxmen, 2012).

For micro-organisms, there is active ongoing research involving GMMs in all the areas described in Section 2.5 as well as in a wide range of other areas where micro-organisms are useful in food and agriculture, such as the use of GMMs to modify rumen function in livestock (McSweeney and Mackie, 2012) or to convert biomass to biofuels (Ruane, Sonnino and Agostini, 2010).

In this brief Section, it has not been our intention to provide a systematic summary of the current status of GM crops, trees, livestock, fish and micro-organisms that may soon be commercialized in developing countries. Indeed, one of the goals of this e-mail conference is to allow a full and open exchange of information from stakeholders all

around the world about the topic so that a good picture can emerge of what is likely to happen soon at the commercial level regarding GMOs in these different sectors in developing countries.

4. Specific points about this e-mail conference

This is the 18th e-mail conference to be hosted by the FAO Biotechnology Forum (http://www.fao.org/biotech/biotech-forum/en/) since it was launched in the year 2000. As with each conference hosted by the Forum, the focus is on applications in developing countries.

There are two main topics that people are asked to address in the conference:

4.1 What new GMOs are likely to be commercialized in developing countries within the next five years (i.e. before the end of 2017) in the crop, forestry, livestock, aquaculture and agro-industry sectors?

Specific questions that can be addressed regarding these new GMOs include:

4.1.1 Which species will they be?
4.1.2 Which traits will they have?
4.1.3 Will they be developed by the public sector, the private sector or through public-private partnerships?
4.1.4 Will they be produced in the developing countries themselves or, alternatively, will they be developed elsewhere (and then imported by developing countries for commercialization purposes)?
4.1.5 What kind of intellectual property management options will be exercised by the bodies commercializing these new GMOs?

4.2 What are the likely implications of these new GMOs for developing countries?

Specific questions that can be addressed regarding this topic include:

4.2.1 What are the likely implications of these new GMOs on food security and nutrition in developing countries?
4.2.2 What are the likely implications of these new GMOs on socio-economic conditions in developing countries?
4.2.3 What are the likely implications of these new GMOs on sustainable management of natural resources in developing countries?
4.2.4 What are the likely implications of these new GMOs on adaptation to climate change in developing countries?

4.3 Topics not covered by the conference

Each conference of the FAO Biotechnology Forum takes one particular theme that is relevant to agricultural biotechnologies in developing countries and opens it up for debate for a limited amount of time. This conference focuses on GMOs in the pipeline - those that are not yet released but which may be commercially available in developing countries within the next 5 years.

This conference does not include discussions on:

i) whether GMOs should or should not be used per se or the general attributes, positive or negative, of GMOs per se.

(Instead, the goal is to discuss the specific kinds of GMOs that are in the near pipeline - which ones are likely to be commercialized in developing countries within the next 5 years and what their implications may be for developing countries).

ii) GMOs which are already commercially available in developing countries

(If they are already commercially available, they are not in the pipeline).

iii) GMOs that are imported to developing countries just for consumption, i.e. for food, feed and processing.

(Instead, the conference focuses on the commercial release of the GMOs for use (cultivation/production) in the crop, forestry, livestock, aquaculture and agro-industry sectors in developing countries).

iv) The kinds of GMOs that are likely to be commercialized in developed countries within the next 5 years and what their implications may be for developed countries.

(The focus of the FAO Biotechnology Forum, and each of its conferences, is on applications in developing countries).

4.4 Instructions for sending a message

Before submitting a message to the e-mail conference, participants are requested to:
a) ensure that it addresses the topics mentioned in Sections 4.1 and 4.2 above
b) limit its length to a maximum of 600 words
c) follow the 'Guidelines for Sending Messages' contained at the end of the Welcome Text that participants receive when they subscribe to the conference. Among other things, the Guidelines note that participants: are assumed to be speaking on their own behalf and not on behalf of their employers (unless they indicate otherwise); should introduce themselves briefly in their first posting to the conference, providing also their full work address at the end of the message; and may not post libellous, insulting or defamatory messages or materials, or links to such materials and should exercise tolerance and respect toward other participants whose views may differ from your own.

5. References, abbreviations and acknowledgements

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FAO. 2001. Glossary of biotechnology for food and agriculture. http://www.fao.org/biotech/biotech-glossary/en/

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ABBREVIATIONS: ABDC-10 =3D FAO conference on 'Agricultural Biotechnologies in Developing Countries'; Bt =3D Bacillus thuringiensis; FAO =3D UN Food and Agriculture Organization; GMMs =3D Genetically modified micro-organisms; GMOs =3D Genetically modified organisms; JRC-IPTS =3D European Commission Joint Research Centre, Institute for Prospective Technological Studies.

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ACKNOWLEDGEMENTS: This document was prepared by John Ruane and Andrea Sonnino, from FAO's Research and Extension Branch. Grateful appreciation is expressed to the following people for their comments on the document: To the external referees: Dominic Glover (Wageningen University, the Netherlands, http://www.linkedin.com/in/dominicglover); Denis J. Murphy (University of Glamorgan, United Kingdom, http://staff.glam.ac.uk/users/184) and Emilio Rodríguez-Cerezo (JRC-IPTS, Seville, Spain, http://ipts.jrc.ec.europa.eu/activities/agriculture/agritech.cfm) as well as to our FAO colleagues: Devin Bartley, Paul Boettcher and Gwenaelle Dauphin.

FAO, 29 October 2012.

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Date: Fri, 2 Nov 2012 14:15:11 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: Welcome to the FAO e-mail conference on GMOs in the pipeline

Dear Colleagues,

Welcome to this FAO e-mail conference on "GMOs in the pipeline: Looking to the next five years in the crop, forestry, livestock, aquaculture and agro-industry sectors in developing countries" !! Thank you for joining.

You can send messages now (send them to biotech-mod2@fao.org). Messages will be posted from Monday 5 November onwards while the last day for receiving messages will be Sunday 2 December 2012.

We hope that the conference will be interesting, constructive and beneficial and we encourage you to participate actively. On joining the conference, you received a Welcome Text which also contains the Guidelines for Sending Messages. Here, we would like to briefly remind you of some of the main points about the running of the conference:

1. Participants should introduce themselves briefly (2-3 sentences) in their first posting to the conference. They should also provide their full work address at the end of the message. When a message is posted, we will replace @ in the e-mail address with (at) to avoid spamming.

2. Messages should not exceed 600 words

3. People posting messages are assumed to be speaking on their own behalf and not on behalf of their employers (unless they indicate otherwise)

4. No messages will be posted with attachments. If you receive a message during the conference with an e-mail attachment, just delete it without opening the attachment.

5. Messages posted in the conference will also be made available on the web, at https://listserv.fao.org/cgi-bin/wa?A0=3DBiotech-Room2-L

6. The Background Document to the conference, sent by e-mail to subscribers of this conference on 30 October, sets the scene for the conference. It is relatively short (just over 6 pages, excluding references) and we strongly encourage you to read it, especially Section 4 (reproduced below) which provides specific guidance about the topics that participants should address in the conference. The document is available at http://www.fao.org/docrep/016/ap109e/ap109e00.pdf (60 KB). Contact me (at biotech-mod2@fao.org) if you want to receive the document by e-mail.

Finally, we encourage you to tell any potentially interested colleagues or contacts about this conference. A short notice is included below for this purpose.

With our sincere best wishes for a successful conference,

John

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GMOs in the pipeline - FAO e-mail conference

From 5 November to 2 December 2012 the FAO Biotechnology Forum is hosting its next e-mail conference on "GMOs in the pipeline: Looking to the next five years in the crop, forestry, livestock, aquaculture and agro-industry sectors in developing countries". Its goal is to inform the debate about genetically modified organisms (GMOs) in the pipeline, considering the specific kind of GMOs that are likely to be commercialised in developing countries over the next five years and to discuss the likely implications of these new GMOs for developing countries. The conference is open to everyone, is free and will be moderated. To subscribe to the conference, send an e-mail to listserv@listserv.fao.org with the following one line in the body of the message (leave the subject line blank):
subscribe biotech-room2-L firstname lastname

Where firstname and lastname refer to the person's first and last name. For example, if the subscriber's name is John Smith, then the line should be:
subscribe biotech-room2-L John Smith

The background document to the conference is available from the Forum website, at http://www.fao.org/biotech/biotech-forum/en/. For more information, contact biotech-mod2@fao.org.

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[FROM THE BACKGROUND DOCUMENT - http://www.fao.org/docrep/016/ap109e/ap109e00.pdf]

4. Specific points about this e-mail conference

This is the 18th e-mail conference to be hosted by the FAO Biotechnology Forum (http://www.fao.org/biotech/biotech-forum/en/) since it was launched in the year 2000. As with each conference hosted by the Forum, the focus is on applications in developing countries.

There are two main topics that people are asked to address in the conference:

4.1 What new GMOs are likely to be commercialized in developing countries within the next five years (i.e. before the end of 2017) in the crop, forestry, livestock, aquaculture and agro-industry sectors?

Specific questions that can be addressed regarding these new GMOs include:

4.1.1 Which species will they be?
4.1.2 Which traits will they have?
4.1.3 Will they be developed by the public sector, the private sector or through public-private partnerships?
4.1.4 Will they be produced in the developing countries themselves or, alternatively, will they be developed elsewhere (and then imported by developing countries for commercialization purposes)?
4.1.5 What kind of intellectual property management options will be exercised by the bodies commercializing these new GMOs?

4.2 What are the likely implications of these new GMOs for developing countries?

Specific questions that can be addressed regarding this topic include:

4.2.1 What are the likely implications of these new GMOs on food security and nutrition in developing countries?

4.2.2 What are the likely implications of these new GMOs on socio-economic conditions in developing countries?
4.2.3 What are the likely implications of these new GMOs on sustainable management of natural resources in developing countries?
4.2.4 What are the likely implications of these new GMOs on adaptation to climate change in developing countries?

4.3 Topics not covered by the conference

Each conference of the FAO Biotechnology Forum takes one particular theme that is relevant to agricultural biotechnologies in developing countries and opens it up for debate for a limited amount of time. This conference focuses on GMOs in the pipeline - those that are not yet released but which may be commercially available in developing countries within the next 5 years.

This conference does not include discussions on:

i) whether GMOs should or should not be used per se or the general attributes, positive or negative, of GMOs per se.

(Instead, the goal is to discuss the specific kinds of GMOs that are in the near pipeline - which ones are likely to be commercialized in developing countries within the next 5 years and what their implications may be for developing countries).

ii) GMOs which are already commercially available in developing countries

(If they are already commercially available, they are not in the pipeline).

iii) GMOs that are imported to developing countries just for consumption, i.e. for food, feed and processing.

(Instead, the conference focuses on the commercial release of the GMOs for use (cultivation/production) in the crop, forestry, livestock, aquaculture and agro-industry sectors in developing countries).

iv) The kinds of GMOs that are likely to be commercialized in developed countries within the next 5 years and what their implications may be for developed countries.

(The focus of the FAO Biotechnology Forum, and each of its conferences, is on applications in developing countries).

Date: Mon, 5 Nov 2012 17:50:23 +0100
Reply-To: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Sender: "Moderated conference on GMOs in the pipeline, hosted by the FAO Biotechnology Forum" <Biotech-Room2-L@LISTSERV.FAO.ORG>
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 1: Potential GE livestock and fish

[Thanks to Jim Murray from the United States for sending in the first message of this FAO e-mail conference on "GMOs in the pipeline: Looking to the next five years in the crop, forestry, livestock, aquaculture and agro-industry sectors in developing countries". All messages will be numbered chronologically. If during the conference you notice that you are missing any messages, just contact me at biotech-mod2@fao.org ...Moderator].

My name is Jim Murray and I am a Professor at the University of California Davis. I am an animal geneticist and have worked in the area of genetically engineering livestock since 1983. I am also the Chair of the organizing committee for the biannual Transgenic Animal Research Conference, which focuses on the production of use of non-murine transgenic animals.

Two things play against there being any application of genetically engineered (GE) livestock or fish in the developing world in the next five years. One is the time it takes to develop and characterize transgenic animals for

agriculture and the second is that, to date, no GE animal has been approved for use as food anywhere in the world. While those of us developing such animals live in hope that regulatory approval will be forthcoming on a number of GE animals, at present the timeframe remains open. That said, there are a number of GE animals currently available that could potentially be of use in parts of the developing world, which I will quickly enumerate. Each of these lines of animals has been extensively studied and no detrimental effects have been identified, either for the animals themselves or for human consumption.

First, for countries with suitable environmental conditions, the AquaAdvantage GE salmon could be produced for export and thus generate economic growth. The potential for a suitable market outside the European Union exists.

Second, the EnviroPig developed in Canada has the potential to increase sustainability by decreasing the environmental footprint of pork production. Again this would depend on the economics of markets and may not be of high priority within some countries.

Third, the bovine alpha-lactalbumin GE pigs developed at the University of Illinois have the potential to increase pork production by increasing the growth of baby pigs pre-weaning.

Fourth, the human lysozyme GE goats developed at the University of California have the potential to produce milk with increased shelf life and antimicrobial activity that may help to combat childhood diarrhea.

These are probably the lines of GE animals most developed and therefore most likely to gain regulatory approval in the near term. With the advent of new techniques to increase the efficiency of gene targeting in vertebrates, it is likely that a number of new lines will be, or already are, in development to improve disease resistance or increase efficiency and sustainability of production.

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[To contribute to this conference, send your message to biotech-mod2@fao.org. For further information on this FAO Biotechnology Forum, see http://www.fao.org/biotech/biotech-forum/]

Date: Tue, 6 Nov 2012 10:33:57 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 2: Selection strategies used to develop new GMOs

My name is Didier Breyer. I have a Ph.D. in Biology from the University of Li=E8ge (Belgium). Since 1995 I have been working as senior scientist in the Biosafety and Biotechnology Unit (SBB) of the Scientific Institute of Public Health (Brussels, Belgium). I am involved mainly in the scientific evaluation and administrative follow-up of biosafety dossiers, providing scientific support to the Belgian Biosafety Advisory Council and the Belgian Competent Authorities in particular regarding the environmental release of GMOs and the placing on the market of GMOs and derived products. I am also national focal point for the Biosafety Clearing-House of the Cartagena Protocol on Biosafety.

My question relates to the selection strategies that will be (or have been) used to develop new GMOs that are likely to be commercialized in developing countries within the next five years. As you know, in the production of

genetically modified (GM) plants, the selection of the rare transformation events amongst the large number of non-transformants is a critical step. The use of antibiotic resistance marker genes (ARMGs) has been demonstrated to be very effective for this selection, cost-efficient and applicable to a large number of plant species, including many species relevant for developing countries. However, the use of ARMGs in transgenic plants is a controversial issue (specially in the European Union) and can represent an obstacle for the political/public acceptance and commercialization of GM plants.

Various strategies exist to avoid the presence of ARMGs in GM plants. They include the use of alternative selectable markers, as well as systems aiming at removing the ARMG from the genome of the GM plant following the initial transformation process. However, the effectiveness, cost-efficiency, biosafety and practical use of these strategies as compared to the use of ARMGs remains a matter of discussion.

I would be interested to know whether the presence of ARMGs in GM plants to be commercialized in developing countries has been considered an issue and whether alternative strategies have been envisaged and/or implemented. If yes, it might be interesting to have some indications on which types of alternatives have been successfully applied and/or on reasons (e.g. technical drawbacks) why alternatives have NOT been successfully applied.

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Date: Tue, 6 Nov 2012 11:33:25 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 3: Re: Selection strategies used to develop new GMOs

My name is Pushpendra K Gupta, and I work as an Emeritus Professor at CCS University, Meerut, India. I am a geneticist and crop biotechnologist by training and mainly work in the area of marker-assisted selection (MAS) in crop improvement. But I have been interested in biotech (GM) crops for many years. I have also recently published an article on regulation of biotech crops (Current Science, India; November 10, 2012). For the last 4 years, I have been a member of "Review Committee on Genetic Manipulation" (RCGM), which is a regulatory body that examines the science behind the GM crops in the pipeline.

I personally feel that the use of antibiotic resistance marker genes (ARMGs) for development of transgenics is an issue, which has been overblown, and does not pose any risk to human beings or to any other target or non-target organisms. There is no evidence that an ARMG associated with GM crops poses any risk whatsoever, and therefore, in my opinion the regulatory system of any country should ignore it and should not insist on the development of marker-free GM crops, or for using markers other than antibiotic resistance.

Pushpendra Kumar Gupta
Emeritus Professor & NASI Senior Scientist

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Date: Tue, 6 Nov 2012 13:05:17 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 4: Re: Selection strategies used to develop new GMOs

I am Adrian Dubock, project manager for Golden Rice (GR). (see www.goldenrice.org). (GR does not include a selectable marker gene.)

I write to applaud Professor Pushpendra K Gupta's comment (Message 3) on the issue: very clearly stated and correct, from my understanding.

I think the question posed from Belgium (Message 2), and the response from India (Message 3) also illustrates well an important issue: it is long overdue to start basing decisions on scientific evidence: NOT on 'public opinion'. (Who are 'the public'? We all are.) Science and policy must be prepared to stand up to correct false information.

I believe that the European Regulators have come to the same decision as Prof Gupta with respect to antibiotic selectable markers.

Adrian C Dubock PhD
Golden Rice Project Manager
Switzerland
contact (at) goldenrice.org

Date: Tue, 6 Nov 2012 16:26:10 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 5: Re: Selection strategies used to develop new GMOs

This is from Didier Breyer, again.

I am happy to see that my contribution (Message 2) on selection strategies used to develop new GMOs has generated some discussion. Let me elaborate a little bit on this topic.

From a personal point of view, I tend to agree with the conclusion that there is no scientific evidence to date suggesting that antibiotic resistance marker genes (ARMGs) currently used in GM plants have been harmful for human or animal health, or have significantly contributed to the problem of clinical antibiotic resistance.

On the other hand, the reality is that several groups, including official bodies, regulators, NGOs and the industry itself have published statements indicating that the use of GM plants devoided of any ARMGs (or at least those conferring resistance to clinically relevant antibiotics) would be preferable or strongly recommended. Although this is mainly a European concern, I think it is important to know how far this concern is shared in developing countries. I therefore thank Professor Gupta (Message 3) for commenting on this and would of course appreciate any other views.

I would like also to mention that developing marker-free GM plants can be also of interest for technical reasons, for instance for GM plants with stacked genes for which several rounds of transformation are needed, or for production of GM plants devoided of any unnecessary and/or non-native DNA sequences (e.g. cisgenic plants).

I thank Dr Dubock (Message 4) for raising the Golden Rice (GR) case. This is an emblematic example of a GMO with great potential for developing countries. And I feel this is also a good case-study for the ARMG issue. Dr Dubock mentioned in his email that Golden Rice does not include a selectable marker gene. If I am not wrong this is only partly true. To my knowledge, some GR lines have been developed by co-transformation and are therefore freed from the hygromycin resistance marker gene used for the initial selection of the transformants. Other GR lines have been developed using the mannose-based Positech(r) technology from Syngenta, which is a positive selection system based on the phosphomannose isomerase (PMI) marker gene.

On the www.goldenrice.org website, I can read that Golden Rice has been developed without the use of ARMGs for public perception reasons. This might be an indication that even in developing countries, avoiding the presence of ARMGs in GM plants might be a trigger in the development of new GMOs. I would be interested also to read other views on this.

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Date: Tue, 6 Nov 2012 17:35:18 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 6: Re: Selection strategies used to develop new GMOs

My name is Henry Lutaaya. I am a journalist from Uganda.

Though I respect the need for evidence-based decision making, I take exception to Adrian Dubock's view (Message 4) on disregarding public opinion. Although Uganda is yet to produce transgenic crops, banana and cassava being in the pipeline, our scientists say that many products have been rejected, as in not being adopted, because they don't suit people's taste - whichever way you define taste. In Uganda's case, biotech varieties that taste differently from ordinary varieties were not adopted by farmers. So public opinion is important.

Henry Lutaaya
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Date: Wed, 7 Nov 2012 11:42:57 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 7: Re: Potential GE livestock and fish

My name is Juan Chávez from Lima, Peru. I am a Professor at the Universidad Nacional Agraria La Molina. I am an Animal Scientist with a Masters Degree in Animal Production and a PhD in Biology (Animal Genetics) from Montana State University at Bozeman, United States. I also coordinate a biosafety project financed by UNEP/GEF (United Nations Environment Programme-Global Environment Facility) with the objective of implementing the Biosafety Framework in my country.

I have two questions related to Jim Murray's message (number 1).

1. What are the productive/reproductive differences between the GE animals of your list related to the conventional ones?

2. He writes: "While those of us developing such animals live in hope that regulatory approval will be forthcoming on a number of GE animals, at present the timeframe remains open". This sentence could be understood as if already there is a market demand for these GM animals in our developing countries, and that regulation is the bottleneck. Is this really the case ?

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Date: Wed, 7 Nov 2012 16:45:43 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 8: Tanzania's 'pipeline GMOs'

My name is Michael Farrelly. I work in Tanzania with small scale farmers - male and female - aiming to improve livelihoods and increase food security through improved agricultural production and access to markets, and to support farmers to develop effective and sustainable responses to climate change. Here's a link to one of our projects http://chololoecovillage.wordpress.com/.

I also take exception to Adrian Dubock's call (Message 4) to ignore 'public opinion' and base decisions solely on 'scientific evidence', particularly if that 'public opinion' includes the views of the millions of African small farmers living below the poverty line, many of whom struggle to afford any form of store-bought external input, or the views of the many NGOs and public agencies that have to pick up the pieces after the latest top down technological fix has failed to deliver. Without considering 'public opinion' how does he propose to answer the questions this discussion is supposed to address, e.g. the likely implications of GMOs on food security, socio-economic conditions, natural resources in developing countries, and adaptation to climate change? To paraphrase Clemenceau: Agriculture is much too important a matter to be left to the scientists.

To begin to address the issues: Tanzania's 'pipeline GMOs' are currently Bt / drought resistant maize, Bt cotton, and disease resistant cassava, through public-private partnerships. New intellectual property rights legislation is being set up nationally (PBR Bill / UPOV 91 accession) and regionally via COMESA (Common Market for Eastern and Southern Africa), EAC (East African Community), SADC (Southern African Development Community), ARIPO (African Regional Intellectual Property Organization) on a UPOV 91 model designed to retain the rights in the control of the large multi-national corporation seed companies. I'll come back on the likely implications.

Michael Farrelly,
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Date: Wed, 7 Nov 2012 16:46:43 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 9: Re: Selection strategies used to develop new GMOs

Jim Murray here again.

Responding to Henry Lutaaya (Message 6), I do not think the comment about public opinion was in reference to acceptability in the market place, but rather was to the role, if any, public opinion should have in the regulatory process. I happen to agree that the regulatory assessment and decision should be made based on scientific data and not on public opinion. If something is safe then it should be allowed to go to market. If the public doesn't like the taste, then it will not succeed in the market place.

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Date: Wed, 7 Nov 2012 16:48:12 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 10: Re: Selection strategies used to develop new GMO

I am Mertxe de Renobales, professor of biochemistry and molecular biology at the University of the Basque Country/EHU in Vitoria-Gasteiz (Spain). For the last 13 years, I have been teaching a course on "Transgenic Foods" in 2 undergraduate degree programs (Food Science and Technology, and Dietetics and Human Nutrition), and currently in 2 Masters programs (Food Quality and Safety, and Nutrition and Health), covering issues related to the current social debate. My interest in this conference is related to my teaching duties because students often raise questions regarding GM plants in developing countries.

As Dr. Breyer says (Message 5), the potential problems related to the use of antibiotic resistance marker genes (ARMGs) is mainly a European concern, promoted by a variety of bodies with different interests, the opinions of which tend not to be based on scientific data. I agree with Prof. Gupta (message 3) in that the issue of ARMGs has been overblown out of proportion and with Dr. Dubock (message 4) in that decisions should be made based on scientific data. In 2004, the European Food Safety Authority published an Opinion regarding the use of ARMGs in GM plants (http://www.efsa.europa.eu/en/efsajournal/doc/48.pdf). In several documents it has repeatedly concluded that the presence of ARMGs in GM plants do not pose a relevant risk to human or animal health or to the environment. Yet, certain interest groups continue to question their use.

Unfortunately, it is my understanding that many developing countries which export foods (raw materials and/or ingredients) to Europe do have to take into consideration European regulations, and attitudes. Many non-scientific views which may also influence public opinion in those countries are transposed to their countries (see R. Paarlberg, Starved for Science - how biotechnology is being kept out of Africa. Harvard Univ. Press, 2008). In my modest opinion, mentioning that Golden Rice was developed without ARMGs in its web page may be a strategy to help

promoting this excellent crop, which certain groups opposed very adamantly. Thank you for any clarifying comments on the perceptions in developing countries.

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Date: Wed, 7 Nov 2012 16:59:36 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 11: Golden Rice

Adrian Dubock again. Oops! I hoped to make a quick comment and exit, but need to respond to both Henry Lutaaya (Message 6) and Didier Breyer (Message 5).

Didier first. I was sloppy in my response. In making my comment (Message 4) I wanted to make it clear that it had nothing to do with defending a position. I meant to make clear that Golden Rice doesn't contain any antibiotic selectable marker gene, which was clearly the subject of your commentary in Message 2. You are correct Didier, the selected transformation event of Golden Rice does contain a selectable market gene PMI. For those who are not in 'the know', this is a sugar based selection, not an antibiotic selectable marker. The strategy of the Golden Rice Humanitarian Board has for many years been to select one transformation event for introgression into all locally preferred - consumer preferences and grower preferences - varieties of rice. The idea it to make registration easier and cheaper to manage. And that is what has been done. You are also correct Didier that the first 'Proof of Concept' Golden Rice published in Science in 2000 (Ye et al) utilized hygromycin antibiotic selectable marker. But the much improved constructs (Paine et al 2005) already licensed to the inventors in 2000, had several advantages and it was from careful data collection from these events, when introgressed into Asian rice varieties and in Asian climate and soils which led to THE event being selected. My view is that scientifically there is no reason not to use antibiotic selectable markers, but if they can be avoided then that's one less reason for emotional concern by some people. And I think that's what European advice is. As a non-molecular biologist I understand that there are not too many alternatives easily available.

And Henry. You are also correct. You will note above that we take account always of "consumer preferences and grower preferences". Again, it was my brevity which led to miscommunication. What I meant to say was that in matters of regulatory permissions it is science, not opinion, which must prevail. In terms of product acceptance and adoption, then that is a different matter, and subjective opinion of course is important, as with any product.

But isn't this conference meant to be about what products are coming from ag biotech in the next 5 years? Well we are very hopeful that Golden Rice will be an early entrant in the period. And the recent results (Tang et al, AJCN 2012) showing that the beta carotene from Golden Rice is better converted to vitamin A than beta carotene from spinach, and that only about 40 grams a day is expected to save both life and sight, is very encouraging.

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[1. The relevant references are

Ye X, Al-Babili S, Klöti A, Zhang J, Lucca P, Beyer P, Potrykus I. 2000. Engineering the provitamin A (beta-carotene) biosynthetic pathway into (carotenoid-free) rice endosperm. Science 287:303-305
Paine JA, Shipton CA, Chaggar S, Howells RM, Kennedy MJ, Vernon G, Wright SY, Hinchliffe E, Adams JL, Silverstone AL, Drake R. 2005. A new version of Golden Rice with increased pro-vitamin A content. Nature Biotechnology 23:482-487.
Tang, G., Y. Hu, S. Yin, Y. Wang, G.E. Dallal, M.A Grusak, and R.M Russell. 2012. β-Carotene in Golden Rice is as good as β-carotene in oil at providing vitamin A to children. American Journal of Clinical Nutrition, 96: 658-664

2. Selectable markers (mentioned first in Message 2) are genes which allow the selection of transformed cells, or tissue explants, by enabling transformed cells to grow in the presence of a certain agent (e.g. a specific antibiotic) added to the medium. To get an easily readable account of these kinds of technical aspects of FAO, please see Module A (introduction to molecular biology and genetic engineering) of the FAO Biosafety Resource Book published in 2011. The book is based on materials from the training courses organized by FAO from 2002 to 2010 in the framework of its biosafety capacity development projects and consists of five modules where special attention has been paid to avoid technical jargon and to keep the modules scientifically accurate as well as accessible to non-specialists. It also contains Module B (on ecological aspects), Module C (on risk analysis), Module D (on test and post-release monitoring of GMOs) and Module E (on legal aspects). All 5 Modules are freely downloadable at http://www.fao.org/docrep/014/i1905e/i1905e00.htm or contact sandra.tardioli (at) fao.org to receive a copy, providing your full postal address.

3. NB. As mentioned in Section 1 of the Background Document to the conference that I sent to you on 30 October, the debate on GMOs is very broad, touching on their implications for food security, the environment, biodiversity, human health, farmers income, the global food system and a number of other issues. The goal of this 4-week conference is not to cover the whole debate. Instead it addresses two main topics. First, what new GMOs are likely to be commercialized in developing countries within the next five years (i.e. before the end of 2017) in the crop, forestry, livestock, aquaculture and agro-industry sectors? Second, what are the likely implications of these new GMOs for developing countries? Before preparing a message, we kindly ask participants to carefully read the Background Document, in particular Section 4 which provides specific guidance about the topics that are to be discussed in the conference...Moderator]

Date: Thu, 8 Nov 2012 14:54:53 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 12: Re: Potential GE livestock and fish

Jim Murray here to respond to Professor Chávez (message 7), in which he asked two questions.

In Message 1, I listed four potential genetically engineered (GE) animals that are currently available and might be useful in developing countries and he wanted to know what are the productive/reproductive differences between the GE animals I listed related to the conventional ones. The AquaAdvantage salmon grow faster, reaching market weight in about 50% of the time needed for conventional salmon. They are more feed efficient. Reproduction would be controlled by the company. The EnviroPig can utilize phosphate from the plant material in the diet and thus does not need to supplemented with phosphate, and produces feces with significantly reduced phosphate, thus reducing the potential impact on surface water. This would also have to be taken into account if using the feces for fertilizing crops. Otherwise the pigs appear normal for growth, reproduction, meat quality, etc. The Illinois alpha-lactalbumin pigs show normal growth and reproduction, the impact is in weaning healthier, larger, and presumably more baby pigs per litter, thus increasing efficiency of production. Finally the lysozyme transgenic goats show normal, growth, reproduction, and lactation.

For Professor Chávez's second question, I do not know if there is a demand in developing countries for any of these animals. In the absence of regulatory approval and companies interested in marketing these animals I am not sure if the people in most developing countries are even aware that such animals exist and if there would be benefits in their countries. I would argue that lack of regulatory approval is at least one major limiting factor for the commercial development of these animals.

I would also speculate that the failure of animals like these to move forward probably limits individuals, scientists and companies in the developing world from actively considering if these animals would be useful, or more importantly to begin thinking about what types of new GE animals might be most useful in various regions of the world. Given some of the recent breakthroughs in the technology for developing GE animals, the timeframe to make new animals targeted to specific problems in specific regions of the world should not take as long as it did to develop these initial animals.

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Date: Thu, 8 Nov 2012 14:51:14 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: Message from the Moderator about the focus of this conference

Dear Participants,

This is the 18th e-mail conference hosted by the FAO Biotechnology Forum since it was launched in 2000. Each of these conferences takes a specific subject related to agricultural biotechnologies in developing countries and opens it for discussion for a limited time period (usually 4-5 weeks).

These topics have included biotechnologies in the crop sector (conference 1), in forestry (conference 2), livestock (conference 3) and the fishery sector (conference 4); their implications for hunger and food security (conference 5); the impact of intellectual property rights (conference 6); gene flow from genetically modified (GM) to non-GM populations (conference 7); the role of biotechnologies in the agricultural research agenda (conference 8); regulation of GMOs (conference 9); and the use of molecular markers for genetic improvement in developing countries (conference 10). More recent conferences have dealt with public participation in decision-making about GMOs (conference 12) and the role of biotechnologies in food processing (conference 11); for characterization and conservation of genetic resources for food and agriculture (conference 13); in coping with water scarcity (conference 14); and for production of bioenergy (conference 15). The last two conferences have dealt with successes and failures with agricultural biotechnologies in developing countries (conference 16) and, finally, strengthening partnerships in agricultural biotechnologies for the benefit of smallholders in developing countries (conference 17). The background and summery documents for these conferences as well as the e-mail messages that were posted are all available at http://www.fao.org/biotech/biotech-forum/.

This current conference focuses on 'GMOs in the pipeline'. Like the other conferences, it does not cover the whole GMO debate. Instead it addresses two main topics. First, what new GMOs are likely to be commercialized in developing countries within the next five years (i.e. before the end of 2017) in the crop, forestry, livestock, aquaculture and agro-industry sectors? Second, what are the likely implications of these new GMOs for developing countries?
It does not focus on whether GMOs should or should not be used per se or the general attributes, positive or negative, of GMOs per se. Also, it is not about GMOs which are already commercially available in developing countries (instead, the focus is on GMOs in the pipeline).

Since the conference began on Monday, I have received messages focusing on issues such as the promise of GMOs and whether they can help to feed the developing world; whether they are safe or not and their impact on the

environment; and the consumers right to choose regarding GMOs. All of these kinds of topics are important. However, they are not the focus of this particular e-mail conference to which you subscribed.

Before preparing future messages for the conference, we therefore kindly ask you to carefully read the Background Document which was sent to you on 30 October, in particular Section 4 which provides specific guidance about the topics that are to be discussed in the conference (reproduced below). People sending messages should also follow the 'Guidelines for Sending Messages' contained at the end of the Welcome Text that you received when you subscribed to the conference. Among other things, the Guidelines note that participants should not simply re-post material that they or someone else has already published elsewhere (such as press releases).

Finally, for those who have not already done it, we encourage you to subscribe to the FAO Biotechnology Forum. On doing so, you will receive a Welcome Text that provides more information about the Forum and, in the future, you will receive information about other e-mail conferences. To subscribe, send an e-mail message to listserv@listserv.fao.org with only the following one line in the body of the message (i.e. leave the subject line blank and have no other text, such as an e-mail signature, in the message):
subscribe Biotech-L firstname lastname

Firstname and lastname refer to the person's first and last name. For example, if the subscriber's name is John Smith, then the line should be:
subscribe Biotech-L John Smith

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[FROM THE BACKGROUND DOCUMENT - http://www.fao.org/docrep/016/ap109e/ap109e00.pdf]

4. Specific points about this e-mail conference

This is the 18th e-mail conference to be hosted by the FAO Biotechnology Forum (http://www.fao.org/biotech/biotech-forum/en/) since it was launched in the year 2000. As with each conference hosted by the Forum, the focus is on applications in developing countries.

There are two main topics that people are asked to address in the conference:

4.1 What new GMOs are likely to be commercialized in developing countries within the next five years (i.e. before the end of 2017) in the crop, forestry, livestock, aquaculture and agro-industry sectors?

Specific questions that can be addressed regarding these new GMOs include:

4.1.1 Which species will they be?
4.1.2 Which traits will they have?
4.1.3 Will they be developed by the public sector, the private sector or through public-private partnerships?
4.1.4 Will they be produced in the developing countries themselves or, alternatively, will they be developed elsewhere (and then imported by developing countries for commercialization purposes)?
4.1.5 What kind of intellectual property management options will be exercised by the bodies commercializing these new GMOs?

4.2 What are the likely implications of these new GMOs for developing countries?

Specific questions that can be addressed regarding this topic include:

4.2.1 What are the likely implications of these new GMOs on food security and nutrition in developing countries?
4.2.2 What are the likely implications of these new GMOs on socio-economic conditions in developing countries?
4.2.3 What are the likely implications of these new GMOs on sustainable management of natural resources in developing countries?
4.2.4 What are the likely implications of these new GMOs on adaptation to climate change in developing countries?

4.3 Topics not covered by the conference

Each conference of the FAO Biotechnology Forum takes one particular theme that is relevant to agricultural biotechnologies in developing countries and opens it up for debate for a limited amount of time. This conference focuses on GMOs in the pipeline - those that are not yet released but which may be commercially available in developing countries within the next 5 years.

This conference does not include discussions on:

i) whether GMOs should or should not be used per se or the general attributes, positive or negative, of GMOs per se.

(Instead, the goal is to discuss the specific kinds of GMOs that are in the near pipeline - which ones are likely to be commercialized in developing countries within the next 5 years and what their implications may be for developing countries).

ii) GMOs which are already commercially available in developing countries

(If they are already commercially available, they are not in the pipeline).

iii) GMOs that are imported to developing countries just for consumption, i.e. for food, feed and processing.

(Instead, the conference focuses on the commercial release of the GMOs for use (cultivation/production) in the crop, forestry, livestock, aquaculture and agro-industry sectors in developing countries).

iv) The kinds of GMOs that are likely to be commercialized in developed countries within the next 5 years and what their implications may be for developed countries.

(The focus of the FAO Biotechnology Forum, and each of its conferences, is on applications in developing countries).

Date: Fri, 9 Nov 2012 09:50:14 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 13: GE animals for human health applications internationally

My name is Dave Edwards and I am the Director for Animal Biotechnology at the Biotechnology Industry Organization (BIO) in Washington, DC. BIO is an industry trade organization for biotechnology including human health, food and agriculture, and industrial/biofuels application. I am an animal geneticist by training with a PhD from Michigan State University in swine genetics, and I work on developing and advocating policies that support biotechnology and research in public policy and funding. BIO holds a Livestock Biotech Summit every other year in which we discuss regulation, policies, and funding for animal biotechnology in food, animal health, and human health applications.

While we concentrate mainly in the United States for our advocacy work, mostly due to resources, we also track animal biotechnology development worldwide. I would like to echo the sentiment of Jim Murray (message 12) that development timelines for genetically engineered (GE) animals are currently lengthy, due to various factors including biology and regulatory delays. The use of these technologies (and especially in the next 5 years) worldwide would be increased with more predictable timelines and further investment (which is dependent on the former).

These concerns aside, my question for the conference is on the use of GE animals for human health applications internationally. So far, most questions have been on food use. That is important to us all, but I thought I would post on this slightly different topic. Many applications are currently being developed, and they could even be in a 5-year time frame to use. My thoughts on these applications will be more general, instead of specific events. They could include the production of human pharmaceuticals in plasma/milk/other harvestable tissues. They could include

animals that would not transmit certain zoonotic diseases that would impact humans as well. They could even include animals that produce vaccine components.

These animals could be bioreactors for these components at a much lower cost than setup and construction of a full manufacturing facility to grow these components in vats of media. Of course, some cost for a setup to separate components from milk or blood plasma may have to be a part of the manufacture, but mammary glands are very good at producing the necessary components from just a few animals.

Are these applications of interest to those in the developing world? Several animals with traits that would impact this area are in research barns right now, but very few have been commercialized so far. What challenges do the attendees of this conference see as hurdles for the use of these animals?

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[As written in the conference Background Document, "Outside the field of agriculture, GM animals have been approved to produce a small number of pharmaceutical proteins that are commercially available (EMA, 2012; Vàzquez-Salat and Houdebine, 2012). These include the use of GM rabbits to produce conestat alfa, the active substance in Ruconest (a medicine used to treat attacks of hereditary angioedema in adults) and the use of GM goats to produce antithrombin alfa, the active substance in Atryn (used to treat patients who have congenital antithrombin deficiency). The pharmaceutical proteins are extracted from the animals' milk". (http://www.fao.org/docrep/016/ap109e/ap109e00.pdf)...Moderator].

Date: Fri, 9 Nov 2012 11:48:18 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 14: What GM crops are in the pipeline in India?

My name is Onkar Tiwari and I am working as Scientific Officer in the Department of Biotechnology (DBT), Ministry of Science & Technology, Government of India. I am looking after the Environmental Biotechnology and Crop Biotechnology programmes in DBT.

In India, the only commercialized GM crop is Bt cotton. India is an agricultural economy. If we have to grow our food production we have to adopt newer technologies. From the starting of the transgenic technology development there have been different views expressed by different stakeholders in India and in other parts of the world. In recent times, two important bodies namely the scientific advisory committee (SAC) to the prime minister and the parliamentary standing committee on agriculture have come up with different views and set of recommendation on transgenics. The Supreme Court of India is also considering the matter. It can be expected that sooner or later everything will be streamlined in terms of regulation.

However, I would like to know that how many scientifically proven, well validated and promising GM crop products have been ingeniously developed in India that are already in the regulatory pipeline or are very near to entering the regulatory pipeline. I would also like to know where India stands in transgenic research & development in comparison to other technologically advanced countries, and how is the world looking towards India as a market place of a developing country or as a technology provider. I am curious to know about this because most of the discussion here is only focused on developing country as a market place only!

Dr. Onkar N. Tiwari,

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Date: Fri, 9 Nov 2012 17:23:34 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 15: Re: GE animals for human health applications internationally

My name is Gabriel Mutis Namur and I am a Risk analyst of agricultural and GMO products from the Colombian Institute of Agriculture (ICA). I want to comment on the issue Dave Edwards was referring to in his message (nr. 13).

In the case of Colombia and I guess a lot of developing countries, in terms of using animals as bioreactors I don't see it happening in less than 5 or maybe 10 years, not because it is not important, but due to the issue of misinformation in the general public.

The lack of risk communication and information referring to biotechnology has led to people to think that when referring to animal biotechnology you are only addressing cloning of animals or even creating mutated animals without heads or limbs to use their organs for food supplies. These comments may sound grim and even ridiculous, but sadly that's the visions the vast majority of the public have in some developing countries.

In a recent experience in September 2012 at Michigan University and Washington D.C in a short course of Agricultural biotechnology sponsored by the US government through the Cochran Fellowship Program, it clearly showed that animal biotechnology is way out of the radar for developing countries and that almost all efforts are being put into GMO crops and agricultural goods.

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Date: Mon, 12 Nov 2012 14:17:35 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 16: Bt brinjal in India

This is Mertxe de Renobales again.

I would like to ask Dr. Onkar Tiwari (Message 14) about Bt brinjal (or insect-resistant eggplant) in India. To the best of my knowledge, together with Golden Rice (about which there has been a discussion in this conference), these are the two crops in the pipeline which are closest to commercialization, but still waiting. Bt brinjal was almost released for commercial distribution a couple of years ago (I am not sure about this datum) but the permit was suddenly withdrawn. Was it due to new scientific, technological or nutritional problems which justified the delay? Or, alternatively, were the difficulties of a different nature (i.e., regulatory, socio-economic)? Thank you very much for clarifying the situation of this crop.

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Date: Mon, 12 Nov 2012 14:18:18 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 17: Re: GE animals for human health applications internationally

This is Juan Chávez, again.

Related to Message 15 of Gabriel Mutis Namur, I think the misinformation relates also to the positive potentiality of transgenesis. In my country (Peru) the main concern is about the free cultivation of genetically modified plants, because of the risk of negative effects on our biodiversity. But there are more possibilities for production of pharmaceuticals using animals as bioreactors (better if they are raised under confinement). Today we are under a moratorium law that prohibits for 10 years the free cultivation/raising of modified plants and animals, but allows research work and production under confinement, including those oriented to the pharmaceutical products for human and veterinary use.

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==========Date:
Mon, 12 Nov 2012 14:18:57 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 18: Re: GE animals for human health applications internationally

My name is Sahar Al-Bayatti. I hold a PhD in Genetic Engineering from Baghdad University and work at the Ministry of Agriculture in Iraq. I am also a member of the national Biosafety committee in the Ministry of Environment which works on putting a legislation for safety use of the biotechnology.

Respond to David Edwards in Message 13 and the comment from Gabriel Mutis Namur in Message 15:

Although I agree with Gabriel in that most of the developing countries are afraid of the genetically modified animals. But I think this is necessary at least at this time and this is because the science till now do not have enough evidence to prove the opposite do they?

Respond to David who asked about the obstacles behind the use of GE animal as bioreactors in the developing world. Let us assume that those animals will not be used for human consumption after using them as a bioreactor,

because this is a whole different issue and of course it is unacceptable. What about the ethic and religion opinion shall we ignore it? I think this issue must be solved. In conclusion I think the developing countries need more time and the scientists who are working on modifying animals need to consider the public opinion in their consideration and need to put to themselves some limit to respect before became so involve.

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Date: Mon, 12 Nov 2012 17:31:52 +0100
From: Biotech-Mod2 <Biotech-Mod2@FAO.ORG>
Subject: 19: Re: Bt brinjal in India

I am Pushpendra Gupta again (message 3).

Responding to Mertxe de Renobales (Message 16): Bt-brinjal in India is under a moratorium since February 2010 and nobody knows when the moratorium will be lifted. In my opinion, the decision was not based on science, but on public opinion. I have discussed the issue in a recent article (Gupta. P.K. 2012. Regulating the dual-use and dual-impact life science research: influenza virus versus biotech crops. Current Science (India) 103, No. 9, 10 November 2012).

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-----Original Message-----
From: Biotech-Mod2
Sent: 13 November 2012 11:27
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 20: Re: Potential GE livestock and fish (& ornamental fluorescent fish)

My name is Carlos Scotto from Lima, Peru. I am a Professor at the Universidad Nacional Federico Villarreal (UNFV) and Universidad Nacional Agraria La Molina. I am an Animal Genetic with a Masters Degree in Animal Production and a PhD in Science Biology. I also am an expert in my country in the field of biosafety hydrobiological, and CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) with objective of implementing the biosafety with transgenic fish.

Responding to Message 12 by Jim Murray: Even though the transgenic salmon grow at a faster rate (50% faster), Peru does not have the water conditions to handle it, nor does there exist a market for salmon since 70% of the aquaculture has been implemented towards trout. In the case of phosphates for pork it wouldn't apply either; in the case of lysozyme and the alpha lactoalbumin in Peruvian goats it wouldn't be successful due to the fact that that livestock are used for subsistence and due to its market being small and for the low income. I think that the crucial

point is that the GMOs made around the world are not applicable to countries like Peru because they do not solve specific problems of our countries. *[In Message 12, Jim Murray provided additional information (following up on his original Message 1) on "four potential genetically engineered (GE) animals that are currently available and might be useful in developing countries" i.e. the AquaAdvantage salmon, EnviroPig, alpha-lactalbumin pigs and lysozyme goats...Moderator]*.

I think the GMOs should be investigated and then prioritize one of them to solve a specific problem before introduction and production. In my case, there are two GMOs in Peru. The transgenic papaya with resistance to the papaya ring spot virus (PRSV) disease, produced at the Instituto Nacional de Innovación Agraria (INIA) with public funds. The other is the introduction of fluorescent transgenic fish (zebrafish) discovered in my laboratory in the year 2006 (see references below). Initially, the Green fluorescent protein (GFP) introduced was green but to this date there are other colors being commercialized. In my lab we managed to synthesize them even though the literature indicated it wasn't possible and it was even possible to hybridize them with zebrafish not transgenic.

Furthermore, today in Peru, transgenic zebrafish are commercialized at a price of one U.S. dollar; five years ago, the price of a non-transgenic zebrafish was one third of the dollar. However, since November 2011 in Peru there is a law (moratorium) that prohibits releasing GMOs until 2021. In my lab we have advanced molecular analyzes and even manage to build a mechanism to produce fluorescent fish, both native and introduced to give them greater economic value. I am convinced that ornamental fluorescent fish will have a greater acceptance than the transgenic salmon destined for human consumption for example. However, we must take appropriate biosecurity measures to prevent the "gene flow" from harming the biodiversity, although, I think a plausible alternative would be to ensure the "sterilization" of these fish to avoid damage to the fauna of native fishes.

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-----Original Message-----
From: Biotech-Mod2
Sent: 13 November 2012 16:45
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 21: Quality improved GM crops in the pipeline

My name is Pascal Tillie, I am a researcher at the Institute for Prospective Technological Studies (IPTS) which is one of the Joint Research Centres of the European Commission. I hold a PhD in Agricultural Economics and I am part of a group in IPTS whose general research focus is on the impacts of GM crops.

Recently we have been reviewing the pipeline for GM crops that present benefits for animal nutrition. This was done for the purpose of a forthcoming publication in a book, to which we were invited to contribute. This message is based on this research. We only considered in our research the events for which a least one clear "proof of concept"

exists. By proof of concept we mean a publication of results, field and/or feeding trials conducted, or a patent registered. Most of the GM events in the pipeline that we identified are not specifically developed for developing countries, but some are:

- a GM cassava with a high protein content is under development in the USA and trials have been conducted in Porto Rico. The primary objective of this GM event funded by a private foundation is to improve the nutritional quality of cassava, for people in Sub-Saharan Africa where it is one of the major staple crops [reference 1]. *[Note, after this was posted,.a participant kindly pointed out that reference 1(by Abhary et al. (2011) was recently retracted by the authors (http://www.scidev.net/en/agriculture-and-environment/gm-crops/news/gm-cassava-study-retracted-over-missing-data.html). Pascal indicates that it is not clear whether the work on this particular kind of GM cassava is still ongoing or has been terminated...Moderater]*.

- Two GM maize events are being developed in China. One provides a grain enriched in lysine [reference 2], the other has a lower phytate content [reference 3]. Less phytate in crops has nutritional, economic and environmental benefits. This latter GM event has been granted its biosafety certificate, and is approved for commercial cultivation in Shandong, while the development stage of the former less clear.

- GM rapeseed: At least two events under development in China by public institutions (high lysine [reference 4] and low phytate [reference 5]) but to our knowledge no field trials were conducted.

- GM rice: Research is conducted in China to develop a lysine-rich event [reference 6] and a low phytate one [reference 7]. They are rather in the first stage of development and no commercial release should be expected before 5 years.

- There is an important research effort currently seeking to obtain a GM sorghum (the Africa Biofortified Sorghum Project, http://biosorghum.org) with enhanced nutritional characteristics, primarily for human but also animal nutrition [reference 8]. This project involves both public and private institutions, from developing (notably South Africa) and developed countries. The event under research would be high in lysine, low in phytate, and would have a better digestibility. The first product is expected to be commercially available by 2017.

- Three different GM soybean events with a low phytate content are under research in China, but their stage of development is rather unclear [references 9, 10, 11]. Apparently no field trials have been undergone.

- Recent research results for a GM wheat with an improved lysine content developed by a public institute in China have been published [reference 12], but at this stage no cultivation should be expected in the following years.

Note, most of the quality traits that are relevant for animal nutrition also carry benefits for human nutrition. Only some are very specific to animal nutrition. For instance both the cassava and the Africa Biofortified Sorghum Project cases listed above are primarily intended for human nutrition; however they will also benefit animals that would be fed with such crops.

This review of the pipeline for GM crops with quality traits (nutritional benefit) confirms the dominant position of China as a developer of GM crops among developing countries. All of the events cited here are being developed in public institutes. For most of them, the route to commercialization is still long, but this gives an insight of the dynamism of the Chinese research institutes, despite of the careful and conservative position of the authorities regarding the commercial release of GM crops intended for food.

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-----Original Message-----
From: Biotech-Mod2
Sent: 13 November 2012 16:47
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 22: Research on subsistence crops for marginal farmers?

I am Dominic Glover, a researcher on technological change in smallholder agriculture, based at Wageningen University in the Netherlands. I'm one of the few people in the world who have read almost all of the peer-reviewed literature on the performance and impacts of Bt cotton in the 'global South' and I am sceptical about the uncritically laudatory ways in which that technology has been celebrated as a 'pro-poor' success. Bt cotton technology 'works' in a technical sense, but it is not without problems and it is not a miracle cure for poverty (Glover, 2010).

I also recently completed a literature review on the performance and impacts of transgenic crops in global agriculture, which includes a chapter on transgenic crops in the pipeline. Unfortunately, the document is not yet in the public domain but my experience in producing that document informs this message.

I have followed the discussion to date with interest and I thank the FAO for organising the conference and all the contributors for taking part. However, I am disappointed to see very little discussion so far relating to the development of subsistence food crops incorporating transgenic traits that could be of interest to resource-poor farmers.

I am thinking primarily of production traits such as drought-tolerance, nitrogen use-efficiency and salt tolerance, or basic characteristics like yield stability, hardiness/adaptation to poor soils, or suitability for intercropping.

I am aware of research programmes under way on important crops of the poor such as cassava, legumes (e.g. pigeonpea and cowpea) and sorghum. As far as I know, these programmes are prioritising traits such as nutritional improvement, insect resistance and virus resistance, all of which are traits whose value to the poorest and most marginal farmers can be questioned.

(For example:
- The Bt cotton experience shows that an insect-resistance trait cannot solve pest problems once and for all.
- Recent human feeding studies with Golden Rice confirm that that crop's beta carotene was bio-available to healthy consumers who were not particularly malnourished, which does not reflect the status of the target group of vitamin A-deficient people (Tang et al., 2009, 2012).
- Viruses are difficult to tackle because they tend to mutate very fast. A decade-long effort to develop a virus resistant crop may be wasted in a year or two if a virulent new strain of virus appears. [Was this a factor helping to explain why the famous transgenic virus-resistant sweet potato developed in Kenya did not perform well in field trials?])

In addition, every time I read about these projects on transgenic subsistence food crops, I hear that they are underfunded and struggling to overcome technical obstacles. Evidently, they remain 'orphan crops' compared to the sums invested in improvement programmes for commercial grain crops. (The possible exception is cassava, which is the focus of the BioCassava Plus project - http://www.danforthcenter.org/science/programs/international_programs/bcp/).

I would like to hear more about these and similar research programmes, especially their potential to reach commercialisation in the short- to medium-term.

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-----Original Message-----
From: Biotech-Mod2
Sent: 13 November 2012 16:48
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 23: Re: Bt brinjal in India

I am Neha Saigal from Greenpeace India working in the capacity of a sustainable agriculture campaigner.

This is in response to Pushpendra Gupta (Message 19). The moratorium on Bt Brinjal was a decision taken on science and public opinion, it is one of the best examples of democratising science and technology. There is a detailed report done by the Ministry of Environment and Forests at the time which gives scientific evidence as to why that particular product was not safe for human/animal consumption. David Andow, scientist from the United States, has done a detailed product on how Bt Brinjal was a bad product. The impacts of GM crops for developing countries go far beyond science and needs to be looked at from a socio-economic and ecological perspective.

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- Bt Brinjal: The scope and adequacy of the GEAC environmental risk assessment. August 2010. By D.A. Andow. http://www.sgm.ac.uk/pubs/micro_today/pdf/021112a.pdf (4.5 MB)

-----Original Message-----
From: Biotech-Mod2
Sent: 13 November 2012 17:11
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 24: Private sector, WEMA and PPPs

This is Tom Nickson. I work for Monsanto Company based in St. Louis, Missouri. I have worked in this company for over 30 years and have over 20 years of experience in regulatory for biotech crops. My principle expertise are in environmental risk assessment and policy having worked on the Cartagena Protocol on Biosafety, Convention on Biological Diversity and most recently the International Treaty on Plant Genetic Resources for Food and agriculture.

In keeping with the theme of this conference, I share with you links to information from the private sector (noting that a colleague from BIO has already made a posting, in Message 13). In particular, Monsanto shares publicly a lot of information on its pipeline, which can be found at: http://www.monsanto.com/products/Pages/research-development-pipeline.aspx .

I wish to highlight the Water Efficient Maize for Africa (WEMA) project, which is a good example of how public-private partnerships are tackling some of the challenges of getting improved technologies into developing countries. This project is funded by the Bill and Melinda Gates Foundation with in-kind support from Monsanto and the International Maize and Wheat Improvement Center (CIMMYT), and the project is led by the African Agricultural Technologies Foundation (AATF, http://www.aatf-africa.org/wema/). WEMA uses a strategy of deploying both GM and non-GM technologies.

In the near term (over the next 5 year) and given the limited investment in agriculture occurring in many developing countries, public-private partnerships financed by philanthropic and in-kind contributions will be an important vehicle to advance biotechnology traits/crops into the developing world. In addition, institutions like the Donald Danforth Plant Sciences Center (www.danforthcenter.org) are working hard to develop biotech-based traits like improved biofortification, nutritional enhancement and virus/disease resistance in developing world relevant crops like rice, cassava and banana.

Finally, based on some of the contributions to this conference, there appears to be interest in accessing information related to existing biotech products and those that are under development (and the information is publicly available). Here is a link that will provide valuable information. One can subscribe to the International Service for the

Acquisition of Agri-biotech Applications (ISAAA) and receive regular updates:
http://www.isaaa.org/kc/cropbiotechupdate/default.asp

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-----Original Message-----
From: Biotech-Mod2
Sent: 15 November 2012 17:45
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 25: Re: Bt Brinjal

This is Tom Nickson again.

I think the discussion on Bt Brinjal is very relevant for this conference because it is one (rare) case of a GM crop developed for a developing world agricultural system by a company in the developing world. Others have pointed out the controversy associated with this product. In particular, we've heard from Neha Saigal (Message 23) and Pushpendra Gupta (Message 19).

I made an inquiry of Mahyco, the developers of Bt Brinjal, to see if they were following this conference. Unfortunately, they were not registered, but asked if I would forward a statement on their behalf. They state:

"Mahyco developed insect-resistant brinjal or eggplant in order to provide India's 1.4 million brinjal farmers an alternative to chemical control methods for the devastating fruit and shoot borer (FSB). Bt brinjal has undergone more that 25 biosafety tests, and about 60 field trials during its development. Socioeconomic and efficacy studies have shown that farmers will benefit by reducing pesticide application for FSB by 70 % and doubling their marketable yields. In Oct 2009, Bt brinjal was approved as safe for release in the environment by the Indian regulators. The decision to place a moratorium on its commercial release was not based on the scientific evidence available, and has denied Indian farmers an opportunity to reduce chemical pesticide use on brinjal, and consumers a healthier alternative at the table."

The story of Bt Brinjal in India highlights the complexities and challenges faced by developers in getting GM crops to farmers in some developing countries. Even after completing regulatory processes, political processes at high levels within the government can become effectively an additional hurdle to market.

For more information, see http://articles.economictimes.indiatimes.com/2011-06-10/news/29643017_1_bt-brinjal-bt-counterparts-multi-location-research-trials

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-----Original Message-----
From: Biotech-Mod2
Sent: 16 November 2012 10:11
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 26: Re: Bt Brinjal

Tassawar Malik here. I am a cotton geneticist and have been engaged in official testing and release of Bt cotton in Pakistan since 2008. Also developed standard operating procedures (SOPs) for testing and release of GM crops in Pakistan. Now working as Consultant in the International Center for Agricultural Research in the Dry Areas (ICARDA)'s Pak-US Cotton Productivity Enhancement Programme (2010-15) at Islamabad, Pakistan.

I will like to discuss Bt brinjal case. Can anybody from India guide what's the position of the government /regulating authorities in putting moratorium on Bt brinjal. Were they not satisfied with the biosafety results or some other genuine issue.

Another crazy thing that has been (unofficially) reported here in Pakistan is that Bt brinjal seeds are being exported to Pakistan/ imported by Pakistani seed merchants through the Lahore boarder without any official record etc. Some researchers collected samples from the Lahore and surrounding markets to confirm the presence of the Bt gene. If Indian authorities are not comfortable with its release, its multiplication and export may be checked from both countries. One can guess that unofficial cultivation of Bt brinjal must be continuing in India as the seeds once spread in the farming community cannot be withdrawn.

One more suggestion. Genetic modifications are carried to usually to get rid of some serious stress(es). Is it possible that when that particular stress, for example fruit and shoot borer (FSB) in case of brinjal issue is totally resolved by Bt brinjal, the authorities, if not satisfied, may consider the replanting of non-Bt (traditional) seeds as they will be expected to be free from the insect/borer damage now. Is it possible in case of other crops as well?

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-----Original Message-----
From: Biotech-Mod2
Sent: 16 November 2012 11:21
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 27: Re: Bt Brinjal

This is Neha Saigal again. This is in response to Tom Nickson's response (Message 25).

I think you are right about the case of Bt Brinjal being put on an indefinite moratorium in India being very important. And I think this is for 2 reasons 1) Whether developing countries have the capacity to regulate GM crops 2) Whether there is a need for GM crops in developing countries in relation to food security.

In the case of Bt Brinjal, India is the centre of origin for Bt Brinjal and we have close to 2500 cultivated varieties of Brinjal and as many as 29 wild species. There is a high risk of contamination from Bt Brinjal to the other varieties thus putting at risk the diversity, which is very crucial for food security. Also in India we practice the Non-Pesticide Management in many parts of Andhra Pradesh that actually eliminates chemical pesticides while the Bt technology only reduces this.

The other issue is the capacity to regulate GM crops. The Genetic Engineering Appraisal Committee (GEAC) which is the apex regulatory body for environmental release of GMOs in India, has faced immense criticism and to state a credible reference Dr Puspha Bhargava who was the Supreme Court appointed member of the GEAC. Some of the credibility issues with respect to Bt Brinjal was the prevalent conflict of interest, the lack of biosafety tests and the lack of chronic toxicity tests. This is the very reason the Government of India is proposing a new regulatory body, the Biotechnology Regulatory Authority of India (BRAI), which like the GEAC does not comply with the Cartagena Protocol of Biosafety amongst many other issues.

So in my opinion Bt Brinjal clearing the regulatory process does not mean much as the regulatory procedures are inadequate. Additionally to name a few scientists who clearly warned the Government of India that Bt Brinjal was not a good product: Prof Seralini, David Andow, Doug Sherman, Dr MS Swaminthan, just to name a few. This is referenced from the report by Mr Jairam Ramesh, the then Minister of State for Environment and Forests (reference/link provided in Message 23). I would suggest participants to read this to get a better view of why there was a moratorium on Bt Brinjal in India.

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-----Original Message-----
From: Biotech-Mod2
Sent: 16 November 2012 11:44
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 28: Re: Bt Brinjal

My name is Godelieve Gheysen and I am Professor of Molecular Genetics at Ghent University, Belgium. I am a biologist with a PhD in Plant Biotechnology.

I have a question to Neha Saigal (Message 27). Can you explain to me what exactly you mean with your statement on diversity?: "There is a high risk of contamination from Bt Brinjal to the other varieties thus putting at risk the diversity,..". How can a gene that gives insect resistance to a plant by "contamination" decrease the diversity of the crop? Do you mean farmers will prefer the GM cultivars because they are useful and ignore all other cultivars, unless they get "contaminated" with the resistance gene? Natural selection will most likely not favor the insect resistant plants in the wild because insect pressure is much lower than in a agricultural field. Farmer selection can of course have a big impact on crop diversity.

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-----Original Message-----
From: Biotech-Mod2
Sent: 16 November 2012 17:12
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 29: Re: Bt Brinjal

This is Neha Saigal again, in response to Godelieve Gheysen (Message 28):

As I mentioned earlier (Message 27), India is the centre of origin and the centre of diversity for Brinjal and we have many wild and cultivated varieties. The vast wealth of plant genetic resource of brinjal have very important medicinal use in ayurveda (a traditional system of medicine in India). One of the major concerns when Bt Brinjal came up for commercialisation was the transgene flow from Bt Brinjal to wild and cultivated varieties thus contaminating the genome. The pest resistance transgene that is carried by Bt Brinjal will confer a selective advantage which might encourage weediness and invasiveness in wild relatives thereby reducing diversity.

Please do go through the report by John Samuels on "Genetically-engineered Bt brinjal and the implications for plant diversity - revisited", where I have referenced the above from (http://www.greenpeace.org/seasia/ph/PageFiles/415937/GE-Bt-brinjal-revisited.pdf, 1.3 MB).

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-----Original Message-----
From: Biotech-Mod2
Sent: 16 November 2012 17:42
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 30: Re: Bt brinjal

This is from Prof. P. Balasubramanian. I am an agricultural scientist working on GM crops meant for resource-poor farmers of India.

This is in response to Neha Saigal (Message 23). Neha states that “David Andow, scientist from the United States, has done a detailed product (sic) on how Bt Brinjal was a bad product.” Here are my arguments against those of Dr. Andow’s (which are in quotation markers). *[The reference/link to this document by David Andow was provided in Message 23...Moderator]*.

"The EE-1 transgene may be a second-rate Bt brinjal product" *[See end of message for explanation of EE-1...Moderator]*.
- The laboratory and field trials have demonstrated that the expression of Bt in EE-1 effectively controlled the target pest, Brinjal fruit and shoot borer (BFSB) (data submitted to Genetic Engineering Appraisal Committee (GEAC), Government of India).
- Early versions of Bt cotton or Bt maize carried only one Bt gene. However, the recently commercialised Bt cotton or Bt maize possess additional cry genes and they were included to broaden the spectrum of resistance as these crops are attacked more than one major target pest. In case Bt brinjal, BFSB is the major target pest.

"Possible environmental risks to biodiversity"

- Agriculture is the first and foremost risk to biodiversity. However, currently commercialized GM crops have reduced the impacts of agriculture on biodiversity and increased yields to alleviate pressure to convert additional land into agricultural use (Carpenter 2011).
- In Bt brinjal, the insecticides used against BFSB was reduced by 80%, (Krishna and Qaim, 2008).
- Bt crops promote arthropod biodiversity and biological control compared to other management tactics (Naranjo 2009; Lu et al. 2012; Marvier et al 2007)
- Bt crops can be a useful component of integrated pest management (IPM) systems to protect the crop from target pests (Yu et al., 2011)
- The US Environmental Protection Agency (USEPA 2000) examined all published reports and concluded that Bt soils had no effect on total biomass, bacteria, actinomyces, fungi, protozoa or nematodes and the C/N ratio.

"Economics of Bt brinjal cultivation"
Bt brinjal (hybrid/varieties) is expected to provide two types of benefits to the producers (higher yield due to reduction in damage from FSB infestation; reduction in cost due to savings in insecticides-use to control FSB)
- Krishna and Qaim (2008) based on Bt brinjal field trial data reported that the technology can significantly reduce insecticide applications and increase effective yields.
- Kathage and Qaim (2012) based on the data collected between 2002 and 2008 reported that Bt cotton hybrids caused a 24% increase in Indian cotton yield per acre through reduced pest damage and a 50% gain in cotton profit among smallholders

"Evolution of resistance in insects"
The insect resistance management (IRM) strategy for Bt brinjal was developed by a team of experts based on science and an understanding of the insect and brinjal cropping system. This strategy will delay the resistance development.

"Effect on human health"
Bt protein expressed in crops is unlikely to affect human or animal health.
- There is a 40-year history of safe use and consumption of foods sprayed with commercial Bt microbial pesticide products (Lemaux, 2008).
- A 15-year history of safe consumption of food and feed derived from Bt crops

Moreover, the arguments expressed by Dr. Andow's (Andow, 2010) are but his personal views (vide inside cover of the book in question; ©David A. Andow, August 2010) on Bt brinjal which appear to have never been peer-reviewed nor validated by proper experiments. The brochure was apparently promoted and published by Ms. Aruna Rodriguez herself.

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- Yu HL, Ly YH, Wu KM. 2011. Risk assessment and ecological effects of transgenic Bt crops on non-target organisms. J Integr Plant Biol., 53: 520-538
- Also, Dr. Tony Shelton's response to Dr. Andow is available at this link: http://speedy.sh/xbZ9F/Response-to-Andow-by-Tony.pdf

[Regarding EE-1, mentioned at the beginning of the message: "Bt Brinjal is the first Genetically Modified food crop in India that has reached the approval stage for commercialization.Bt Brinjal has been developed by inserting a gene cry1Ac from a soil bacterium called Bacillus thuringiensis through an Agrobacterium-mediated gene transfer. It is a genetically modified brinjal developed by the Maharashtra Hybrid Seed Company Ltd. (Mahyco), a leading Indian seed company. Bt Brinjal event EE1 has been developed in a Public Private Partnership mode under the aegis of the Agriculture Biotechnology Support Project from Cornell University where the Bt technology available with M/s Mahyco has been transferred (free of cost) to Tamil Nadu Agriculture University, Coimbatore, University of Agricultural Sciences, Dharwad and the Indian Institute of Vegetable Research, Varanasi". From a booklet prepared in 2010 for public consulations on Bt brinjal called by the Minister of State for Environment and Forests (http://moef.nic.in/downloads/public-information/Bt%20Brinjal%20Primer.pdf)...Moderator].

-----Original Message-----
From: Biotech-Mod2
Sent: 16 November 2012 17:59
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 31: Re: Bt Brinjal

I am arriving at this conference and would like to present my gratitude for all organizers and participants for being here exchanging knowledge and friendship. My name is Paulo Cezar Mendes Ramos. I am Environment analyst at the Federal Biodiversity Conservation Chico Mendes Institute in Brazil; Cordinator of the Working Group about Transgenic and Agrotoxic of the Brazilian Agroecology Association (ABA) and a Member of the National Biosafety Technical Comission (CTNBio). I have Master in Ecology, master in Agroecology and PhD in Ecology.

Related to Message 28 by Godelieve Gheysen, I would like to stress that: (i) it is unacceptable and irresponsible the introduction of the transgenic Brinjal traits at its origin center (ii) related to the biodiversity we should consider the contamination a problem without solutions. The great variety of Brinjal in their origin center can be affected and nobody knows how. There are no studies that could give reasonable answers for that. There are no studies over the effects of the transgenic as a whole on the food web. The only few studies considers the agronomic factors related to yield. (iii) contaminated species are different from the original ones and it's hard to say how these contaminated ones will affect the autoctonous populations. (iv) Bt transgenics are dangerous for the wild as a whole and dangerous for health as Neha Saigal already stressed.

Paulo Ramos
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-----Original Message-----
From: Biotech-Mod2

Sent: 19 November 2012 15:41
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 32: Re: Potential GE livestock and fish

My name is Patrick Monk, registered nurse (RN). Hospice nurse. A co-founder of Noe Valley Farmers Market, San Francisco, United States. 40 years ago cultivated 4 acre organic garden on Orcas Island, SanJuan Islands, Wa, USA. Lifelong interest in organic foods. Organiser for California's Proposition 37 requiring labeling of GM foods sold to public. I'm not a scientist, I'm a layperson here to learn, my questions will be simple please remember that in any responses. Thank you.

Responding to Message 12 (by Jim Murray):

Are the proposed new species mentioned here intra-genic or trans-genic.

In the event of deliberate release or accidental escape, particularly of salmon, will this pose a threat to, or dilute the wild stock.

Patrick Monk,
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[Just a reminder of the background: In Message 12, Jim Murray provided additional information (following up on his original Message 1) on "four potential genetically engineered (GE) animals that are currently available and might be useful in developing countries". These four were:
"First, for countries with suitable environmental conditions, the AquaAdvantage GE salmon could be produced for export and thus generate economic growth. The potential for a suitable market outside the European Union exists. Second, the EnviroPig developed in Canada has the potential to increase sustainability by decreasing the environmental footprint of pork production. Again this would depend on the economics of markets and may not be of high priority within some countries.
Third, the bovine alpha-lactalbumin GE pigs developed at the University of Illinois have the potential to increase pork production by increasing the growth of baby pigs pre-weaning.
Fourth, the human lysozyme GE goats developed at the University of California have the potential to produce milk with increased shelf life and antimicrobial activity that may help to combat childhood diarrhea"....Moderator].

-----Original Message-----
From: Biotech-Mod2
Sent: 19 November 2012 15:43
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 33: Re: Bt Brinjal

This is Prof. Balasubramanian again and my message is in response to Ms. Neha (Message 29).

In my opinion, Ms. Neha is trying in vain to project Bt brinjal as a scientific pariah (untouchable). Speaking in ayurvedic terminologies, the very popular name of brinjal in Hindi (baingan= bina gun) implies that it is not anything good. It is widely accepted that wild relatives of brinjal (the so called ayurvedic brinjals) inherently are sexually incompatible with cultivated brinjal varieties. Hence, there is no question of transgene flow from Bt brinjal and subsequent weediness and invasiveness culminating a reduction in biodiversity. I would also like to add that transgenic crops need not necessarily spoil biodiversity but global agriculture (which since the mesopatomian days up till today has repeatedly cultivated only six grasses [rice, wheat, sorghum, barley, oat and minor millets put together; not even a single dicot] as the staple food of the entire human race) certainly would. Can we ban all agricultural activities on this earth in order for saving biodiversity from disaster?

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-----Original Message-----
From: Biotech-Mod2
Sent: 19 November 2012 15:43
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 34: GM crop pipeline in India

This is Dr P. Ananda Kumar. I am a Principal Scientist working at National Research Centre on Plant Biotechnology, New Delhi, India. I pioneered the development and and field testing of Bt brinjal in 1996. I have constructed and patented codon-modified Bt genes which are deployed in Pod bore resistant chickpea and pigeonpea.

I wish to respond to the specific questions that people were asked to address in the conference in Section 4 of the Background Document:

"4.1 What new GMOs are likely to be commercialized in developing countries within the next five years (i.e. before the end of 2017) in the crop, forestry, livestock, aquaculture and agro-industry sectors?"

Response: India. Bt brinjal, Bt chickpea and Bt pigeonpea

"4.1.1 Which species will they be?"

Response: Solanum melongena, Cicer arietinum and Cajanus cajan

"4.1.2 Which traits will they have?"

Response: Insect pest resistance

"4.1.3 Will they be developed by the public sector, the private sector or through public-private partnerships?"

Response: Public sector as well as through public-private partnerships.

"4.1.4 Will they be produced in the developing countries themselves or, alternatively, will they be developed elsewhere (and then imported by developing countries for commercialization purposes)?"

Response: Developed in India

"4.1.5 What kind of intellectual property management options will be exercised by the bodies commercializing these new GMOs?"

Response: intellectual property rights belongs to national agricultural research system

"4.2 What are the likely implications of these new GMOs for developing countries?
4.2.1 What are the likely implications of these new GMOs on food security and nutrition in developing countries? "

Response:
- Chickpea and Pigeonpea: Food and nutritional security, reduction in pesticide use and protection of human health, animal health, non-target organisms, biodiversity and environment.
- Brinjal: Reduction in pesticide use, protection of human health, animal health, non-target organisms, biodiversity and environment.

"4.2.2 What are the likely implications of these new GMOs on socio-economic conditions in developing countries?"

Response: Significant improvement in the socio-economic status of poor and marginal farmers.

"4.2.3 What are the likely implications of these new GMOs on sustainable management of natural resources in developing countries?"

Response: Reduction in pesticide use, protection to soil, water and environment and biodiversity.

"4.2.4 What are the likely implications of these new GMOs on adaptation to climate change in developing countries?"

Response: Indirect benefits through environmental protection.

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-----Original Message-----
From: Biotech-Mod2
Sent: 19 November 2012 15:44
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 35: Re: Bt Brinjal

This is from Dr Suman Sahai, geneticist and currently chair of the Indian research and advocacy organisation Gene Campaign (www.genecampaign.org).

Apart from all the discussions on the problems with biosafety testing of Bt brinjal, there are other regulatory problems associated with its release.

Bt brinjal was being promoted in India but there is no system in place for food labelling. A law and a system for the labelling of GE food must precede the introduction of genetically engineered (GE) foods. India's position in the Codex Alimentarius is in support of mandatory labelling. Labeling of GE food has to be informative and make sense to ordinary people. No process of labelling will make any sense unless the consumer understands the technology and the risks associated with it. Informed consumer choice is a right. Introducing Bt brinjal without a system of mandatory labelling in place violates this right. How will GE food be labelled in a country where food is not sold only in supermarkets? Labeling will require clear segregation of Bt brinjal and non-Bt brinjal at all stages from the field to the market. There are no provisions for this to be done.

There is no liability law in India. In the event of contamination of non-Bt brinjal with Bt brinjal, there is no process of recall. Who will be liable to producers of organic brinjal? In case of adverse health impact from eating a GE food, it would not be possible to fix liability to claim compensation. There are no provisions for monitoring the long term impact of GE foods on the health of consumers.

Because pollen flow is inevitable even in brinjal which is usually self-pollinating, organic farming of brinjals would be put at risk with Bt brinjals planted in the vicinity. It would be difficult to ensure the purity of native brinjal germplasm, an issue of concern since India is the center of origin of brinjal.

The plant family (Solanacae) to which brinjal (and nightshade, dhatura and other poisonous plants) belong, has several natural toxins. Specific and sensitive tests need to be developed and conducted to detect the creation of new toxins or the resurfacing of old ones. This is a distinct possibility in a toxin rich botanical family. None of these tests have either been developed or conducted.

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-----Original Message-----
From: Biotech-Mod2
Sent: 19 November 2012 15:45
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 36: GMO pipeline in India - crops, pharma

I am Rachel Predeepa, and am currently working as Assistant Manager, Garphi Biosciences Private Limited, India. To be frank I am no way closely working with GMO products, but do have an earnest opinion on the status of GMOs in India as this is of common interest, which I would like to share.

As far as countries like India are concerned the majority of the workforce is dependent on the agricultural economy and any new technology introduced will not have wide appeal unless useful to this sector. However there are a number of controversies underpinning in implying the GMO technology for the betterment of crops for human use. As this stage is not set for discussing these controversies, let us have a closer look at where the GMO technology is moving forward.

The Government has not neglected GMO technology and its usefulness altogether. It has taken an honest initiative by laying down rules and regulatory measures to mediate the smooth commercialisation of the GMO products for the future. The website of the Indian GMO Research Information System (IGMORIS, http://igmoris.nic.in) stands evidence and provides ample information on the status and regulatory requirements for commercialisation of GMOs in India.

As mentioned elsewhere in the on-going conference, the only commericalised GM crop is the Bt cotton, and to further the commercialisation of other GM crops like tomato, rice, brinjal, maize and wheat, I wonder whether adopting technologies similar to Golden Rice or sterilisation (similar to the suggestion of Carlos Scotto in Message 20) would work. I also wonder, if the case that India is the centre of origin for Brinjal and contamination of genome be the problem, whether sequencing the genome of brinjal and studying the implications of contamination of genome using this information at in vitro and/or at in situ trial sites at genomic level might help!?!

However, GMO has not been in toto neglected. The prospects of the use of this technology in the pharma industry are successful and flourishing. Twenty such products are in wide use with wide public appeal, and one such example is Hepatitis B vaccine, which especially helped in the reduction of cost of this vaccine following its production in India, if I’m not wrong. However, not all the twenty recombinant products are synthesized using GMOs like Escherichia coli, Saccharomyces cerevisiae, etc.,.. Some of them are produced using animal cell lines, and is not within the scope of this discussion. If only more information could flow into the discussion on the booming GMOs (biologics) in the pharma sector in comparison to the agrisector will be great.

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-----Original Message-----
From: Biotech-Mod2
Sent: 19 November 2012 15:46
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 37: Re: Bt Brinjal

This is SKT Nasar from Kolkata, India joining in late on second thoughts. As a first reaction, I found the mandates in the conference Background Document, reiterated by the Moderator on 8 November 2012, somewhat restrictive. My resolve to skip this conference melted when I found messages relating to Bt brinjal in the Indian context virtually clogging the conference.

My humble submission to those discussing GM crops in general and Bt brinjal in particular is to kindly study, not just read, the report by the Committee on Agriculture (2011-2012) entitled "Cultivation of genetically modified food crops – Prospects and effects" presented to the two houses of Parliaments (India's Lok Sabha and Rajya Sabha) on 09 August 2012. This report is available at http://164.100.47.134/lsscommittee/Agriculture/GM_Report.pdf (5.7 MB). One may or may not agree with its contents, but would find answers to many questions on Bt brinjal and GM food.

In addition, alleged violation of Indian Biodiversity Act concerning Bt brinjal is under consideration of the National Biodiversity Authority (NBA).

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-----Original Message-----
From: Biotech-Mod2
Sent: 19 November 2012 15:46
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 38: GMOs in pipeline - Iran

This is from Farhad Mirzaei. I completed a Ph.D. from the Dept. of Livestock production & Management, National Dairy Research Institute (NDRI), Karnal, India (http://www.ndri.res.in) and am working at the national animal science research institute of Iran. I have 20 years experience as senior researcher. Currently, I have some projects on production management with reference to greenhouse plans.

The world's leading producers of GM crops are the United States, Argentina, Brazil, Canada, India and China. In 2005, Iran and the Czech Republic were added to the list of countries commercially growing transgenic crops. There are some research work on rice species, but not for livestock and poultry yet.

For next 5 years, I think, following to advanced countries, Iran will do some projects on GMOs, but it is not confirmed officially yet

Dr. Farhad Mirzaei,

Livestock Production & Management (Ph.D)
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-----Original Message-----
From: Biotech-Mod2
Sent: 19 November 2012 15:47
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 39: GM livestock pipeline in China

I am Abdulmojeed Yakubu, a senior lecturer of animal breeding and genetics at Nasarawa State University, Keffi, Shabu-Lafia Campus, Lafia, Nigeria.

Please I will like someone to share the experience of the latest GMOs in livestock in China.

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[Yes, insights from participants regarding GM livestock in the pipeline in China are warmly welcome. In the conference Background Document, we wrote "In livestock, Vàzquez-Salat and Houdebine (2012) reported that a small number of countries, particularly Argentina and China, have invested heavily in GM animals for food production while more have focused on GM animals for medical purposes. In China, it is reported that nearly 800 million US dollars were invested in GM pigs, cattle, sheep and crops between 2008 and 2012 and that over 20 GM food animals are being developed, including a fast-growing carp (Maxmen, 2012)". The last reference is to a News in Focus article in the 18 October 2012 edition of the journal Nature where, inter alia, Amy Maxmen wrote: "China invested nearly $800 million in transgenic pigs, cattle, sheep and crops between 2008 and 2012, says Ning Li, director of the State Key Laboratories for AgroBiotechnology in Beijing. More than 20 GE food animals are in development in China, he says, including a fast-growing carp and cows that produce milk with reduced allergenic potential. However, a Chinese researcher who asked to remain anonymous because he did not have permission to speak to the press predicts that approval for the animals will lag because the government has not determined how to ensure that the products are safe"...Moderator].

-----Original Message-----
From: Biotech-Mod2
Sent: 19 November 2012 17:45
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 40: Re: Bt Brinjal

I am Pushpendra Gupta again (message 3) and I agree with Prof. Balasubramanian (Message 33). I don't think there is any science involved in the argument that Bt Brinjal will contaminate and will thus affect biodiversity. In genetic terms, contamination does not mean anything. Related species do keep crossing in nature, and genes are introgressed, But in the case of Bt-brinjal, even this possibility is ruled out. We know, that pollen flow does occur,

but the consequences of this pollen flow is not at all alarming, since the progeny may not survive, and even if it survives, the progeny will not be fertile, thus eliminating any possibility of permanent gene transfer. Effect of GM crops on biodiversity is thus only an imagination, and cannot be explained on the basis of science of genetics.

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-----Original Message-----
From: Biotech-Mod2
Sent: 20 November 2012 14:18
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 41: GM fish in China

My name is Li Kangmin, Emeritus Professor of Freshwater Fisheries Research Center, Chinese Academy of Fisheries Sciences (CAFS), China. Here is the information on GM fish in the pipeline in China:

China conducted the first transgenic fish research in 1983. The research team led by Zhu Zuoyan (a senior researcher of the Institute of Hydrobiology, an academician of Chinese Academy of Sciences [CAS]) transferred successfully fish growth hormone gene into fertilized eggs and in 1984, developed the world's first batch of transgenic fish. On this basis, they confirmed that the integration, expression, gonad transfer, the growth-promoting effect of its expression product of the exogenous growth hormone gene in receptor fish and they established a theoretical model of transgenic fish research. However, transgenic fish research for breeding is involved in molecular biology, genetics, developmental biology, physiology, aquaculture science and ecology and other disciplines. It is difficult to further deepen the research in many laboratories after the initial attempt, now there are only a few labs to continue in China, the United States, Canada, and the United Kingdom and so on.

In recent years, he cultivated the common carp family of "all-fish" growth hormone gene; with its growth rate that is 42% faster, feed conversion ratio 18.5% higher, of which he got completely independent intellectual property rights. He clarified some related molecular biological mechanisms, set up a model, created the experimental system of the ecological safety, developed successfully the transgenic fish with ecological safety, and established an efficient farming mode of transgenic fish, thus to provide a sufficient scientific and material reserve for commercialization of the first transgenic fish.

Zhu Zuoyan has therefore developed GM fish for nearly 30 years, but so far we have not seen any GM fish commercialized in market. I don't think any government will dare commercialise the GMO crops or animals without considering the oppositions. That is why the gene-altered fish is still not commercialised on market in China, maybe in next five years, I'm not sure.

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-----Original Message-----
From: Biotech-Mod2

Sent: 20 November 2012 14:19
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 42: Re: Bt brinjal
Importance: High

This is from Bhagirath Choudhary. I am an agricultural researcher working as a national coordinator of the International Service for the Acquisition of Agri-biotech Applications (ISAAA)- a not for profit organization with biotech information nodes (BICs) in around 25 developing countries including the one in India. Ever since the Bt brinjal project was declared safe and recommended for commercial release by India's Genetic Engineering Appraisal Committee (GEAC) in October 2009, there has been a much hue and cry about every aspect of this indigenous project undertaken in the true spirit of the public private partnership in India, Bangladesh and the Philippines. I hope the participants of this conference would pay a little attention to why Bt brinjal project was undertaken and how would it help and benefit 1.4 million small brinjal farmers and more than a billion consumers of India, Bangladesh and the Philippines.

SELECTION OF BRINJAL FOR GENETIC MODIFICATION: Brinjal is a very important common man's vegetable in India. A total of 1.4 million small, marginal and resource-poor farmers grow brinjal on 550,000 hectares annually of which 50% or more is already planted with hybrids. Brinjal is prone to attack by many insect-pests, and diseases; by far the most important of which is the fruit and shoot borer (FSB), for which resistance has not been identified and thus it causes significant losses of up to 60 to 70% in commercial plantings. FSB damages brinjal in two ways. First, it infests young shoots which limits the ability of plants to produce healthy fruit bearing shoots, thereby reducing potential yield. Secondly, and more importantly, it bores into fruits making them unmarketable at harvest - it is this decrease in marketable yield, as opposed to total yield, that is the most important yield loss caused by FSB. Due to the fact that FSB larvae remain concealed within shoots and fruits, insecticide applications, although numerous, are ineffective. Farmers usually spray twice a week, applying 15 to 40 insecticide sprays, or more, in one season depending on infestation levels. The decision of farmers to spray is influenced more by subjective assessment of visual presence of FSB rather than guided by the more objective science-based methodology of economic threshold levels. This reliance on subjective assessment of visual presence leads to gross over-spraying with insecticides, higher insecticide residues, and unnecessary increase in the farmers' exposure to insecticides. On average, 4.6 kg of active ingredient of insecticide per hectare per season is applied on brinjal at a cost of Rs 12,000 per hectare; this is the highest quantity applied to any vegetable crop in India with the exception of chilli. To illustrate the importance of FSB, of the 15 recommended insecticides by the Central Insecticides Board and Registration Committee (CIBRC) for brinjal more than half, or eight are prescribed only for FSB. Typically, farmers indiscriminately apply a cocktail of insecticides on brinjal, including insecticides such as monocrotophos that are restricted or banned for use on vegetable crops. In a survey of pesticide residues in vegetable crops taken at the farm gate and markets from 1999 to 2003 confirmed that of the 3,043 samples, two-thirds were found to have pesticide residues, but these were within accepted tolerances, whereas 9% contained residues above the minimum recommended levels. The increasing amount of insecticide residues in vegetables and fruits has been a major concern to consumers who currently have no choice except to buy brinjals with high insecticide residues, but despite the application of many insecticides the brinjal fruits sold in the market are still of inferior quality, infested with larvae of FSB.

IMPACT OF Bt BRINJAL: Indian company Mahyco in collaboration with three public sector institutions namely the University of Agricultural Sciences (UAS), Dharwad; the Tamil Nadu Agricultural University (TNAU), Coimbatore; and the Indian Institute of Vegetable Research (IIVR), Varanasi have indigenously developed Bt brinjal between 2000 to 2009. It has undergone a rigorous science-based regulatory approval process in India with the compliance of two dozens of regulatory permits being issued by Indian regulatory authorities from 2000 to 2009. Studies on food and feed safety, including toxicity and allergenicity tests, have been conducted on rats, rabbits, fish, chickens, goats and cows; these studies have confirmed that Bt brinjal is as safe as its non-Bt counterpart. Similarly, environmental impact assessments to study germination, pollen flow, invasiveness, aggressiveness and weediness, and effect on non-target organisms were completed, and it was confirmed that Bt brinjal behaves in a similar way to its non-Bt counterparts. Agronomic studies showed a significantly lower number of FSB larvae on Bt brinjal, 0-20 larvae, as compared to 3.5-80 larvae on the non-Bt counterpart. Multi-location research trials confirmed that insecticide requirement for Bt brinjal hybrids was on average 80% less than for the non-Bt counterpart for the control of FSB; this translated into a 42% reduction in total insecticides used for control of all insect-pests in Bt

brinjal versus the control. As a result of the effective control of FSB, Bt brinjal's average marketable yield increased by 100% over its non-Bt counterpart hybrids, 116% over popular conventional hybrids and 166% over popular open-pollinated varieties (OPVs) of brinjal. Thus the studies mostly conducted by independent public sector institutions and submitted to the regulatory authorities confirm that Bt brinjal offers the opportunity to simultaneously provide effective control of the most important pest of brinjal, FSB, decrease insecticides for this important insect-pest by 80%, and more than double the yield over conventional hybrids and open-pollinated varieties, thereby providing significant advantages for farmers and consumers alike. At the national level it can thus contribute to food safety and security and to sustainability.

SIGNIFICANCE OF Bt BRINJAL PROJECT: Bt brinjal (both hybrids and varieties) is of particular interest for three reasons. Firstly, it is likely to be the first biotech vegetable crop commercialized in India, following the unparalleled success of the commercialization of Bt cotton which occupies more than 90% of area in 2011 in India. Secondly, Bt brinjal technology has been generously donated by its private sector developer, Mahyco, to public sector institutes in India, Bangladesh and the Philippines for incorporation in open-pollinated varieties (OPVs) of brinjal for the use of small resource-poor farmers. This royalty-free donation of Bt brinjal event EE-1 to public sector institutions is one of the true examples of private sector philanthropy and public private partnership (PPP) to advance GM crops in developing countries. Thirdly, sharing of knowledge and experience of the regulation process for Bt brinjal in India could greatly simplify and lighten the regulatory burden in Bangladesh and the Philippines by eliminating duplication of the significant effort already expended by India, thereby contributing to the important goal of harmonizing regulations between countries.

For details of Bt brinjal project, I would like participants to refer to ISAAA Brief "the Development and Regulation of Bt Brinjal in India (Eggplant/Aubergine)" that provides a comprehensive review of all aspects of the cultivation, development and regulation of Bt brinjal, which is available at:
http://www.isaaa.org/resources/publications/briefs/38/download/isaaa-brief-38-2009.pdf (2.2. MB).

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-----Original Message-----
From: Biotech-Mod2
Sent: 20 November 2012 14:19
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 43: AquAdvantage Salmon

I am Henry Clifford, senior executive with AquaBounty Technologies, the US company which has developed the GM salmon, commonly known as AquAdvantage Salmon (AAS), referred to earlier by Dr. Murray (Message 12). I am a 30+ year veteran of the global aquaculture industry, with 20+ years working with genetic improvement programs in aquaculture.

I would like to respond to the two questions posed in Message 32, with specific reference to the questions about our salmon:

A. "Are the proposed new species mentioned here intra-genic or trans-genic".

Technically our salmon is transgenic, since we transferred a gene from a chinook salmon to an Atlantic salmon (two different species), but practically speaking, it was "salmon to salmon"

B. "In the event of deliberate release or accidental escape, particularly of salmon, will this pose a threat to, or dilute the wild stock".

No it will not for the following reasons:

1. AAS are sterile (triploid),
2. AAS are all female.
3. Atlantic salmon are reproductively incompatible (cannot breed) with any of the five Pacific salmon species.
4. For reasons 1, 2, and 3, AAS are unable to establish reproductively active, self sustaining populations in the wild.
5. AAS will only be reared in land based, contained culture systems with multiple, redundant containment barriers preventing their escape into the wild. They will not be reared in sea cages.
6. Due to the unique physiological characteristics of AAS, they are actually at a competitive disadvantage in the wild when compared to wild fish populations.

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-----Original Message-----
From: Biotech-Mod2
Sent: 20 November 2012 14:20
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 44: Re: Bt brinjal

This is Neha Saigal again!

This is in response to Prof. Balasubramaniam (Message 33) and I would like to emphasise here that the opinion that Bt Brinjal will destroy the medicinal properties of brinjal due to loss of synergy, differences in the alkaloids and changes in other active principles is not mine alone but that of doctors of the Indian Systems of Medicine including ayurveda, siddha, homeopathy and unani. Please refer to page 13 of http://www.moef.nic.in/downloads/public-information/minister_REPORT.pdf (800 KB).

I also think Dr Suman Sahai (Message 35) has expressed the regulatory problems with the release of Bt Brinjal very aptly. I would also like to request Prof Balasubramanium to send references of where is it widely accepted that wild relatives of brinjal (the so called ayurvedic brinjals) inherently are sexually incompatible with cultivated brinjal varieties.

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-----Original Message-----
From: Biotech-Mod2
Sent: 20 November 2012 14:20
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 45: Re: Bt Brinjal

This is from Professor C Kameswara Rao, Executive Secretary, Foundation for Biotechnology Awareness and Education (FBAE), Bangalore, India.

The questions raised against Bt brinjal have all been answered repeatedly. I draw the attention of the Moderator and the participants to the following articles. If anyone wants, I can send pdf files of all of them.

1. Kameswara Rao, C. 2010. Moratorium on Bt brinjal. A review of the order of the Minister of Environment and Forests, Government of India. Bangalore. Foundation for Biotechnology Awareness and Education. Pp 70 http://www.whybiotech.com/resources/tps/Moratorium_on_Bt_Brinjal.pdf (5.9 MB, accessed on November 20, 2012).

2. Kameswara Rao, C. 2011. Use of brinjal (Solanum melongena L.) in alternative systems of medicine in India. Bangalore. Foundation for Biotechnology Awareness and Education. Pp. 32. FBAE, Executive summary at http://plantbiotechnology.org.in/Brinjal%20alt%20syst%20med%203.pdf (430 KB, accessed on November 20, 2012).

3. Kameswara Rao, C., Shantharam, S. and Moses, V. (2011). Bt brinjal is an important tool for the control of fruit and shoot borer. Microbiology Today, 38: 60-61. http://mag.digitalpc.co.uk/fvx/sgm/mbt/1102/ (accessed November 20, 2012).

4. Ammann, K. (20120817) (August 20, 2012). The Bt Brinjal battle in India pp 21 http://www.ask-force.org/web/Brinjal/Ammann-Brinjal-Blog-revised-20120817.pdf (1 MB, accessed on November 20, 2012).

As regards some specific issues raised in the message of Suman Sahai (Message 35):

a) Food labeling: Codex Alimentarius has not taken any decision against or for labeling GM foods. Early this month, the California State (US) has rejected the proposal to label GM foods. If someone is so vehement, GM foods can be labeled on the pack, shelf rack or the shelf, the way organic foods are announced with pride. Labeling every fruit is impossible and adds heavily to consumer costs. There is yet no evidence to show that Bt brinjal is more harmful than non-Bt brinjal, either to the consumer or the environment, to warn the public.

b) Liability laws: It is unwise to block marketing GM foods on that there are no liability laws, which are in fact unnecessary as the existing Indian laws are adequate to bring to book any fraudulent food or pharmaceutical product. Farmers have taken hundreds of crores (10 millions) of rupees as compensation claiming failure of Bt cotton.

c) Pollen flow from Bt brinjal to non-Bt brinjal: Transgenic technology does not alter the pollination or breeding behavior of any crop. The quantum of gene flow would be the same as between the isogenic and other varieties of the crop. There is a lot of evidence to show that gene flow among varieties of brinjal was negligible and this is not a scientifically valid concern.

d) Centre of origin of brinjal: That India is not the centre of origin of brinjal, but only a centre of domestication, was repeatedly emphasized in the publications listed above. There is a detailed discussion in the publication by Weese, TL & Bohs, L., 2010. Eggplant origins: Out of Africa, into the Orient. Taxon, 59: 49-56.

e) Resurfacing of new toxins: This is an utterly spurious concern. Every species of food plant belongs to a family that has species with deadly toxins. Many of the plant foods we consume can be toxic at times, which does not discourage us from consuming any of them. Bt brinjal is no more toxic than non-Bt brinjal.

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[As Codex Alimentarius and labeling has been mentioned: An item on labelling of foods and food ingredients obtained through certain techniques of genetic modification/genetic engineering had been on the agenda of the Codex Committee on Food Labelling for many years. At its 39th Session, that took place on 9-13 May 2011 in Quebec City, Canada, the Committee agreed to advance the text contained in Appendix III of the Session report (title Proposed draft compilation of Codex texts relevant to labelling of foods derived from modern biotechnology) to the 34th Session of the Codex Alimentarius Commission (4-9 July 2011, Geneva, Switzerland) where it was adopted. This "Compilation of Codex texts relevant to the labelling of foods derived from modern biotechnology" is available in English, French and Spanish from http://www.codexalimentarius.org/standards/list-of-standards/en/. The Codex Alimentarius Commission, established by FAO and WHO in 1963, develops harmonised international food standards, guidelines and codes of practice to protect the health of the consumers and ensure fair trade practices in the food trade. The Commission also promotes coordination of all food standards work undertaken by international governmental and non-governmental organizations...Moderator].

-----Original Message-----
From: Biotech-Mod2
Sent: 20 November 2012 14:21
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 46: Re: Bt brinjal

This is P. Ananda Kumar again. I pioneered the development and field testing of Bt brinjal in 1996.

Bt brinjal is absolutely essential to protect the health of human beings, other mammals, non-target organisms, soil, water, biodiversity and environment in general. Bt genes may escape from GM brinjal to normal brinjal in a natural way but it will not adversely affect the brinjal. The chances of gene transfer by natural inter-specific crossing are extremely negligible and are not a matter of great concern. “Contamination” refers to something that is harmful. Since Bt gene and its protein products are innocuous the phenomenon of gene transfer cannot be termed “contamination”. The origin of Solanum melongena is a matter of controversy since 1930s. Recently, scientists have proposed African origin for S. melongena. India can only be termed as a centre of brinjal diversity. Bt brinjal will not affect brinjal diversity in any manner. There is a need to transfer Bt genes to as many traditional varieties as possible to reduce the use of pesticides thereby protecting human health. Bt has been under extensive use by organic farmers all over the world for several decades and hence Bt crops can very well fit into the concept of organic farming. Brinjal, which is part of our diet for several centuries, does not have any toxins harmful to human health. The internationally accepted protocols for food safety testing address the concerns of unintended effects of GM crops including Bt brinjal.

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-----Original Message-----
From: Biotech-Mod2
Sent: 20 November 2012 14:17
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 47: Re: Quality improved GM crops in the pipeline

I am Mertxe de Renobales again.

I thank all contributors for the information provided in this conference regarding Bt Brinjal in India. After reading it carefully, it is my conclusion that the commercialization of this interesting crop was not realized because of non-scientific reasons. I understand that these reasons are beyond the scope of Section 4 of the Background document, so I will not mention them again.

Adding to the list of quality improved GM crops in the pipeline provided by Pascal Tillie (Message 21), and understanding "in the pipeline" as being at least at the field trial phase, I want to mention a multivitamin-containing corn developed by a research group from the (public) University of Lleida (Spain). According to the investigators, it is destined to small farmers from developing countries and it contains up to 169-fold the normal amount of beta-carotene, 6-fold the normal amount of ascorbate, and double the amount of folate. It was created from an authochtonous South African corn. It is an open pollinated variety (not for hybrid production) of modest productivity, but farmers will be able to keep their seed. The researchers have decided to make it freely available to poor farmers. Field trials are now being conducted in Spain (http://gmoinfo.jrc.ec.europa.eu/gmp_report.aspx?CurNot=B/ES/12/38).

Reference: S. Naqvi et al., "Transgenic multivitamin corn through biofortification of endorsperm with three vitamins representing three distinct metabolic pathways". PNAS 106(19), 7762-7767, 2009.

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-----Original Message-----
From: Biotech-Mod2
Sent: 20 November 2012 17:08
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 48: Genetic modification of insects for pest control

My name is Camilla Beech and I am the regulatory manager for an SME company called Oxitec Ltd, based in the UK.

I would like to make the conference aware of some very different applications of genetically engineered (GE) animals, namely those of GE insects for the control of pest insects in both agriculture and human health. These were not listed in the conference background document but are very much tools that will be available within the 5 year timeframe under discussion. *[Insects that are genetically modified for agricultural purposes were not specifically mentioned in the Background Document, but are indeed relevant to this conference on 'GMOs in the pipeline in developing countries'...Moderator]*.

Pest insects are devastating in terms of agricultural/horticultural losses and for the transmission of human diseases such as dengue and malaria. The pesticides used in controlling mosquitoes are largely ineffective, as not all breeding sites can be accessed and mosquitoes are increasingly resistant to them. The World Health Organisation estimates that there are between 50 and 100 million cases of dengue each year, and these are only the reported cases, many more go undiagnosed. There is no therapeutic treatment for dengue and a vaccine is someway off. Therefore new tools are urgently required to control the populations of the dengue mosquito.

The technology is based on enhancement to the sterile insect technique (SIT), that has been used for over 50 years, where insects are mass-reared, made sterile (usually through irradiation) and then released regularly at inundative ratios to mate with wild populations. The resulting offspring do not survive and therefore the population is subsequently controlled. The irradiation used to sterilise insects is too damaging for many species and makes high levels of training and security necessary. For some insect pests, there are no methods for cheap, large scale rearing or to separate the sexes. Oxitec has developed a new solution which will replace the need for irradiation and make it easier to sort males from females – making SIT more affordable, even safer, and applicable to a wider range of pests. Oxitec has inserted genes that confer a dominant conditional lethality to the insects, so the progeny of matings with released insects do not survive to adulthood. The approach is targeted at a single species, unlike conventional insecticides or pesticides which kill insects indiscriminately. This means that, as well as being more effective, it is much better for the environment than conventional pesticides. One advantage is that all the modified insects contain a heritable, fluorescent marker to distinguish them from native pest insects and to help scientists with the management of pest control programmes through monitoring (an essential component of any insect control program).

For Aedes aegypti, the mosquito that transmits dengue fever there have already been open field trials of the modified mosquito in Grand Cayman, Malaysia and Brazil and the results have shown that population suppression can be achieved by 80-85% despite immigration of mosquitoes to the area (Harris et al, 2012; Lacroix et al, 2012). The approach is targeted towards disease endemic countries as a potential tool to control the mosquito populations that transmit diseases such as dengue and the World Health Organisation has produced a draft common framework for risk assessment which is currently available for public consultation (http://www.who.int/tdr/news/2012/guidance_framework/en/index.html)

However the approach is also suitable for the control of agricultural pests and we have strains of Plutella xylostella, Pectinophora gossypiella, Ceratitis capitata, Anastrepha ludens, and Bactrocera oleae containing the conditional lethal traits, as well as working on emerging pests such as Tuta absoluta. The United States Department of Agriculture (USDA) in 2009 produced an environmental risk assessment for genetically engineered fruit flies and pink bollworm that concluded it was the “environmentally preferable alternative” in pest control programs when examined against other alternatives (http://www.aphis.usda.gov/plant_health/ea/downloads/eis-gen-pbw-ff.pdf (3.4 MB).

All products should be assessed on their merits as well as potential risks and we should not dismiss potentially valuable tools that offer real solutions in developing countries just because they have been produced by genetic modification, when many exotic biocontrol agents are being released without such burdens. In fact we should look to the well established biocontrol regulatory regimes as a template for guidance on how to use genetically modified/engineered insects.

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- Harris, A.F., McKemey, A.R., Nimmo, D., Curtis, Z., Black, I., Morgan, S.A., Neira Oviedo, M., Lacroix, R., Naish, N., Morrison, N., Amandine C., Stevenson, J., Scaife, S., Dafa'alla, T., Fu, G., Phillips, C., Miles, A., Raduan, N., Kelly, N., Beech, C., Donnelly, C.A., Petrie, W.D., and Alphey, L. (2012) Successful suppression of a field mosquito population by release of engineered male mosquitoes. Nature Biotech., 30:828-830

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From: Biotech-Mod2
Sent: 20 November 2012 18:03
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 49: Regulatory pipeline for Africa - crops

My name is Jose Falck-Zepeda. I am a Senior Research Fellow at the International Food Policy Research Institute (IFPRI) and Leader of the policy team for IFPRI's Program for Biosafety Systems (PBS). I have worked most of my career in the socioeconomic assessment of GM crops and in the evaluation of plant breeding outcomes in developed and developing countries. This has included on-the-ground experience conducting surveys with producers and implementing socioeconomic impact assessment studies, as well as, literature reviews and extensive interactions with regulators, policy and decision makers. Furthermore, I have worked on examining science, technology and innovation policies and in addressing R&D, science and technology capacity in developing countries. Lately I have been working on examining issues related to compliance with national measures for biosafety and the Cartagena Protocol on Biosafety including the cost of compliance, implications of the time value of money of regulatory delays, and trade-offs involved with decision making.

With some colleagues here at IFPRI/PBS and through our extensive network of national and regional partners, we have compiled a list of those GM technologies undergoing confined field trials in Africa. Some, but not all, may come into commercialization approval within the 5 year time horizon described in the conference background document. We have not included technologies currently in contained use evaluation such as the bio-fortified sorghum and weevil resistant sweet potato in Kenya, a viral resistant tomato in Egypt, and several technologies being tried in South Africa which we could not identify proponent or stage. Note that many of these technologies are public-private and public-public partnerships. Even those listed with one proponent, usually means that is the main proponent, but is likely to be a consortium of research organizations.

Table of advanced GM technologies in Africa

Country	**Crop**	**Trait under testing**	**Stage**	**Partners**
Uganda	Maize	Drought tolerance	CFT, 2nd season	NARO, AATF
Uganda	Banana	Bacterial wilt resistance	CFT	NARO, AATF, IITA
Uganda	Banana	Nutrition enhancement (Fe and Pro-vitamin A)	CFT	NARO, QUT
Uganda	Cassava	Virus resistance	CFT, 2nd season	NARO, Danforth Plant Sci. Center, IITA,
Uganda	Cotton	Bollworm resistance and herbicide tolerance	CFT, 3rd season	NARO
South Africa	Maize	Drought Tolerant		African Agricultural Technology Foundation (AATF) ; Monsanto (USA)
South Africa	Cassava	Biofortified and modified starch		HarvestPlus
South Africa	Sugarcane	virus resistance, increased yields, alternative products		
South Africa	Maize	Maize IR resistant to MSV		U. of Cape Town, Pannar Seed Co.
South Africa	Potatoes	IR		Agricultural Research Council (South Africa), Michigan State University (US)
South Africa	Sorghum	Biofortified		ICRISAT, the U of Pretoria, the Kenya Agricultural Research Institute (KARI), the Agricultural Research Council for South Africa (ARC), the Burkina Faso Environmental and Agricultural Research Institute (INERA) and the Institute of Agricultural Research (IAR) in Nigeria
Burkina Faso	Cowpea	IR	CFT	AATF, NGICA, IITA, CSIR, Monsanto

Egypt	Maize, Zea mays	Insect resistance	CFT	Pioneer, AGERI
Egypt	Cotton, Gossypium barbadense	Insect resistant	CFTs	ARC
Egypt	Wheat, Triticum durum L.	Drought tolerant	CFTs	AGERI
Egypt	Wheat, Triticum durum L.	Fungal resistance	CFTs	AGERI
Egypt	Wheat, Triticum durum L.	Salt tolerant	CFTs	AGERI
Egypt	Potato, Solanum tuberosum L.	Viral resistance	CFTs	AGERI
Kenya	Maize, Zea mays l.	Insect resistance (Insect Resistant Maize for Africa against stem borers)	CFTs	KARI, CIMMYT, Monsanto, University of Ottawa, Syngenta Foundation for Sustainable Development
Kenya	Maize, Zea mays l.	Drought Tolerance (WEMA)	CFTs 2nd season	AATF, CIMMYT, KARI, Monsanto, Bill & Melinda Gates Foundation' -Howard G. Buffett Foundation
Kenya	Cotton, Gossypium hirsutum L.	Insect resistance (bollworms)	CFTs completed, Environmental release application to be submitted in 2012	KARI/Monsanto
Kenya	Cassava, Manihot esculenta	Disease resistance (cassava mosaic viral disease)	CFT 1st season	KARI, Danforth Plant Science Center

Kenya	BioCassva Plus	BioCassva Plus, Enhanced levels of iron and zinc, protein, Vitamin A and E	CFT 1st season	Donald Danforth Center, KARI, IITA, CIAT
Nigeria	Cassava (*Manihot esculenta)*	Increased level of beta-carotene (Provitamin A)	CFT, 3rd season	DDPSC, NRCRI
Nigeria	Cassava (*Manihot esculenta)*	Nutrition enhancement for increase in iron level	CFT 2nd season	DDPSC, NRCRI
Nigeria	Cowpea (*Vigna unguiculata*)	Insect resistance	CFT, 3rd season	AATF, NGCIA, IITA, Purdue University; Monsanto, Rockefeller Foundation USAID, DFID, CSIR, INERA, The Kirkhouse Trust, IAR
Nigeria	Sorghum (*sorghum bicolor*)	Bioavailability of iron, zinc, protein, vitamin A	CFT	Africa Harvest, Pioneer Hi-Bred International Inc.; CSIR, ICRISAT; AATF, FARA. University of Pretoria, Agricultural Research Council; UCB, IAR

Sources for the individual country data in the Table are:
Burkina Faso (source: Karembu, M. et al (2009), authors' compilation); Egypt (Karembu M. et al. (2009), authors' compilation); Kenya (Karembu M. et al. (2009), authors' compilation); Nigeria (Dore M., (2011) personal communication); South Africa (CERA (2010), authors' compilation); and Uganda (Wafula D. & Sengooba T., (2011) personal communication).

In terms of the impact of these technologies in the pipeline, the focus of many of these crops will be on crops and traits with an increased emphasis on food security and nutritional considerations –some of these technologies are anticipated to also raise income as cash crops- so the expectation is that the economic impact will be at least the same if not better than what we have observed with existing technologies. We have conducted an extensive literature review of existing publications with an identifiable degree of peer review (Smale et al. 2009). You can review the literature database here http://ebrary.ifpri.org/cdm/search/collection/p15738coll6/searchterm/%20case%20studies/mode/exact). There are approximately 252 papers with an identifiable peer review approval process in this database.

Our conclusion in the Smale et al (2009) review is that that the evidence from ex ante and ex post studies show there are (potential and observed) tangible net economic benefits to the adoption of GM crop technologies in developed and developing countries. These results are quite variable in terms of crops, traits, location and producers. These same studies have shown other direct and indirect impacts derived from the adoption of this technology including reductions in some pesticides while others may increase, a shift to less toxic chemistries, support of integrated pest management, adoption of sustainable agricultural practices such as low-till and no-till agriculture and others. Our conclusions for the 2009 literature review were later supported by meta-analysis conducted by Areal et al. 2012 and Finger et al 2011 specifically for cotton, and by our multiple socioeconomic studies which we have conducted on site. More on the impact issue later.

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References on socioeconomic impacts of GM crops:

Areal, F. J., L. Riesgo, and E. Rodriguez-Cerezo.. 2012. Economic and agronomic impact of commercialized GM crops: a meta-analysis. Journal of Agricultural Science, doi:10.1017/S0021859612000111

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Special Issue AgbioForum “Farmers and Researchers Discovering Biotech Crops: Experiences Measuring Economic Impacts among New Adopters” Melinda Smale and José Falck-Zepeda, Guest Editors, Vol 15, Num 2, 2012. www.agbioforum.org

-----Original Message-----
From: Biotech-Mod2
Sent: 21 November 2012 17:51
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 50: Re: Bt Brinjal

I am E.M. Muralidharan from India. I work for a publically funded forestry research organization and am involved in different aspects of research in biotechnology of forestry species.

I thought it would be relevant to the ongoing discussion on GM crops in India, particularly on Bt Brinjal, to point out that a mass petition was recently submitted to the Supreme Court of India, signed by at least 100 scientists, urging that the recommendations of the court-appointed Technical Expert Committee (TEC) be implemented. The TEC had earlier advocated a moratorium or ban on open field trials of different categories of GM crops until certain criteria were met. The Government of India had opposed the findings of the report.

It would be a mistake, I feel, to show haste in deployment of GMOs without first reconciling the issues that has been raised against them, even if some of them are not based on science. That would go a long way in making the technology acceptable to a larger section of the public eventually. As pointed out by Suman Sahai (Message 35) the important issues are that the regulatory system is not as well established as one would want it to be, to be effective and there are issues such as labeling and liability laws that have not even been discussed in the public sphere.

The prevalence of illegal GM cotton in India and of Bt brinjal across the border in Pakistan (Tassawar Malik, Message 26) is itself an indication of the ground reality when it comes to effectiveness of regulatory systems.

On the other hand, the advancements made within India in the area of GMOs are too extensive and with great potential, albeit for the future, to be stifled with a blanket ban. Scientific options are available to overcome potential risks given a larger time frame. My suggestion then, is that GM crops in the pipeline remain there for a while and we address in the meanwhile the issues that have made the technology so unpopular to a large section of the people who are the intended beneficiaries.

All things considered it is best that research and contained field trials be permitted under strict regulatory supervision and transparency, so that the technology and its impact is studied in its entirety and reviewed later for implementation when regulatory mechanisms and an effective infrastructure to implement them are in place.

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-----Original Message-----
From: Biotech-Mod2
Sent: 21 November 2012 17:52
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 51: Re: Bt Brinjal

This is from C Kameswara Rao again, responding to Message 44 from Neha Saigal with a request for references on sexual incompatibility among varieties of brinjal. Besides published literature, my familiarity with pollination and reproductive behavior of species of Solanum comes from three of my co-researchers who worked on inter-specific hybridization in the genus at the Andhra University a long time ago.

The anthers (pollen sacs) in potato, tomato and brinjal are tubes with a terminal pore (characteristic of the genus Solanum) through which the rather sticky pollen cannot easily come out and also cannot be easily air borne. In tomato, the pollinators (bumble bees) hang on to the anther column and ‘sonicate’ by a very rapid vibratory movement of the wings to force out a small quantity of pollen. In potato, tomato and brinjal, insects can take the nectar without touching the anther tips or the stigmas and so insect visitation is not an evidence of pollination and mere pollination is not an evidence for hybridization. This fact would certainly be appreciated by those who know the floral structure of brinjal and its pollination behavior and not those who simply circulate popular misconceptions.

On experimental hybridization among species of Solanum supposedly related to brinjal, Rao and Rao (1984) found the chances for fertile F1 progeny were extremely low and fertile F2 progeny was not obtained. When experimental hybridization was difficult, the chances for natural hybridization are far less. There is no evidence to show that transgenes enhance sexual promiscuity among related varieties and species.

A small quantum of cross-pollination may occur even in the most rampantly self-pollinated crops. Cross-pollination can be of concern only when its incidence results in hybrid seed (F1) and then only if fertile F2 population results from the F1 seed. Even this is of no consequence if there was no selection pressure for the new gene(s) to be fixed in the population, which would require at least five or six generations. It is only the scientists who know the species and those who work with the crop understand its reproductive behavior but not even those in other areas of biology. Pollen flow data generated during Bt brinjal evaluation and most literature that is available indicate that brinjal is over 90 per cent self-pollinated, outcrossing was less than 2.7 per cent and pollen migration distance is about 20 meters (see Chaudhary and Gaur, 2009 for details).

Cultivated brinjal does not run wild and no appreciable volunteer or feral populations are known. Farmers are quick to detect changes in crop features and qualities and have grown for decades different varieties of brinjal in neighbouring fields without ever complaining that the varieties were not breeding true. The fact that there is a large number of cultivars of brinjal is in itself an evidence that the quantum of cross-breeding in brinjal need not be a matter of concern.

No crop variety is successful outside the cultivated field where it is heavily pampered, with irrigation, fertilizers and crop protection chemicals. Without such protection, non-Bt brinjal plants and hybrids would rapidly succumb to pests and diseases. What would happen if the Bt gene in Bt brinjal gets into a non-Bt brinjal variety? A new Bt brinjal variety without effort or expense.

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-----Original Message-----
From: Biotech-Mod2
Sent: 22 November 2012 09:12
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 52: Re: AquAdvantage Salmon

My name is Philipp Aerni. I currently work at FAO on a project on payments for environmental services in agriculture. I wish to respond to Message 43.

In 2004, I published a paper on the regulation of transgenic salmon in 2004 ('Risk, regulation and innovation: the case of aquaculture and transgenic fish' in the Journal 'Aquatic Sciences'). In this paper, I argue that the development of transgenic salmon needs to be understood in the historical context. It represents one of the business responses to the challenge of dealing with risk (overfishing), regulation (discouraging unsustainable fish harvesting practices) and innovation (moving from fish catching to fish farming). Transgenic salmon resulted from the need to address environmental and fish health concerns in aquaculture as well as the need to produce more fish with less resources in view of the growing global demand. Disease resistant, fast growing, and sterile fish would allow to make existing aquaculture sites less prone to disease outbreaks, less risky to genetic introgression between bred and wild salmon (escaped sterile fish are normally unable to reproduce) and more productive (slowing down expansion of aquaculture into environmentally sensitive coastal areas). There is no doubt, that there are also risks involved with respect to the release of transgenic salmon, but after 15 years of risk research there is not much evidence that the risks would be any different from the risks that are already known from existing aquaculture practices and fish breeding techniques. In turn, the existing risks in commercial aquaculture, fish breeding and high sea fishing remain real and are likely to increase with increase in global demand for fish. So far, policy makers have failed to address the growing need to produce more healthy and safe fish with less environmental impact. In this context, the case of regulation of transgenic salmon in the United States illustrates how policy makers tend to discourage investment in innovation in fish farming through costly regulation. The general experience in the area of green biotechnology

shows, however, that more regulation does not decrease but actually increases public anxiety. Those who benefit most from this trend are the incumbents in the fish industry. They do not feel pressure to innovate because of high barriers to market entry caused by prohibitive regulation. As a consequence, concentration in industry is likely to increase and the usual Schumpeterian life cycle of technological change from a technology as a tool of domination to technology as a tool of empowerment is delayed substantially. This will have a negative impact on the sustainability of fish farming on the long-run.

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-----Original Message-----
From: Biotech-Mod2
Sent: 22 November 2012 09:18
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 53: Re: Bt Brinjal

This is Prof. Balasubramanian again in response to Message 44 posted by Ms. Neha Saigal and Message 51 posted by Prof. K. Rao.

While thanking Dr Rao for having answered Ms. Neha's query on my behalf, I have a question to Ms Neha again. Can Ms. Neha get me a peer-reviewed evidence for the claim made by her (that Bt Brinjal will destroy the medicinal properties of brinjal due to loss of synergy, differences in the alkaloids and changes in other active principles) on behalf of the doctors of Indian systems of medicine including ayurveda, siddha, homeopathy and unani? She wrote in her Message 44: "I would like to emphasise here that the opinion that Bt Brinjal will destroy the medicinal properties of brinjal due to loss of synergy, differences in the alkaloids and changes in other active principles is not mine alone but that of doctors of the Indian Systems of Medicine including ayurveda, siddha, homeopathy and unani".

Looking forward to her valuable reply in this regard through this conference.

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-----Original Message-----
From: Biotech-Mod2
Sent: 22 November 2012 10:35
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 54: Re: AquAdvantage Salmon

Hello, Adrian Dubock again.

I am very encouraged by the exchange of views in the conference about the Bt Brinjal case. I understand that such clarity of exchange from the scientists was not practical in the noisy atmosphere of the 'public consultation' meetings organized by the Minister of Environment in India.

I am also encouraged by Philipp Aerni's erudite comments in message 52. One of my sons is a marine biologist and ecologist and has also made me more aware of some of these issues. Philipp, I am particularly interested in your statement about the delays to "the usual Schumpeterian life cycle of technological change from a technology as a tool of domination to technology as a tool of empowerment". Please can you provide a reference or two where I can understand this concept and its origins more fully, as it seems to me to potentially apply much more widely than fish technology, and I have never come across it before.

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-----Original Message-----
From: Biotech-Mod2
Sent: 22 November 2012 13:58
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 55: Re: AquAdvantage Salmon

This is Philipp Aerni again, responding to Adrian Dubock (Message 54).

Thanks for the interest. Schumpeter himself discussed the role of technological change in his seminal book 'Socialism, Capitalism and Democracy' (http://books.google.it/books/about/Capitalism_Socialism_and_Democracy.html?id=6eM6YrMj46sC&redir_esc=y). There are also my own publications where I link his argument to the current debate on sustainable development:

Aerni, P. Agricultural biotechnology and its contribution to the knowledge economy. Adv. Biochem. Engin./Biotechnol. 107: 69-96 (2007)

Aerni, P. Learning from the Past: How to bring ethics and economics in line with the real nature of the human being: In M. Cockell et al. (eds) Common Knowledge: the Challenge of Transdisciplinarity. EPFL Press, Lausanne: 15-30 (2011)

Plus some online publications:
- Aerni, P. 2006. Mobilizing science and technology for development: The case of the Cassava Biotechnology Network (CBN). AgBioForum, 9(1), 1-14. http://www.agbioforum.org/v9n1/v9n1a01-aerni.htm

and

Aerni, P. 2007. Exploring the Linkages of commerce, higher education and human development: A Historical review. ATDF Journal Volume 4, Issue 2
http://www.afee.ethz.ch/people/Staff/aernip/Publications/History_Higher_Ed-2.pdf (200 KB).

Then is also our most recent African Technology Development Forum (ATDF) journal issue on 'Technology as a Tool of Empowerment': http://www.atdforum.org/spip.php?article499

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[Thanks to Philipp for responding to the request from Adrian for references on Schumpeter. This thread is now cut...Moderator].

-----Original Message-----
From: Biotech-Mod2
Sent: 22 November 2012 17:51
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: More than halfway through this FAO e-conference on 'GMOs in the Pipeline' - Moderator's message

Dear Participants,

Firstly, a big thanks to all of you who have sat down and submitted messages to this FAO e-mail conference on "GMOs in the pipeline: Looking to the next five years in the crop, forestry, livestock, aquaculture and agro-industry sectors in developing countries".

The conference began on Monday 5 November and lasts 4 weeks, so we are now more than halfway through the e-mail conference. The last day for receiving messages is Sunday 2 December 2012. These final messages will be posted on Monday 3 December and the conference is then closed.

In the remaining time that is left, I encourage you to continue the discussion about the conference's two main topics. First, what new GMOs are likely to be commercialized in developing countries within the next five years (i.e. before the end of 2017) in the crop, forestry, livestock, aquaculture and agro-industry sectors? Second, what are the likely implications of these new GMOs for developing countries?

I note so far, that no messages have yet considered the issue of new GMOs in the forestry sector. Also, the conference Background Document described the many areas in food and agriculture where GM micro-organisms are currently being used (e.g. in food processing, in animal nutrition, for metabolic modifiers and for production of vaccines). No messages have yet have yet considered the issue of new GMO micro-organisms for any of these purposes.

I remind you that all of the messages posted in the conference are available at the searchable website https://listserv.fao.org/cgi-bin/wa?A0=Biotech-Room2-L (note, you do not need to log in to read them). To see the messages sorted by date (latest on top), see https://listserv.fao.org/cgi-bin/wa?A1=ind1211&L=Biotech-Room2-L&O=D&H=0&D=1&T=1

Finally, I conclude by hoping that you will find the rest of the conference to be interesting, constructive and beneficial and by reproducing Section 4 (below) from the conference Background Document which provides specific guidance about the topics that participants should address in the conference. The document is available at http://www.fao.org/docrep/016/ap109e/ap109e00.pdf (60 KB). Contact me (at biotech-mod2@fao.org) if you want to receive the document by e-mail.

With best regards

John

John Ruane, PhD
Moderator,
E-conference on GMOs in the pipeline,

From: Biotech-Mod2
Sent: 23 November 2012 13:26
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 56: New GM crops for developing markets

My name is Jonathan Shoham. Until about 18 months ago I worked for Syngenta, where I founded and headed the Business Intelligence function. In this capacity I monitored all external trends likely to have an impact on the business, including biotechnology. I am currently working as an independent consultant based in Haslemere, Surrey, UK. In this capacity I am managing a database of public-private partnership (PPPs) which I set up for the Syngenta Foundation for Sustainable Agriculture and also act as agricultural adviser for the business intelligence company Prognoz. My comments all relate to crops.

Most of the contributions about crops to this conference so far have focused on work going on in the developing countries themselves, for example the very useful inputs from Pascal Tillie (Message 21) and Jose Falck-Zepeda (Message 49). As also mentioned, China is investing heavily in this area. However the bulk of R&D investment in GM crops comes from the leading seed companies – Monsanto, Syngenta, DuPont/Pioneer, Bayer, Dow and BASF. Their combined spend on seed R&D is around $3 billion and I would estimate around half of this is on GM. Many of the traits developed as a result have been launched. However even where traits have been launched their use is often limited to a relatively small number of countries. According to the International Service for the Acquisition of Agri-biotech Applications (ISAAA), currently only around 30 countries have so far launched GM crops, although the number grows every year and growth is much faster in emerging markets than the developed world.

There are various reasons for relatively low number of countries where GM crops have so far been launched. For example:

- Bio-safety regimes may not be developed. I recently read that only 5 of the 50+ countries of Africa have bio-safety regimes in place
- There may be political opposition to GM crops even where the regimes are in place

Whatever the reasons the corollary is that there is potential for traits already launched in some countries to be rolled out to others as the regulatory and political environment improves and this could lead to greater uptake of GM crops in developing markets. For example herbicide tolerance in soybeans is the single largest trait in area terms and used on over 90% of the crop area in the US, Argentina and Brazil, but has yet to be launched in China or India, the 4th and 5th largest soybean producers in the world. In addition to traits already commercialized the major R&D companies also have new traits in their pipelines which could be launched in developing markets over the next few years.

To help identify existing and new traits which might be launched within the next 5 years in developing markets I have prepared the table below. This distinguishes between different types of traits as this can influence their acceptability. There is more sensitivity around 'consumer traits' than traits directed at the farmer. Likewise there is a lot more resistance to traits in food crops than in those crops used primarily for processing, as exemplified by what has happened with Bt brinjal in India, and the delays to Bt rice in China.

GM traits so far launched and [in development] in the major crops					
Crop	Herbicide tolerance (HT)	Insect resistance (IR)	Disease resistance/ Agronomic traits	Processor/Consumer traits (e.g. bio-fortification)	Comments/scope for technology transfer
Maize	Glyphosate resistance Glufosinate resistance Dicamba resistance 2,4-D resistance [HPPD resistance]	Bt vegetative insecticidal protein (VIP)	Drought tolerance [Nitrogen use efficiency]		[WEMA project in East Africa]
Soybeans	Glyphosate resistance	[Bt]		Healthy oils	Scope to expand HT and IR to (other) developing countries
Cotton	Glyphosate resistance [Glufosinate resistance] [Dicamba resistance]	Bt [VIP]	[Drought tolerance]		Bt cotton the most widely used trait in emerging markets so far
Canola	Glyphosate resistance Glufosinate resistance			[Healthy oils]	
Sugar	[Glyphosate	[Bt]			Initially being developed in Brazil

Cane	resistance]				but potential in many emerging markets
Rice		[Bt]	[Drought tolerance] [Nitrogen use efficiency] [Salt tolerance]	[Golden rice]	Launch of Bt rice in China would be highly significant Agronomic traits unlikely before 2017? Not clear if all these traits are GM or native traits
Wheat			[Ug99]		

[ ] denotes under development

Finally, I developed a PPP database of public-private partnership in agriculture, especially those aimed at smallholders in emerging markets, for the Syngenta Foundation For sustainable Agriculture. This contains more information on the some of the traits already mentioned by other contributors – e.g. Water Efficient Maize for Africa (WEMA), bio-fortification projects - and can be found here:
http://www.syngentafoundation.org/index.cfm?pageID=745

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-----Original Message-----
From: Biotech-Mod2
Sent: 23 November 2012 13:28
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 57: Re: Bt brinjal

I am Devi and I have worked on sustainable agriculture and safe food issues in the US, Europe and India and am currently associated with Thanal (Kerala), an advocacy and research group, and Urban Leaves (Mumbai), a volunteer group, in India.

I was (like someone said before in this conference) planning to be a silent participant, just to understand different viewpoints, however feel compelled to speak up due to the bias I feel in the discussion. The fact of the matter is that peer reviewed papers can parse the truth any which you frame the research question and they do not make for the only source of truth in the world.

As regards Bt brinjal, it is not wise for a highly populated yet richly bio-diverse nation to take a dismissive stance about its biodiversity. The answer is to the question is we have to calibrate our activities so that our valuable resource of biodiversity is not further eroded, the respected The Economics of Ecosystems and Biodiversity (TEEB, http://www.teebtest.org/) initiative clearly points out the inextricable link between poverty and loss of biodiversity, and that Millennium Development Goals (MDGs) are at risk due to loss of biodiversity. Their report that clearly shows that India is already threatened by loss of biodiversity.

The Parliamentary Standing Committee of India representing the federal government, cutting across party lines has given a detailed analysis of GM crop situation in India and has clearly asked for a relook at the Bt brinjal decision as it said that the whole thing "indicative of collusion of worst kind" and has recommended a "thorough probe into the Bt brinjal matter...by a team of eminent scientists and environmentalists" (page 72 of the Parliamentary Standing Committee report). *[The link to this report by the Committee on Agriculture (2011-2012) entitled "Cultivation of genetically modified food crops – Prospects and effects" was given in Message 37...Moderator]*.

A technical expert committee formed at the behest of the Supreme Court of India has released their interim report last month and recommended among other things a 10 year moratorium be imposed on field trials of Bt food crops and a multi-disciplinary stakeholder evaluation be done of herbicide tolerant crops before even considering them in the Indian context. (http://indiagminfo.org/wp-content/uploads/2012/10/SC-TEC-interim-report-oct17th-2012-GMO-PIL.pdf - 1.5 MB).

To say that "Bt brinjal is absolutely essential to protect the health of human beings, other mammals, non-target organisms, soil, water, biodiversity and environment" (Message 46) to me sounds more asking for blind faith and prayer rather than peer reviewed science !! Might be interesting to read Dr.Altieri's "Ten reasons why biotechnology will not ensure food security, protect the environment, and reduce poverty in the developing world" (http://www.agbioforum.org/v2n34/v2n34a03-altieri.htm).

As regards the generous donation of Bt brinjal event and its incorporation into open pollinated varieties (Message 42) is currently a case of bio-piracy, in which the govt has initiated action (details: http://www.esgindia.org/campaigns/press/nba-confirms-monsantomahyco-and-ors-be-c.html).

Therefore, I think that quoting from some peer reviewed papers (or non reviewed) is not sufficient to understand the implications of and decide on whether Bt brinjal is a good product, appropriate for the Indian context, whether the Indian industry and regulatory authorities have done the due diligence and whether our society, people, polity and agriculture system will benefit from it or be harmed by it.

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-----Original Message-----
From: Biotech-Mod2
Sent: 23 November 2012 13:29
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 58: Re: Bt Brinjal

Neha Saigal again with my response to Dr Rao (Message 51)

One of the first issue, I would like to emphasise, based on Dr. John Samuels' report *[referenced in Neha's message nr. 29...Moderator]*, is that the probability of crop-to-wild gene flow depends on the geographic distribution of crops and their wild relatives (Jenczewski et al, 2003). In this context there is a caution being raised on Bt Brinjal in India as it is at least a centre of diversity, if not a centre of origin for brinjal. Brinjal eggplant is 'an often cross-pollinated crop' (Singh, 2009) with up to 70% cross-fertilization (Daunay et al 2001). Chaudhary & Gaur (2009) state that Solanum pollen is sticky, an adaptation which facilitates insect-pollination and, if it becomes insect borne then the pollen may travel kilometres rather than 20 metres, as stated by Dr Rao.

To make my other point, I will refer to Norman Ellstrand's paper (Phil. Trans. R. Soc. Lond. B, 2003. 358: 1163–1170. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1693201/pdf/12831483.pdf - 180 KB). If a transgenic crop is released in regions where wild relatives grow, we would expect that spontaneous hybridization will occur. Insect-resistance is a beneficial trait to the plant, and therefore, the Bt gene might be expected to spread through the wild population. This also applies to landraces and weedy populations.

Regarding the statement made by Dr Rao towards the end of his Message 51: "What would happen if the Bt gene in Bt brinjal gets into a non-Bt brinjal variety? A new Bt brinjal variety without effort or expense", the following applies.

Spreading of the Bt transgene into these populations has implications for ecology and agricultural biodiversity. The Bt gene provides a plant with resistance to certain insect pests. This gives the plant a selective advantage that might encourage aggressive growth. Coupled with the strong tendency for these brinjal relatives to sprout where not planted, such GE contaminated plants could become overbearing weeds. In addition, there are concerns regarding possibility of toxic effects on non-target organisms – for example, beneficial insects – raising the risk of effects at the species population level.

Traditional cultivars and landraces are considered valuable resources as they may contain traits in their genes (e.g. drought resistance) which may be needed in the future. However, these genetic resources will be compromised if contaminated by GE genes, such as genes from GE Bt brinjal. Concerns regarding the outcrossing of GE crops to local relatives, including GE Bt crop, have been expressed many times in the peer-reviewed literature (e.g. Ellstrand op cit. and Halfhill et al. (2005) Molecular Ecology 14: 3177–3189) for other more widely cultivated crops, but not, as yet, for brinjal. Absence of evidence is not evidence of absence. It is not clear whether non-GE brinjal will remain uncontaminated, and this risk needs to be evaluated (Andow, 2010). In this regard it is best to adopt the precautionary principle as stated in the Cartagena Protocol on Biosafety which is the international standard to regulate GMOs. And this is exactly what India did in the case of Bt Brinjal.

And finally, I would like to point out that there is something called "choice" and every farmer whether in the developed or developing world should have this "choice". And this becomes especially important for farmers who grow their crops organically, they would not want their fields to be contaminated by the Bt gene and will not share the same sentiment as Mr Rao does in his email.

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-----Original Message-----
From: Biotech-Mod2
Sent: 23 November 2012 13:25
To: 'biotech-room2-L@LISTSERV.FAO.ORG'

Subject: 59: Re: Bt brinjal

I am Sylvia Uzochukwu from the Department of Food Science and Technology of the University of Agriculture, Abeokuta, Nigeria. I am a Biosafety Specialist in the area of GMOs.

I salute the great Scientists that have contributed to this conference so far. With reference to Message 53, I am also waiting eagerly to be educated by Neha Saigal's response to message 53.

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-----Original Message-----
From: Biotech-Mod2
Sent: 24 November 2012 06:39
To: biotech-room2-L@LISTSERV.FAO.ORG
Subject: 60: Re: Bt brinjal

This is John Samuels joining the conference. Appologies for being a late arrival! I am a plant taxonomist, based in the United Kingdom, working independently on the Solanaceae family. I have a PhD in Plant Taxonomy (Solanaceae-brinjal wild relatives) and have worked in this field since the 1980s. I would like to contribute to the Bt brinjal discussion, focusing here on the potential for transgene transfer between Bt brinjal and other solanaceous species.

1. Interfertility relationships between brinjal and its wild relatives in India:

Ms. Saigal (message 44) posed the question regarding evidence of sexual incompatibility between brinjal and its wild relatives. This was based on Prof. Balasubramanian's statement (message 33) that brinjal wild relatives are inherently sexually incompatible with cultivated brinjal. (At this point it is important to make clear the difference between cultivated brinjal (Solanum melongena L., the brinjal eggplant) and its wild relatives in India, some of which are also known as brinjals (for example, bitter brinjal, Solanum virginianum L.) and are completely different species.

Prof. Rao's response (message 51) refers specifically to one study of the 1980s, performed in India (Rao & Rao, 1984), which looked at the success rate of sexual crosses between brinjal and five other related species. They found, as Prof. Rao states, that certain cross-combinations were unlikely to produce fertile progeny. However, it is crucial to mention that they also found that crossing brinjal with S. violaceum Ortega (a common ruderal weed) gave a successful two-way cross, producing vigorous, highly fertile F1 hybrids!

Many similar investigations involving brinjal and other closely-related species have been performed; useful summaries can be found in Daunay et al. (1991), Kashyap et al. (2003) and Rao (1979). More importantly, it is noteworthy that six wild relative species and four cultivated Solanum species found in India are known to be able to cross with brinjal to produce hybrids with measurable fertility Samuels (2012a). Message 51 also suggests that the chances of natural hybridization taking place are very low. In contrast to this, there is a considerable body of opinion that adheres to the idea that brinjal and its closest wild relatives can freely interchange genes by natural hybridization (e.g. Karihaloo & Rai, 1995; Meyer et al., 2012; Weese & Bohs, 2010). There is also a comparably large body of opinion which supports the idea that brinjal exists in feral form (see Karihaloo & Rai, 1995) and, like most solanums, will readily adapt to a ruderal or adventive mode of survival.

2. The brinjal centre of origin of controversy:

Dr. Kumar (message 46) and Prof. Rao (message 45) referred to the centre of origin of brinjal-this is a relevant consideration in relation to the possibility of transgene transfer. The exact whereabouts of the centre of origin of brinjal is still open to discussion. Recent reference has been made to the African "origins" of S. melongena (e.g. Weese & Bohs, 2010). However, this relates to S. incanum L., the putative progenitor of brinjal. This species had its origins in East Africa and, as it evolved, migrated across north-east Africa, the Middle East and into northern India (Samuels, 2012b). It therefore seems likely that brinjal domestication took place in India, and one of the most recent genomic analyses supports this (Meyer et al., 2012). But, in the context of Bt brinjal, the crucial relevance of the centre of origin is not so much its precise location, as the fact that brinjal wild relatives will be found there (Samuels, 2011). Indeed, in India, of approximately 50 Solanum species (wild and cultivated) found there, 23 species belong to the three sections with the potential to form fertile hybrids with brinjal (Samuels, 2012a). Added to this, India is certainly one of several centres of diversity of brinjal, comprising many ancient, traditional and modern landraces and varieties of the crop.

I hope that this helps to put into context the relevance and importance of the two main points above.

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-----Original Message-----
From: Biotech-Mod2
Sent: 25 November 2012 07:17
To: biotech-room2-L@LISTSERV.FAO.ORG
Subject: 61: Re: Potential GE livestock and fish

Jim Murray here again to respond to Patrick Monk (Message 32).

All of the species I mentioned are transgenic, although I am not sure that matters given that the regulatory paradigm used in the US considers a genetic construct containing only sequences from the intended target (i.e. all cow sequences in a gene construct for use in a cow) as a transgene. I am not sure what you mean by the term intra-genic though and how that relates to breeding using an inter-generic cross, say American bison crossed with European cattle to create beefalo (meat from which is available today), or the very many crosses of this type performed regularly during plant breeding. Keep in mind that cultivars like seedless watermelon have been made by inducing triploidy, which essentially gives the plant one additional copy of every watermelon gene and thus would fall into what I think you mean by intra-genic manipulation.

With specific reference to the AquaBounty transgenic Atlantic salmon, studies would indicate that it would not pose a significant risk to the wild stock for a number of reasons, including (1) grower stocks are intended to be all female, triploid fish (which are sterile), (2) in breeding tests artificial streambed environments the transgenic fish are at a mating disadvantage, (3) the proposed growing location is a landlocked facility in Panama, where there are no wild stocks, with a large number of physical and environmental barriers to survival of escaped (or released) fish, and (4) previous attempts to establish "wild" Atlantic salmon breeding populations in the Pacific ocean have failed. That said, I think other GE fish would need to be looked at on a case by case basis.

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-----Original Message-----
From: Biotech-Mod2
Sent: 26 November 2012 10:26
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 62: GM crop pipeline in Pakistan

I am Dr Yusuf Zafar, Director General Agriculture & Biotechnology of the Pakistan Atomic Energy Commission (PAEC), Islamabad, Pakistan. I served 32 years in agri-biotech sector of the country and presently have an official assignment in Vienna, Austria. I was part of the team which developed and released Biotech cotton (Bt cotton) in the country which now cover nearly 3.0 million hectare and readily accepted by farmers.

I wish to respond to the specific questions that people were asked to address in the conference in Section 4 of the Background Document:

"4.1 What new GMOs are likely to be commercialized in developing countries within the next five years (i.e. before the end of 2017) in the crop, forestry, livestock, aquaculture and agro-industry sectors?"

The following crops are already approved by the national biosafety committee for contained field testing in Pakistan: Cotton, wheat, sugarcane and corn

"4.1.1 Which species will they be?"

Gossypium hirsutum (cotton), Triticum aestivum (wheat), Saccharum sps (sugarcane) and Zea mays (hybrid maize)

"4.1.2 Which traits will they have?"

- Virus (Gemini) resistant cotton, insect resistant cotton, herbicide tolerant cotton, drought/salt tolerant cotton – single or stacked forms
- Herbicide and drought/salt tolerant wheat
- Drought/salt tolerant sugarcane
- Insect resistant/herbicide tolerant hybrid corn

"4.1.3 Will they be developed by the public sector, the private sector or through public-private partnerships?"

All GM crops except GM corn have been developed by the public sector. In few cases public sector obtained support from the foreign universities/ research organization. The private sector (multi-national corporations) conducted field evaluation of insect/herbicide tolerant GM corn and waiting for final approval. Private sector is also conducting contained field evaluation of insect resistant and herbicide tolerant hybrid cotton.

"4.1.4 Will they be produced in the developing countries themselves or, alternatively, will they be developed elsewhere (and then imported by developing countries for commercialization purposes)?"

GM corn is exclusively imported and so is hybrid cotton. All other GMOs i.e. open-pollinated variety (OPV) cotton, wheat and sugarcane have been developed indigenously by the public sector.

"4.1.5 What kind of intellectual property management options will be exercised by the bodies commercializing these new GMOs?"

Private sector patented their technology in the country while public sector also managed their technology assets by following national patent laws.

"4.2.1 What are the likely implications of these new GMOs on food security and nutrition in developing countries?"

Wheat, corn and sugarcane are among top five major crops of Pakistan. If field performance would as per claim, it will boost productivity in marginal lands.

"4.2.2 What are the likely implications of these new GMOs on socio-economic conditions in developing countries?"

Epidemic of cotton leaf curl virus is one of the major challenges to cotton production and virus resistant GM cotton have been vigorously pursued for nearly 2 decades. Expected to realize cotton vision of 2015 of 20 million bales of cotton. The textile is the major (65%) export commodity.

"4.2.3 What are the likely implications of these new GMOs on sustainable management of natural resources in developing countries?"

It is expected to stop migration from the marginal rural areas (salt and drought affected villages) to fertile lands/urban areas.

"4.2.4 What are the likely implications of these new GMOs on adaptation to climate change in developing countries?"

The major thrust is on salt and drought tolerance which are emerging threats in the backdrop of climate change. These attempts will contribute to mitigate adverse effects especially drought and salt tolerant wheat, sugarcane and cotton.

Pakistan has ratified the Cartagena Protocol on Biosafety and is founding member of WTO/TRIPS. All statuary bodies (though weak) are in place. National biosafety committee already approved 108 cases of GM crop development (labs., greenhouse, contained field testing) and several cases are now pending for commercial release especially GM hybrid corn.

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-----Original Message-----
From: Biotech-Mod2
Sent: 26 November 2012 10:22
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 63: Indigenous GM crop technology for developing world

This is from Anup Karwa. I am a bio-entrepreneur and one of the founders of Krishidhan Seeds Group India, a three decade old plant breeding and agribiotech group of companies. I am also founder of KRFPL (Krishidhan Research Foundation Private Limited) which focuses on basic and applied plant biotechnology research. KRFPL was established with an aim to develop indigenous technologies and undertake technology business incubation. KRFPL is engaged in engineering durable insect & herbicide resistance and abiotic stress tolerance in key crops. Our vision is to incubate indigenous technologies and transform research leads into commercial products.

I would like share some of our efforts we have initiated in the last 8 years in India to develop indigenous GM technologies in key crops that are envisaged to be commercialized in next 5 years time frame.

1) We are developing proprietary marker free Bt eggplant and have deployed indigenous Bt gene(s). This technology is likely to be taken forward in regulatory studies and trials very soon and envisaged to be commercialized by 2014-15.

2) We have novel thermo-tolerant technology solution that can tackle high temperature stress (ranging from 50-60 Degree Celsius) and drought tolerance (DT) in key crops like maize, wheat, pearl millet and cotton.

3) We have indigenous herbicide resistance technology being engineered in maize and other crops likely to be commercialized as insect resistant (IR) and broad herbicide tolerant (HT) maize by 2016. Although, such traits would make the crop more durable and help stabilize yield under adverse changing climatic conditions.

4) A short recent press release on this technology and others can be read at
http://www.KrishidhanSeeds.com/media.html

Our dominant aim has been to incubate innovation driven indigenous package of technology which will offer better cost effective solutions and choices to Indian and other developing world farmers.

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-----Original Message-----
From: Biotech-Mod2
Sent: 27 November 2012 18:20
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 64: Re: Bt brinjal

This is from Aruna Rodrigues. I am the lead Petitioner in the Supreme Court of India for a moratorium on GM crops in the absence of proper regulation and rigour in the oversight of GM crops, (on-going since 2005). I am submitting the following facts based on affidavits to the Supreme Court. There have been several comments on the case of Bt brinjal in India (message nos: 14, 16, 19, 22, 23, 25, 26, 27, 28, 29, 30, 33, 34, 35, 36, 37, 40, 42, 44, 45, 46, 47, 50, 51, 53, 54, 57, 58, 59). This is a reply to them collectively; and necessary in order to set the record straight in this international conference because of assumptions and suppositions being made without the science to back these statements, by several proponents of GM crops.

For those who have asked the question: are there problems with the safety of Bt brinjal, (?) the answer is an unqualified "yes", based on the assessment of the Mahyco-Monsanto safety dossier by eminent independent international scientists and based on the fact that Monsanto have quite simply not done the tests required in a stringent risk assessment and hazard identification protocol; the dossier is also not compliant with the letter and spirit of the Codex Alimentarius and the Convention on Biological Diversity.

The scientists who appraised various section of the raw data of the dossier include (but are not limited to), Profs Dave Schubert, Jack Heinemann, David Andow, Arpad Pusztai, Gilles-Eric Seralini, Judy Carman, Lou Gallagher, Doug Gurian-Sherman. It is also necessary to also put the record straight about Prof Balasubramanian's strong insinuation that casts aspersions on both Prof Andow and me – ref Message 30. This is uncalled for, because it is quite simply in deliberate error. It is also therefore, in poor taste. The slur on Prof Andow is particularly unfortunate as he has done India a great service. The US National Academies of Science on behalf of Minister Jairam Ramesh (erstwhile Minister of the Ministry of Environment and Forests, MoEF) who had requested the US NAS to ask leading scientists to respond to his review process of Bt brinjal), approached Prof Andow. Given his undeniable credentials, I too requested Prof Andow whether he would take up the ERA (environment risk assessment) of Bt brinjal, not merely a tome-of-an-undertaking, but to boot that I could not offer him a fee for doing so! In return however, I would publish his research. It is odd indeed that Prof Balasubramaniam emphasises peer review for Prof Andow's ERA of Bt brinjal. Peer review is necessary in certain cases as an absolute requirement. Such an absolute requirement was Monsanto's dossier of Bt brinjal for the obvious reason that the food and diet of over 1 billion people would be affected by such a release. This dossier based on the appraisal of it by several leading scientists mentioned above would fail peer review. Monsanto of course habitually keeps its dossiers secret (ref the case of Mon 863. They tried to do the same with bt brinjal –see below). It is also relevant to clarify that the thrust of the Supreme Court process for the last 8 years has been to prove (a) inadequacies in regulation (b) the serious conflict of interest that exists in the regulators and (c) provide documented evidence of the significant gaps in risk assessment protocols exemplified by the case of Bt brinjal. The need and challenge was to find scientists who have an impeccable record as independent scientists and who are internationally renowned for their work in GM science in their respective fields.

The case of Bt brinjal is the test case for India. It is the only event for which a biosafety dossier was executed by the crop developer Mahyco-Monsanto and put into the public domain by the MoEF because of an Order of the Supreme Court in the case of Aruna Rodrigues (AR) & others. Even so it took 15 months for the Regulator and Monsanto to comply with this Order under threat of contempt of court (eventually in August 2008). Its assessment as stated above by several independent international scientists must be balanced against a self-assessed dossier by Monsanto and as it is now known, with virtually no regulatory oversight by the Indian regulators. The Mahyco-Monsanto Bt brinjal dossier was found formally deficient by the erstwhile Minister of the MoEF Shri Jairam Ramesh on serious grounds of a lack of independent studies and studies not done, particularly long term studies for chronic toxicity. The moratorium on Event EE 1 is indefinite until risk assessment is addressed to the satisfaction of the scientific community.

Subsequently, a two year enquiry by India's Parliamentary Standing Committee (PSC) on the 'Cultivation of Genetically Modified Food Crops – Prospects and Effects' completed in Aug 2012, has been severely critical of

India's regulatory system with its heavy entanglement in conflict of interest across connected institutions: The official press release of the PSC (9 August 2012) says: "----these developments are not merely slippages due to oversight or human error but indicative of collusion of a worst kind, they have recommended a thorough probe into the Bt. brinjal matter from the beginning up to the imposing of moratorium on its commercialization by the then Minister of Environment and Forests (I/C) on 9 February, 2010, by a team of independent scientists and environmentalists". (Ref. PSC Recommendation: Para No. 2.79).

The PSC in the matter of the Department of AYUSH (traditional Indian Systems of Medicine), a matter which has also been raised in this forum, states: "In view of the serious reservations expressed by the Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy about the likely impact of transgenics in agricultural crops on the medicinal value of various plants, the Committee have sought a detailed explanation from GEAC about action they had taken on the advice of Department of AYUSH while approving commercial release of Bt. brinjal. The Committee have also sought a detailed explanation from Ministry of Environment and Forests on their refusal to co-opt the representative of Department of AYUSH to the GEAC right away, when Bt. brinjal was approved for commercial release and several other crops having medicinal propriety are already being assessed/approved by RCGM/GEAC" (the regulators). (Ref. PSC Recommendation: Para No. 6.149 and 6.150). *[The quotation is also from the same press release as above...Moderator]*.

In the final analyses, civil society requires it to be demonstrated by Regulators they can impose trust in, that Bt brinjal is safe on multiple dimensions. I will post emails, separately addressing various aspects of the appraisal of Bt brinjal, of clear relevance to this forum's objectives under 4.2 and several posted messages.

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-----Original Message-----
From: Biotech-Mod2
Sent: 27 November 2012 18:27
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 65: Re: Bt brinjal

This is Aruna Rodrigues again. As a new-comer to this conference and with just days to go for the deadline to post replies on this subject, I am responding collectively to all those who have posted their responses on Bt brinjal – I will be posting a couple more on different aspects of the independent scientific appraisal of the Mahyco-Monsanto bio-safety dossier. The importance of the appraisal of Bt brinjal is that with the government-imposed moratorium on it, the regulators were morally bound in the public interest, to stop open release of GMOs in field trials until they had satisfactorily addressed safety issues and the open conflict of interest that exists. Indeed, the Parliamentary Standing Committee on GM crops in its report published in August came to the conclusion that for the present all open field trials in "any garb" must cease forthwith. Most of the documents quoted in this message form part of the Jairam Ramesh Report, available on the website of the India's Ministry of Environment and Forests (MoEF). Subsequently, the Supreme Court nominated Technical Expert Committee, in the first of its two-stage report has arrived at the same conclusion. Many conditions need to be addressed, and until then, open field trials must stop.

This message deals with the genetic construct and the molecular characterisation of Bt brinjal, which is the starting point of any appraisal of a GMO event. The following comments rely essentially on Prof Jack Heinemann's assessment of the raw data of the 'dossier' both for the Supreme Court and the Minister's review process. It demonstrates minimal regulatory oversight of a self-assessed biosafety-dossier by the developers and serious cover-up by Mahyco-Monsanto. Some of the more important findings are provided here as examples of these serious charges:

a. Chimeric Gene Construct of Bt Brinjal: Seralini was asked by the regulators to clarify why he called Bt Brinjal event EE1 a 'chimeric gene'. In reply he pointed the regulators to page 33 of Monsanto's Dossier! (Did they even read it, is the obvious question?). The construct is described as having 99.4% identity with Cry 1 Ac, which the Regulators described as a difference of only 1 amino acid. A very quick calculation by both Dr P Bhargava and Prof Antoniou revealed the accurate count of a difference of 7 amino acids at the claimed 99.4% identity. As Heinemann was to point out much later in 2012, the question of a difference of 1 amino acid was never on record. The difference of 7 is "consistent with the original description by Monsanto, 1997". However, at "94% identity" (consistent with current GenBank comparison), there could be a difference of up to 70 different amino acids. "To conclude that a novel protein is likely to be of no safety concern because of even as few differences as 7 amino acids is not a research-based conclusion. Changes of single amino acids can significantly alter the characteristics of proteins (a fact that underpins the field of directed evolution". The critical and fundamental characterisation of the event was not completed, usually because of assumption-based reasoning. "When such fundamental misunderstandings of the basic tools of the procedure were demonstrated by the developer, seemingly went unchallenged by the regulator, it was very difficult to accept assurances that the other procedures in the evaluation of Bt brinjal could be trusted". (Heinemann, 2012)
b. Several scientists including India's leading entomologist Dr Keshav Kranthi have said that the Bt brinjal construct is old and outdated; it could well be termed 'gene dumping' (Andow). *[Note, a few days later, Aruna Rodrigues wrote the following to me "I wish to issue a corrigendum with regard to my reference to Dr Keshav Kranthi (ref my post 65). Dr. Kranthi's position is as follows: While Dr Kranthi has referred to the available Cry 1 Ac toxin events of cotton not being high dose events for the cotton bollworm Helicoverpa armigera, he has made no statement whatsoever on Bt brinjal Event EE-1. The confusion and error is greatly regretted"...Moderator]*
c. Monsanto states on pg 93 of its dossier that "it is unlikely that seed or other brinjal tissues would enter aquatic habitats". This has been proved wrong. Bt corn residues and pollen were found to concentrate in streams and have a significant effect on aquatic organisms in the US Midwest.
d. Methods and number of insertions: Mahyco has not eliminated the possibility that there is more than one insertion of recombinant DNA and that all insertions are free of vector "backbone" DNA. Such experiments are relatively inexpensive and the methods so common that they are taught in some high schools, so there should be absolutely no reason to fail on this first step of a safety assessment. "I HAVE NEVER SEEN LESS PROFESSIONALISM IN THE PRESENTATION AND QUALITY ASSURANCE OF MOLECULAR DATA THAN IN THIS STUDY" (Heinemann)
- Novel RNA (Ribonucleic acid) and Proteins
"MAHYCO HAS PROVIDED NO INFORMATION WHATSOEVER ON NOVEL RNAs". This is a significant omission. According to (Codex, 2003) (p. 14, paragraph 32), "Information should be provided on any expressed substances in the recombinant-DNA plant; this should include: the gene product(s) (e.g. a protein or an un-translated RNA); the gene product(s)' function…". Moreover, since Mahyco uses the nos3′ terminator (The role of the terminator is to signal the end of a gene to prevent the production of transcripts from "downstream" DNA) in its construct it has an added obligation to look for novel RNAs. The nos3′ is NOT an efficient terminator in eukaryotes,(organisms of one or more cells each with a nucleus and other well-developed intracellular compartments. Eukaryotes include all organisms except bacteria, viruses, and certain (blue-green) algae which, by contrast, are prokaryotes), leading to read-through, longer mRNA molecules and potential fusion proteins.

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[The reference to Codex (2003) is to the 'Guideline for the conduct of food safety assessment of foods derived from recombinant-DNA plants'. This text, as well as three others that represent the outcome of the Codex Alimentarius Commission's work on principles and guidelines for food safety assessment of foods derived from modern biotechnology, are available in a short publication entitled 'Foods derived from modern biotechnology' (2009, 2nd edition). The four texts are the Principles for the risk analysis of foods derived from modern biotechnology; Guideline for the conduct of food safety assessment of foods derived from recombinant-DNA plants; Guideline for the conduct of food safety assessment of foods produced using recombinant-DNA micro-organisms; and guideline

for the conduct of food safety assessment of foods derived from recombinant-DNA animals. See http://www.fao.org/docrep/011/a1554e/a1554e00.htm (in English, French and Spanish) or contact codex (at) fao.org for more information...Moderator].

-----Original Message-----
From: Biotech-Mod2
Sent: 27 November 2012 18:27
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 66: What we mean by 'GMOs in the pipeline'

This is Denis Murphy, Professor of Biotechnology at University of Glamorgan, UK. I recently worked with FAO on the report entitled 'Current Status and Options for Crop Biotechnologies in Developing Countries', in Biotechnologies for Agricultural Development (http://www.fao.org/docrep/014/i2300e/i2300e00.htm). This formed part of the background material for the FAO international technical conference dedicated to Agricultural Biotechnologies in Developing Countries (ABDC-10) that took place in Guadalajara, Mexico on 1-4 March 2010. I am currently working on the role of crop improvement in addressing global food security and have just returned from several high level meetings addressing this topic in China and Abu Dhabi.

This conference is meant to be about GMOs in the pipeline but one of the problems I have with this is exactly how we define a GMO. I'll begin by paraphrasing a passage in my recent book: Plants, Biotechnology, & Agriculture, CABI Press, http://bookshop.cabi.org/?page=2633&pid=2263&site=191

"..by 2012, the global area of crops carrying GM traits had almost reached 160 Mha and was still rising. This is 10% of the global arable land area, which at first sight is an impressive achievement. But such statistics can be rather misleading unless taken in the context of the overall plant breeding process. This is because crop varieties labelled as 'GM' additionally carry many other trait combinations that are the result of other forms of breeding technology. In many cases it is the latter traits that are the most useful in the crop rather than the GM traits.

For example, several agbiotech companies have used non-GM methods such as mutagenesis, wide crossing, and MAS to develop new oilseed varieties with higher levels of useful fatty acids such as oleic acid. These varieties are marketed for the improved nutritional or industrial qualities resulting from their altered fatty acid profiles. However, the varieties are also classified as transgenic because in one of the final stages of the breeding process they were crossed with older GM herbicide-tolerant (HT) and/or insect-resistant varieties. In another example, between 2009-2011, novel traits such as drought tolerance were produced in maize via non-GM methods. However, in many cases the subsequent incorporation of a transgenic trait such as herbicide-tolerance (with its stronger patent protection) caused the new varieties to be labelled as GM although their new traits were unrelated to GM technology.

In the future this could lead to almost any new crop variety being classified as GM simply because a transgene from an older variety had been crossed in at some stage of the breeding programme. Clearly, this can lead to a misleading idea of the true impact of this technology. While it is true that the impact of GM technology has been very significant in the four crops where it has been widely applied, its impact has been relatively modest in terms of the bigger picture of global agriculture and the dozens of complex traits involved in crop performance. However, GM technology is still developing and may well have a much greater impact in future decades."

This is not meant as an anti-GM statement as I am in favour of the safe and appropriate application of modern biotechnologies. My point is that, due to existing patent regulations, biotech companies can more readily protect seeds via intellectual property rights (IPR) if they contain transgenes. Some of the traits (eg healthy oils) mentioned by Jonathon Shoham in his interesting message (nr. 56) were developed by non-GM breeding methods but the plants were crossed with old Bt or HT lines so that they could be labelled GM and thereby qualify for stronger IPR than would otherwise be the case.
Therefore it may be the case that GMOs in the pipeline do not actually need to be GM at all!

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[Thanks to Denis for this interesting point regarding exactly what might be defined as a 'GMO in the pipeline' Another related issue, and relevant also to Messages 32 and 61 of this conference, is that of products developed using new techniques. For example, the European Commission established in 2007 a New Techniques Working Group (NTWG, http://ec.europa.eu/food/plant/gmo/new_breeding_techniques/index_en.htm) to analyse a non-exhaustive list of techniques for which it is unclear whether they would result in a genetically modified organism or a genetically modified micro-organism as defined under European legislation. The NTWG considers the new biotechnological techniques applied in plant breeding and/or the modification of other organisms, looking at 8 technologies [oligonucleotide directed mutagenesis (ODM); zinc finger nuclease (ZFN) technology comprising ZFN-1, ZFN-2 and ZFN-3; cisgenesis comprising intragenesis; grafting; agro-infiltration; RNA-dependent DNA methylation (RdDM); reverse breeding; and synthetic genomics]. In January 2012, the European Food Safety Agency (EFSA) issued an opinion on the risks of cisgenesis and intragenesis (http://www.efsa.europa.eu/en/efsajournal/doc/2561.pdf). In October 2012, EFSA provided a scientific opinion about plants developed using zinc finger nuclease 3 and other site-directed nucleases with similar function (http://www.efsa.europa.eu/en/efsajournal/pub/2943.htm). For those interested in more information on the subject, a paper entitled 'Transgenic or not? No simple answer!', by N. Podevin, Y. Devos, H.V. Davies & K.M. Nielsen, was published earlier this month in EMBO reports and provides a good overview, noting that "New plant products (NPPs) blur the sharp distinction between genetically modified plants (GMP) and non-GMP, and introduce a new continuum between genetic engineering and conventional breeding"...Moderator].

-----Original Message-----
From: Biotech-Mod2
Sent: 27 November 2012 18:28
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 67: Re: Bt brinjal

I am P. Ananda Kumar again.

As a continuation of my message (46) and in light of the comments made by Dr Samuels (60), I would like to reiterate that cross-fertilization between cultivated brinjal and its wild relatives cannot be ruled out. The chances of such events happening naturally are extremely negligible and the chances of propagation of fertile progeny are further remote. Plant breeders have spent decades to transfer desirable traits (including pest resistance) from wild relatives of crops to cultivated species (including brinjal) by various approaches such as inter-specific hybridization, inter-generic hybridization, protoplast fusions etc and the successful examples are difficult to find. If available, the penalties in terms of yield and quality are not acceptable to farmers and consumers. Several wild relatives of brinjal are resistant to Shoot and Fruit Borer (SFB) (Sarvayya, 1936). The efforts to transfer SFB resistance to brinjal were unsuccessful which shows that it is imperative to confer resistance mediated by innocuous Bt genes/proteins. The ‘Fitness Advantage’ to wild species of brinjal as endowed Bt is negligible because these species are already resistant to SFB.

Reference: Sarvayya. V. 1936. The first generation of an interspecific cross in Solanums between Solanum melongena and S. xanthocarpum. Madras Agric. J., 24: 139-142.

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From: Biotech-Mod2
Sent: 27 November 2012 18:29
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 68: GM crops in India: Products in the pipeline as of 2012

I am T. M. Manjunath, a Ph.D. in agricultural entomology with over four decades of research and executive experience, both in public and private sectors. My areas of interest include biological pest control, insect resistant transgenic crops and integrated pest management. I was a key member of the Monsanto-Mahyco team that was responsible for introducing the Bt-cotton technology into India, right from the early stage till its regulatory approval in March 2002 and thereafter. I am presently an independent technical consultant and also serving in several expert committees of Govt of India and others.

I have prepared the following note keeping the present theme of the e-mail conference in mind. *Bt*-cotton continues to be the first, and until now the only, GM or GE crop approved in India for commercial cultivation since March 2002. Its adoption rate (about 95%) and success are phenomenal. This has generated enormous interest in crop biotechnology and work on various traits and crops are in progress. The names of private and public sector organizations involved in such product development are separately indicated below in alphabetical order with serial numbers for easy reference. The various traits and crops, the year(s) in which the trials were approved by Genetic Engineering Appraisal Committee (GEAC), and also the names of product developers indicated by their respective serial numbers in parenthesis, are listed in the table below.

GM crops in India at various stages of regulatory field evaluations as of 2012

(8 traits; 17 crops; 32 institutions)

Traits	**Crops, Year(s) of approval and Product developers*** *(*see the names of the product developers below by looking at the nos. in parenthesis)*
Insect resistance	Brinjal/Eggplant - 2006, 2007 to 2010 (*4,9,14,21,23,28,30*); Cabbage - 2006, 2009 (*12,14*); Castor - 2006, 2011 (*19*); Cauliflower - 2006, 2008 (*12,14*) ; Chickpea - 2009 (*25*); Corn /Maize - 2006, 2010 (*10,15*); Cotton - 2008 to 2012 (*3,5,7,8,11,16*);

	Okra - 2006,2007(*9*); Rice- 2006, 2007 to 2011 (*3,6,9,11,21,28*); **S**orghum - 2009,2011 (*20*); Sugarcane - 2010 (*27*); Tomato - 2006,2010 (*9,23*)
Virus resistance	Groundnut - 2006, 2009-2010 (*24*); Papaya - 2010 (*22*); Potato - 2006, 2009 (*17*); Tomato - 2006,2010 (*21,22*); Watermelon - 2010 (*22*)
Herbicide tolerance	Corn/Maize - 2012 (*10*); Cotton - 2010, 2012 (*3, 9*)
Herbicide tole. & Insect resis. stacked	Corn/Maize - 2008 to 2011 (*10,13,15*) ; Cotton - 2008-2009, 2011-2012 (*3,9,10,13,15*) ; Rice - 2010 (*3*)
Drought tolerance	Chickpea - 2009 (*24*); Groundnut - 2009 to 2012 (*24*); Mustard - 2010 (*25*); Rice - 2011 (*32*); Sorghum - 2010 (*18*)
Yield enhancement	Rice - 2011 (*2*)
Delayed ripening	Tomato - 2006,2008,2010 (*1,21,25*)
Male sterile, female inbred lines	Mustard - 2010-2011 (*31*) ; Rice - 2010-2011 (*6*)
Compiled by: Manjunath,T.M. (2012); Data source: http://igmoris.nic.in/field_trials.asp (refer to this website for details on genes/events).	

Product developers:

Private companies: 1. Avesthagen Ltd., 2**.** BASF India Ltd., 3. Bayer Bioscience Pvt Ltd., 4. Bejo Sheetal Seeds, 5. Dow Agrosciences India Pvt Ltd., 6. E. I. Dupont India Pvt. Ltd., 7. J. K. Agri Genetics, 8. Krishidhan Seeds, 9. Maharashtra Hybrid Seed Co. Ltd. (MAHYCO), 10. Monsanto India Ltd., 11. Metahelix Life Sciences Pvt Ltd., 12. Nunhems India Pvt Ltd., 13. Pioneer Overseas Corporation, 14. Sungro Seeds Pvt Ltd., 15. Syngenta Biosciences Pvt Ltd.,

Public Institutions: 16. Central Institute for Cotton Research, Nagpur; 17. Central Potato Research Institute, Shimla; 18. Central Research Institute for Dryland Agriculture, Hyderabad; 19. Directorate of Oil Seeds Research, Hyderabad; 20. Directorate of Sorghum Research, Hyderabad; 21. Indian Agricultural Research Institute, New Delhi; 22. Indian Institute of Horticultural Research, Bengaluru; 23. Indian Institute of Vegetable Research,

Varanasi; 24. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad; 25. National Research Center for Plant Biotechnology, New Delhi; 26. Rubber Research Institute of India, Kottayam; 27. Sugarcane Breeding Institute, Coimbatore/Lucknow; 28. Tamil Nadu Agricultural University, Coimbatore; 29. University of Agricultural Sciences, Bangalore; 30. University of Agricultural Sciences, Dharwad; 31. University of Delhi - South Campus, New Delhi; 32. University of Calcutta, Kolkata,

Products in pipeline:

Of the 17 crops listed in the table, only brinjal or eggplant (*Solanum melongena*) incorporated with the lepidopteron specific *Bt* gene, *cry1Ac*, for controlling the Fruit-and-Shoot Borer, *Leucinodus orbonalis*, has undergone all the biosafety and agronomic tests between 2000 and 2008 as originally prescribed by the regulatory committees. The *Bt* gene was introduced into brinjal hybrids by Mahyco and into local varieties by Tamil Nadu Agricultural University and University of Agricultural Sciences (Dharwad) and these were recommended by GEAC as safe and beneficial for commercial approval in 2009. However, the then Minister of Environment & Forests, after the controversial public consultations and apparently under tremendous pressure from certain activist groups, announced a moratorium in February 2010, saying it has to undergo some more safety tests without specifying them. As of now, the moratorium is still in force. Thus, *Bt*-brinjal is foremost among the crops awaiting final approval. While *Bt*-rice and *Bt*-okra, both developed by Mahyco, have undergone Multi-Location Research Trials (MLRT), all other crops with various traits are in the first or second year of Biosafety Research Level-1(BRL-1). The biosafety data of approved genes/events as well as of new genes/events under regulatory evaluation are available at: http://igmoris.nic.in/major_developments.asp. These are the products in pipeline, but considering the prevailing regulatory uncertainty in the country, it is difficult to forecast when these will be approved.

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-----Original Message-----
From: Biotech-Mod2
Sent: 28 November 2012 09:28
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 69: Re: Potential GE livestock and fish

[Thanks to Joe Cummins for the message below. A reminder that we are now in the last week of this FAO e-mail conference on "GMOs in the pipeline: Looking to the next five years in the crop, forestry, livestock, aquaculture and agro-industry sectors in developing countries" and that the last day for receiving messages is Sunday 2 December 2012. The final messages will be posted on Monday 3 December and the conference is then closed. I also remind you that all of the messages posted in the conference are available at the searchable website https://listserv.fao.org/cgi-bin/wa?A0=Biotech-Room2-L. To see the messages from November sorted by date (latest on top), see https://listserv.fao.org/cgi-bin/wa?A1=ind1211&L=Biotech-Room2-L&O=D&H=0&D=1&T=1 ...Moderator].

I am Prof. Joe Cummins Professor Emeritus of Genetics, University of Western Ontario, Canada and Fellow of the Institute of Science in Society, London UK.

Commenting on Jim Murray's Message 61. The term most frequently used to deal with gene transfers between sexually compatible plants and animals is cisgenic rather than transgenic. It has been demanded that the cisgenic plants or animals should not be regulated. However, there are both genetic and epigenetic considerations that make regulation of cisgenic organisms desirable. However, the main concern is that synthetic manipulations of both promoters and terminators or even the primary gene that may be palmed off as being cisgenic to avoid the cost of the regulatory hurdles.

Turning to the Aquabounty salmon, my understanding is that the fertilized eggs of the transgenic salmon will be produced in Prince Edward Island (PEI) Canada then transported to Panama for growth of the embryos. There has not been reported monitoring of the PEI facility to ensure that the fertilized eggs were safely contained and have not resulted in feral populations of the transgenic salmon. By the way, triploid salmon are known to revert to fertile animals at low but significant frequency.

Turning to the introduction of Atlantic salmon in the Pacific, Atlantic Salmon are farmed extensively in British Columbia where Infectious Salmon Anaemia Virus was introduced from the Atlantic Salmon into wild Pacific salmon stocks threatening the very survival of the Pacific stocks which lack resistance to the virus. Feral wild Atlantic salmon have been found in British Columbia presumably having escaped from the fish farms. Nearly a century ago efforts were made to establish wild Atlantic salmon stocks on the west coast and such efforts failed but the huge number of Atlantic Salmon escaping from pens may produce conditions driving the formation of stable wild populations. Who knows what the fast growing big feeding transgenic salmon will do to wild populations? In nature Atlantic Salmon (Salmo salar) sexually forms hybrids with brown trout while Chinook Salmon (Oncorhynchus tshawytscha) forms hybrids with pink salmon and perhaps steel head and rainbow trout. Natural hybrids of Atlantic and Chinook salmon have not been reported and are unlikely in nature but may be produced in the laboratory. Therefore the fast growing salmon is transgenic. However, the proponents of cisgenics in crop plants sometimes like to push the idea that gene transfers within a family (rather than genera or species) should be called cisgenic. I hope that the regulators worldwide will stick to limiting the term cisgenes to plants or animals with natural hybrids rather than artificial laboratory produced hybrids.

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-----Original Message-----
From: Biotech-Mod2
Sent: 28 November 2012 09:54
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 70: Bt rice in China

This is the second message from Dominic Glover of Wageningen University in the Netherlands.

The moratorium on Bt brinjal in India has stimulated a lot of discussion in this conference, but I would also like to learn more about the reasons behind the continued non-commercialisation of Bt rice in China.

I have not followed this topic very closely and I am not an expert on China’s biotechnology politics, so I would be interested to hear from others taking part in this conference who may have more insights to share.

Commercialisation of this transgenic food crop in China has been eagerly anticipated by many stakeholders for well over a decade, and an imminent approval was confidently predicted for many years, until recently, by organisations such as the International Service for the Acquisition of Agri-biotech Applications (ISAAA) and CropLife International, among others.

In November 2009, it was reported that China had issued a biosafety clearance for a Bt rice variety and it was expected that the crop would be commercialised within two or three years, following pre-commercialisation field trials [1]. However, to my knowledge, a decision to formally release the crop into the market has still not been taken.

In fact, the latest news that I am aware of is from NGO sources, referring to reports in China's Economic Observer newspaper in September 2011, stating that the Chinese government had decided not to proceed with the commercialisation of transgenic rice [2]. Furthermore, in February 2012 Greenpeace East Asia claimed that the Chinese government was drafting legislation to restrict 'research, field trials, production, sale, import and export' of transgenic grains [3].

As is well known, Chinese policy making is obscure to outsiders, so the reasons for these decisions, if confirmed, are unclear. We know that some Chinese intellectuals and public officials protested against the biosafety clearance for Bt rice, but there was no reason to expect that these objections would prevent commercialisation [4].

One can speculate that the Chinese government may have been influenced by the EU's decision to impose stringent import checks on Chinese rice, after Chinese rice shipments to Europe were found to contain transgenic events that had not been approved by either the EU or China [5]. That news is not particularly surprising, since unapproved transgenic rice varieties are known to be spreading unlawfully in China [6].

I feel sure that other participants in this conference must have further insights into the current situation with transgenic rice in China and I hope they will be able to share them with us.

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[1] 'China gives safety approval to GM rice', Reuters, 27 November 2009, http://www.reuters.com/article/2009/11/27/idUSPEK37812

[2] 'China suspends commercialisation of genetically engineered rice and wheat' Third World Network Biosafety Information Service / GMWatch, 6 October 2011, http://www.gmwatch.org/latest-listing/1-news-items/13440-china-suspends-commercialisation-of-gm-rice-and-wheat ; 'China says "no" to genetically engineered rice', Greenpeace East Asia, 31 January 2012, http://www.greenpeace.org/international/en/news/features/China-says-no-to-genetically-engineered-rice/

[3] 'China drafts legal proposal to completely shut down GE rice', Greenpeace East Asia, 22 February 2012, http://www.greenpeace.org/eastasia/news/blog/china-drafts-legal-proposal-to-completely-shu/blog/39139/

[4] 'Chinese green light for GM rice and maize prompts outcry', Nature Biotechnology 28, 390–1, 2010.

[5] 'EU imposes stiff controls to block Chinese GM rice', EU Observer, 15 November 2011, http://euobserver.com/885/114287

[6] 'GM rice "spreading illegally in China"', SciDev.Net, 20 June 2011, http://www.scidev.net/en/news/gm-rice-spreading-illegally-in-china-.html

-----Original Message-----
From: Biotech-Mod2
Sent: 28 November 2012 14:40
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 71: Transgenic subsistence crops in the near pipeline from the commercial sector?

This is the third message from Dominic Glover of Wageningen University.

I'd like to thank participants who have provided information about transgenic crops in the pipeline in various developing countries (e.g. messages 21, 34, 38, 49, 62, 63, 68). I don't know if any of these messages were responses to my appeal for more discussion of transgenic subsistence crop technologies relevant to the needs of poor and marginal farmers (message 22), but I note that (only) a few of the examples mentioned fit the kinds of criteria I mentioned in my message.

Several of the messages in the conference have mentioned the role that the private sector is playing in development of new GMOs that may be commercialized in developing countries within the next 5 years (e.g. messages 24, 25, 56). My PhD research was about a fascinating programme run by Monsanto, called the Monsanto Smallholder Programme (MSP). The MSP was remarkable for combining corporate social responsibility rhetoric and philanthropic aspirations with a market expansion strategy, essentially through the trial and refinement of novel marketing strategies designed to reach smallholder farmers with modern agricultural technologies.

One of the reasons I took up my study in the first place was that I felt Monsanto's expansion into agricultural input markets in the 'global South' ought to open up a space for the company to orient its technological research and development (R&D) strategies around the needs and priorities of poor and marginal farmers, in addition to the large-scale, industrialised farmers the company was accustomed to dealing with in areas like North and South America.

Some aspects of the MSP project I studied in Andhra Pradesh, India, were quite innovative in marketing terms, and warmly appreciated by the farmers I interviewed. However, I was disappointed to find that the MSP had created no mechanism for consulting the farmers, listening to their needs and priorities, working with them to set research agendas, or seeking their feedback on the performance and utility of the technologies Monsanto was promoting.

As a result, the technologies Monsanto wanted to promote in India were essentially similar to the ones the company promotes in industrialised farming systems. The marketing strategy was different, but an opportunity had been missed, to create a mechanism for the development of new technologies and crop varieties specifically for poor and marginal farmers. At that time (around 2007), there was no sign that Monsanto's experiences with the MSP had led the company to adjust its R&D pipeline in order to deliver technologies matching the kinds of criteria I mentioned in message 22 (Glover, 2007a, b, c).

I would like to ask participants in this conference whether there are more grounds for optimism as we look ahead from 2012. Can they point to examples from the commercial sector involving the development of subsistence crops with transgenic traits that make them suitable for poor soils, low-input conditions, with a low risk profile, that can be made available at low cost and that are likely to be commercialised in the next 5 years? Is it misguided to expect commercial entities to serve such markets, in spite of the profit potential at the 'bottom of the pyramid'? Must we rely on philanthropic funding, public-private partnerships and government aid programmes for the development of these types of technologies?

I look forward to your responses.

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-----Original Message-----
From: Biotech-Mod2
Sent: 29 November 2012 09:17
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 72: Argentina´s GMO pipeline

My name is Patricia Gadaleta. I am a biologist working as Senior Scientific Officer for the Biotechnology Directorate at the Ministry of Agriculture, Livestock and Fisheries from Argentina. I am involved mainly in the scientific evaluation of biosafety dossiers of genetically modified plants, animals and microorganisms. Other members of the Biotechnology Directorate are also participating in this conference.

We would like to address the issue of the conference by introducing what we anticipate to be Argentina´s GMO pipeline for the next years. Currently, we only have transgenic plants applications submitted for environmental risk/safety assessment intended for further application for commercial release. Applications on GM animals and microorganisms are sporadically submitted for confined and experimental release, but currently we do not have any active applications for these kinds of GM organisms for commercial release.

Regarding GM crops, we anticipate working on the safety assessment of GM soybean, maize, cotton, wheat, rice, potato and sugarcane, inter alia, carrying traits such as insect and virus resistance, tolerance to diverse herbicides, drought resistance, modified fatty acid profile, among others. Almost all these traits are submitted for assessment as individual events and also as stacked events obtained by conventional breeding. Some of these genetic modifications were developed by the private sector overseas, while others through public-private partnerships in Argentina.

Finally, we would like to thank the organizers for the opportunity to participate in this conference. We work at the Ministry of Agriculture, Livestock and Fisheries, supporting the National Ag-Biosafety Commission (CONABIA) which is chaired by our Director of Biotechnology Martin Lema.

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-----Original Message-----
From: Biotech-Mod2
Sent: 29 November 2012 09:22
To: 'biotech-room2-L@LISTSERV.FAO.ORG'

Subject: 73: GMO pipeline in Bangladesh

I am Md. Shahjahan, a newly PhD fellow at the Graduate School of Chinese Academy of Agricultural Sciences, China in the field of animal genetics, breeding and reproduction. I did my B.Sc (2008) and M.Sc (2010) from Bangladesh Agricultural University.

From my little knowledge, no satisfactory GMO research is yet developed in Bangladesh for livestock and aquaculture. But the research of GM crops is ongoing for rice, potato, brinjal and papaya. However, Bangladesh will be the most affected country for climate change where drought and salinity resistance are likely to be more important issues for further development of GM crops. The thinking of GMOs commercialization is almost confined for the next 5 years in our country.

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-----Original Message-----
From: Biotech-Mod2
Sent: 29 November 2012 09:42
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 74: Re: AquAdvantage Salmon

This is Henry Clifford again. I would like to address some of the statements made by Joe Cummins in Message 69 regarding the genetically modified (AquAdvantage) salmon.

A. "There has not been reported monitoring of the [Prince Edward Island] PEI facility to ensure that the fertilized eggs were safely contained and have not resulted in feral populations of the transgenic salmon."

This is a grossly inaccurate statement. We have been operating the PEI facility for a very long time, with strict standard operating procedures (SOPs) requiring daily monitoring and inspection of the multiple, redundant containment measures in place, and extensive records indicating continuous containment at the facility. These records have been reviewed by several agencies in Canada and by the U.S. Food and Drug Administration (FDA). In fact after review of our containment protocols and track record of successful containment, the FDA approved the PEI site within the framework of our FDA application by issuing a FONSI (finding of no significant impact). And of course, it goes without saying that no incidents of feral populations of transgenic salmon have been reported in PEI.

B. "By the way, triploid salmon are known to revert to fertile animals at low but significant frequency."

I am unaware of any publication documenting this in Atlantic salmon; if you can corroborate this with references, please do so. Reversion has been observed in triploid oysters, but not in Atlantic salmon that I am aware of.

C. ".....but the huge number of Atlantic Salmon escaping from pens may produce conditions driving the formation of stable wild populations. Who knows what the fast growing big feeding transgenic salmon will do to wild populations?"

The answer to that hypothetical question is: "nothing". As was previously stated in my Message 43, AquAdvantage Salmon will not be reared in net pens, but will only be cultured in land based, contained aquaculture systems (e.g. tanks) with multiple, redundant containment barriers. Our FDA application contemplates only one approved

production site for growout (once FDA approval is granted), and it is in Central America, where feral populations of Atlantic salmon (or brown trout) do not exist. There are no other sites under consideration for growout. At the Central America site the biosecurity protocols consist of 21 individual containment elements, with a minimum of seven sequential elements in series. So not only are there 21 physical barriers confining the salmon to the culture system, plus the two biological containment measures previously described in Message 43 (sterility + single sex), but there is a natural thermal barrier (lethal ambient water temperatures) preventing the salmon from reaching the ocean, should they somehow manage to breach the 21 physical containment barriers. And there are no wild populations of salmon present.

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-----Original Message-----
From: Biotech-Mod2
Sent: 29 November 2012 15:12
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 75: Re: Transgenic subsistence crops in the near pipeline from the commercial sector?

This is Jonathan Shoham again.

In answer to Dominic Glover's request for more information on GM traits being developed by the private sector for subsistence crops (Message 71) it is not 'black and white'. *[Dominic asked whether there were "examples from the commercial sector involving the development of subsistence crops with transgenic traits that make them suitable for poor soils, low-input conditions, with a low risk profile, that can be made available at low cost and that are likely to be commercialised in the next 5 years"...Moderator]*.

Major R&D based companies are bound to focus on the larger and more commercial crops as that is where they will get the best returns and they have financial obligations to their shareholders. Having said that there is also a trend for them increasingly to address the sort of targets Dominic Glover describes, driven by the following forces:

- The new technological possibilities being opened up by biotechnology advances. For example it is getting faster and cheaper to map plant genomes.

- Diversification of the crops which the private sector is addressing: initially most private sector GM R&D was devoted to corn, followed by soybeans and cotton. Now the focus is moving increasingly to rice and wheat, where the public sector has dominated up until now.

- The increasing prominence of corporate social responsibility (CSR) considerations in the private sector, as reflected in moves towards social impact investing, inclusive business, shared values etc. The rise of public-private partnerships (PPP's) is a manifestation of this, although a lot more needs to be done in this area.

- The increasing potential offered by developing countries. Dominic refers to 'Bottom of the Pyramid' opportunities. This in one aspect. There is also the overall growth potential. A study by McKinsey on African agriculture (reference below) forecasts the market for inputs (seeds, fertilizers, etc) would increase four-fold between 2008 and 2030 in order to propel the increased crop production required.

Getting down to specifics, organisations which are addressing opportunities in subsistence and orphan crops are Arcadia, the private company, which has several PPP's addressing the sort of issues Dominic Glover refers to (drought tolerance, nitrogen use efficiency; salt tolerance, heat tolerance), and The Danforth Institute which focuses on 'orphan' crops such as cassava, cowpeas etc and is involved with several PPP's.

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Reference:
'Lions on the move: The Progress and Potential of African Economies', McKinsey Global Institute 2010.
http://www.mckinsey.com/insights/mgi/research/productivity_competitiveness_and_growth/lions_on_the_move

-----Original Message-----
From: Biotech-Mod2
Sent: 29 November 2012 15:39
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 76: Little contribution about GM crop pipeline in Brazil

This is from Mairson Santana. I'm a commercial manager in a seed company called Girassol Sementes that multiplies varieties of soybeans from Monsanto and TMG (Tropical Melhoramento Genético), a local company in Brazil that breeds soybeans for Cerrado. With the discussion that I had read in this conference, I have a lot to learn about and a little to contribute for the level of this conference.

We produce seed with Roundup Ready and some non-GMO varieties too. In Brazil GMO laws, regulatory agency like CTNBIO, GMO release becomes an uncertain adventure. We are waiting for Monsanto Intacta Pro Soybeans release, that is waiting for China's approval. (Brazil could not export Intact Pro Soybeans to China, because is not yet approved in China, so the growers asked the Agricultural Ministry to block commercial release to growers in Brazil to avoid contamination in the field, storage facilities, or others and prevent problems in the market next year). In corn, we have other traits coming. In cotton, we have Bayer with one trait in the market. In rice we have long debate about GMOs in crops that are food staple and for direct human consumption and possible contamination of non-GMO fields, so Liberty Link (LL) rice from Bayer is not released to the market yet. The GM bean (Phaseolus vulgaris) developed by EMBRAPA to resist the bean golden yellow mosaic virus (BGYMV) is in the early stage and we do not have commercial variety in the market. For producers and agronomists in the field, the yellow mosaic virus is not a relevant problem today in Brazil, so the impact will not be significant.

The main problem of GM crops, and a lot of traits into the market that growers, seed producers and traders are asking for, is how to segregate all those products in the future in case like Intacta Pro and the restriction of the China market? Who will have the responsibility to keep free of a GMO specific trait to other crop, fields, neighbor, etc, of production contamination.

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-----Original Message-----
From: Biotech-Mod2
Sent: 29 November 2012 17:45
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 77: Re: Bt brinjal

This is Adrian Dubock again.

In message 58 concerning the Bt Brinjal debate occurs the following sentence: "it is best to adopt the precautionary principle as stated in the Cartagena Protocol on Biosafety which is the international standard to regulate GMOs."

I disagree. In his essay "The Real GM Food Scandal" Lord Dick Taverne wrote (Prospect Magazine, November 2007, p 24-27): "The [precautionary] principle has long been a major impediment to good sense in public policy. It is either so obvious as to be otiose ("if there is cause for concern, be careful"), or so vague as to be meaningless. But in its most common application-"where an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically"-it has been an invaluable tool for those who want to stop any new scientific development that they dislike."

Also in message 58 is stated: "And finally, I would like to point out that there is something called "choice" and every farmer whether in the developed or developing world should have this "choice"."

How do poor Indian farmers who would like to have choice to help them have harvestable and consumable Bt brinjal from the land which they work exercise their choice? I note from this conference that Bt Brinjal is already being grown and consumed in Pakistan. Presumably it is already being grown in India too. Just as Bt cotton was in India before it was registered for use. Just as glyphosate tolerant corn was in Brazil before it was registered. Growers will demonstrate their choice for more productive agriculture, if they are not held back by excessive concern, and even it appears, eventually when they are.

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[This thread is now cut...Moderator].

-----Original Message-----
From: Biotech-Mod2
Sent: 29 November 2012 17:45
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 78: Re: Bt brinjal

This is Aruna Rodrigues again in my third message on this subject, bringing various aspects of the independent assessment of the Mahyco-Monsanto dossier to the notice of this FAO email conference. These assessments which contributed to the moratorium on Bt brinjal will affect every GMO in the pipeline unless fully addressed in a transparent way to the satisfaction of civil society and the independent scientific community. I acknowledge the important contribution of Dr John Samuels (Message 60). Thank you indeed for your abundant clarification on the factual position regarding India's diversity in brinjal and its certain contamination if Bt brinjal were commercialised. In fact, India with 2500 varieties of brinjal and 29 wild species is the "centre of the world's biological diversity in brinjal" (Andow). Many will be interested in his professional assessment of the raw data of the dossier (relevant chapters) published in "Event EE-1: Bt brinjal: The scope and adequacy of the GEAC environmental risk assessment". Andow is acknowledged as one of the leading experts in the environmental risk assessment (ERA) of GM crops.

In "Bt brinjal: The scope and adequacy of the GEAC environmental risk assessment", he states: "most of the possible environmental risks of Bt brinjal have not been adequately evaluated; this includes risks to local varieties of brinjal and wild relatives, risks to biological diversity, and risk of resistance evolution in BFSB". Briefly, "--- EC-II relied on dubious scientific assumptions, did not focus on realistic environmental concerns, inadequately evaluated some important environmental concerns, and ignored other real environmental concerns".

Some of the more important findings include:

EE-1 is a very old transgene, a view shared by Heinemann and Seralini, who also evaluated the raw data of the dossier; and while it may not be exactly "transgene dumping," India would do better to wait for a more efficacious transgene before seriously considering approval of Bt brinjal. Again, Andow with other scientists prove that the Dossier does not comply with the scientific aspects of transgene characterisation described in the 'Guideline for the Conduct of Food Safety Assessment of Foods Derived from Recombinant-DNA Plants' (Codex Alimentarius, 2003, CAC/GL 45-2003), a serious deficiency. The EC-II (The regulators' Expert Committee on Bt brinjal) not only failed to pick this up but wrongly affirmed that the dossier was compliant with the Codex Alimentarius.

There are six kinds of potential adverse environmental effects that Bt brinjal could have on biological diversity. These are: (i) increased secondary pests, either through direct enhancement or indirectly through the reduction of natural enemy controls or other means; (ii) reduction in soil quality or health, adversely affecting crop production in either the short or long term; (iii) reduced value of non-crop economic activities (such as honey production or wild food harvesting); (iv) reduced cultural value by affecting a cultural icon or a species of cultural significance (e.g., Monarch butterfly in the United States); (v) increased conservation concern, such as an adverse effect on an endangered species; and (vi) reduced environmental quality through an effect on an ecosystem service such as pollination. EC-II also draws conclusions about the absence of environmental risk in the absence of supporting data. For example, EC-II (page 41) concludes "there is no accumulation of the [Bt] protein in the soil associated with production of Bt brinjal," but this is not supported by any scientific data.

The evolution of resistance in the Brinjal fruit and shoot borer (BFSB) to overcome Bt brinjal is a real risk that must be managed. EC-II does not acknowledge this risk, and the Dossier does not propose effective means to manage it. The likelihood of resistance evolving quickly is high. Without any management of resistance evolution, Bt brinjal is projected to fail in 4-12 years. Effective use of 20% non-Bt refuges can extend this time by 25% or more. The reason for this high risk is that EE-1 is a "low dose" event, by virtue of the relatively low control efficacy. Resistance risk would be substantially reduced if EE-1 Bt brinjal were never released commercially and India were to wait for a "high-dose" Bt brinjal. Resistance to EE-1 would be a stepping stone for more rapid resistance in any subsequent, improved event.

Nearly all brinjal farmers in India are small-scale resource-poor farmers, who farm <1ha for all of their crops (Department of economics and statistics, 2008). They grow brinjal in small (~65 m2) plots, and sell to local village and town markets. For these farmers, brinjal production is essential for their overall economic security and well-being (Agricultural and Processed Food Products Export Development Authority, 2009).

EE-1 Bt brinjal is proposed as a hybrid, and is unlikely to fit well in the small-scale production systems relying on open-pollinated varieties (OPVs) of brinjal. For small-scale resource-poor farmers, brinjal is critical for creating economic security. Farmers are expected to retain only 10% of the increase in profitability from Bt brinjal, but are expected to retain 63% of the increase from brinjal integrated pest management (IPM).

BFSB causes significant economic damage to brinjal throughout India for all farmers --averaging about 30% yield loss (a comparison of yield with pest management versus no pest management). Farmers are prone to overestimate the loss to BFSB, precipitating an over-use of insecticides significantly beyond that justified by the actual economic significance of BFSB. Real losses from BFSB are higher for large-scale commercial producers than for small-scale resource-poor producers because of the way damaged fruit can be used by the small-scale resource-poor farmers. EC-II vastly over-estimated losses to BFSB.

Insecticide use can be reduced substantially using IPM. Useful alternative production systems for control of BFSB are being tested, actively used, and promoted in India: IPM, traditional pest management, organic production and other locally-derived methods that reduce costs associated with external inputs.

Andow lists some 37 studies of which perhaps 1 has been conducted and reported to a satisfactory level by Monsanto

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-----Original Message-----
From: Biotech-Mod2
Sent: 30 November 2012 09:04
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: Reminder that are in last days of this FAO e-mail conference on 'GMOs in the pipeline'

Dear Participants,

This is just to remind you all that we are in the very last days of this FAO e-mail conference on "GMOs in the pipeline: Looking to the next five years in the crop, forestry, livestock, aquaculture and agro-industry sectors in developing countries". The conference has addressed two main topics: What new GMOs are likely to be commercialized in developing countries within the next five years (i.e. before the end of 2017) in the crop, forestry, livestock, aquaculture and agro-industry sectors and, second, what are the likely implications of these new GMOs for developing countries?

The last day for receiving messages is Sunday 2 December 2012. The final messages will be posted on Monday 3 December and the conference is then closed.

To contribute to the conference, send your message to biotech-mod2@fao.org

A warm thanks to all of you who have contributed messages so far.

Best regards

John

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-----Original Message-----
From: Biotech-Mod2
Sent: 30 November 2012 09:39
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 79: GMOs from Iran in the next 5 years

My name is Behzad Ghareyazie. I am a senior scientist at the Agricultural Biotechnology Research Institute of Iran (ABRII), a public research institute, and currently serving as the President of the Biosafety Society of Iran (a non-

governmental academic society). I have been working on the development and release of transgenic rice during the last 20 years. I am attending in this conference on my capacity as the President of Biosafety Society of Iran and am not representing the government of Iran.

Before making my interventions, I wish to thank and present my gratitude for the organizers, participants and in particular the moderator for the arrangement of this on-line conference, exchange of information and the very excellent moderation.

I have been following the discussion very closely though I was silent during the past 3 weeks. I was happy seeing relevant discussions and somehow disappointed with some interventions (in particular, messages 23, 44 and 35) because of emphasizing too much on "opinion" rather than the "facts" and scientific findings or updates. In message 44, Ms. Neha Saigal says "..the opinion that Bt brinjal will destroy the medicinal properties of brinjal… is not mine alone..". I was not expecting another round of endless ideological opposition (or support) from anti (or pro) groups/individuals against (or for) genetic engineering. Though I am also tempted to reply to those "opinions" and I may do that in my future interventions, but for now, I wish to merely obey our nice moderator and update the conference with the status of genetic engineering in Iran and the likely GMOs to be commercialized in the next years in my country.

Iran has a relatively strong genetic engineering program. Genetic engineering and biotechnology has received full support from the Supreme Leader and is reflected in the strategic plans. According to the Iran strategic plan for Biotechnology, Iran should grow minimum of 0.2% and 0.5% of global area under the transgenic plants in the short and mid-term respectively. According to the Iran's National Biosafety Law "all activities related to production, release, import, export, transit and transportation, commercialization, use and application of LMOs are permitted" and "the government should take all necessary actions to facilitate these". In the same law, decision making is based on scientific data and not on the ideological beliefs or other basis.

Iran officially commercialized the first insect resistant Bt rice in the year 2004 coinciding with the international year of rice (James 2005). This rice was released among farmers who wanted to reduce application of chemical insecticides against striped stem borer which is a very devastating insect pest of rice in Iran. In the year 2005 with the election of Dr. Ahmadi Nejhad as the President of the country and the following changes in the administration, the "extension" of this transgenic rice was stopped on the basis of two excuses: 1) there was no national Biosafety law in the country, and 2) lack of harmonization among different stakeholders (Ministry of Agriculture, Environmental Protection Organization etc.). Though there was no moratorium and no court order or any officially made decision against any GMO in Iran, but the record of area under the cultivation of Bt rice was lost and the government did not support the release of GM crops in spite of relatively good investment in terms of R&D.

Since then, all the infrastructures including the national biosafety law were set in place and, as mentioned above, the Law asks the government to "facilitate" the release and use of living modified organisms (LMOs).

Therefore the first LMO to be commercialized again in Iran is the Bt rice and the herbicide tolerant rice. The combination of these two will bring drastic changes to the current "unsustainable" and traditional methods of rice cultivation in Iran, saving a lot of practices/money for the farmers while reducing the environmental footprints because of the dramatic reduction in the application of agrochemicals. These plants are produced at public sector. So far no private sector is active in the LMO business due to the current administrations stand on the transgenic issue. Bt cotton, Bt sugar beet, herbicide tolerant canola and Bt alfalfa are the next GM crops to be released in the next 5 years.

In terms of transgenic animals, there is no project on production of transgenic animals for food production purposes. But there are transgenic goats called Shangool, Mangool and Habbeye Angoor (the three characters of the famous Iranian popular folk story “Shangool, Mangool and Habbe-ye angoor") that have been produced since 3 years ago with the goal to produce pharmaceuticals in their milk. Recombinant human proteins (factor 9) is produced in Shangool's and Mangools's milk and is currently extracted and purified from their milk. Habbeye angoor and other transgenic goats, also produced by the Royan Research Institute with the full support from the Supreme Leader of the country, produce tissue plasminogen activator (tPA). This is a protein involved in the breakdown of blood clots. tPA catalyzes the conversion of plasminogen to plasmin that is the major enzyme responsible for clot breakdown.

Because it works on the clotting system, tPA is used to treat embolic or thrombolytic stroke. There will be no resistance in any parts of the government for commercialization of GM animals (the drugs produced in their milk) produced by the Royan Research Institute. The products will be in the market within the next 2-3 years. Erythropoietin and Albumin are two other proteins to be expressed in goat milk and is expected to be commercialized in the next 5 years.

There are several other crop plants/traits at different stages of research and development but I do not think that they will be commercialized in the next 5 years.

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[As Behzad mentions, the UN General Assembly designated 2004 as the International Year of Rice (IYR). As part of facilitating IYR implementation, FAO convened a Rice Conference on 12-13 February 2004 in Rome, Italy, that brought together leading experts from around the world to present their perspectives on latest trends and industry developments, covering also the topic of biotechnology. Proceedings of the conference are available at http://www.fao.org/docrep/008/y5682e/y5682e00.htm...Moderator].

-----Original Message-----
From: Biotech-Mod2
Sent: 30 November 2012 10:29
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 80: Re: AquAdvantage Salmon

I am Tim Schwab, a researcher at the non-profit consumer organization Food & Water Watch in Washington DC.

I have been following the genetically engineered (GE) salmon issue closely and noticed the comments on this issue, and I wanted to make a contribution regarding the purportedly fast growth rates of the fish, which relates to environmental impacts, food security implications and potential economic growth that this pipeline product can offer. This subject may also add valuable context for framing questions around the risks the fish poses, including the less-than-100 percent sterility rate.

After it was widely reported (and repeated a few times in this conference) that GE salmon reach harvest weight in half the time as traditional salmon, commercial salmon growers have challenged these growth-rate claims. The fast growth rate claims of GE salmon are this product's real raison d'etre, so it would seem critical that we be able to scientifically substantiate real-world growth comparisons before we start talking about feeding the world and before we begin thinking about how to manage and mitigate the risks of this fish.

However, it appears that AquaBounty's growth-rate studies compared GE salmon to a wild-type Atlantic salmon, which fails to offer a meaningful, real-world look at growth rates. Traditional salmon growers say their salmon--which are already in commercial production and which have benefitted from decades of selective breeding--grow as fast or even faster than GE salmon purports to (www.salmobreed.no/newsletters/en/newsletter_5_2011.pdf, 285 KB). There has never been a head-to-head comparison between these fish.

This begs a question about the benefits of GE salmon--in terms of reducing the environmental impact of protein production or driving economic growth in aquaculture in developing countries (or elsewhere).

We should also look at this in the context of food security: farmed salmon is an expensive protein source whose high price already limits its accessibility outside of the Western diet. Even if GE salmon could demonstrate fast growth rates, which it has not, the product doesn't appear to be an accessible food source in developing nations.

The unclear growth-rates also reframe the risks of GE salmon within the larger regulatory context: GE salmon is the first GE food animal to move this far pipeline toward regulatory approval. We absolutely must set a high bar, insisting that the right questions be asked and thoroughly answered.

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-----Original Message-----
From: Biotech-Mod2
Sent: 30 November 2012 10:45
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 81: Re: Transgenic subsistence crops in the near pipeline from the commercial sector?

This is Tom Nickson again from Monsanto providing some thoughts based on Dominic Glover's Message 71.

I think there is every reason to be optimistic as long as we can address the challenges, which again, are not scientific. Water Efficient Maize for Africa (WEMA, links provided below) is a very good example of a public-private partnership aimed at developing products that are suitable for growing conditions in Sub-Saharan Africa (SSA). Through conventional and molecular breeding programs and the combination of germplasm from the public and private sectors, we anticipate that WEMA will create new more drought tolerant hybrids, developed for SSA countries. Transgenic traits for additional drought tolerance and insect protection will also be evaluated in these hybrids and in this geography and developed and deployed to farmers, if they are well suited.

In direct response to Dominic's questions, the transgenic traits being explored and utilized in WEMA were developed for the US market originally. However, we believe that these traits have potential for providing benefit and value to African farmers and will evaluate the performance of those traits in Africa.

I think there may be hope for the development of biotech traits for specific geographies by the private sector if government policies provide an enabling environment such that companies have some realistic expectation that investments will someday be rewarded in the form of a profitable business. For example, predictable, efficient and appropriately protective biosafety frameworks would allow a developer (public or private) to test, and potentially develop a product. Harmonization of such a system at a regional level would be beneficial for a region and reduce costs compared to having to work on a country-by-country basis. Many developing countries highlight their lack of capacity in international negotiations. As such, pooling resources and sharing experiences and expertise (which the Convention on Biological Diversity and the Cartagena Protocol encourage) would help enable technology uptake and environmental protection. Another example would be the establishment and enforcement of an effective system or intellectual property (IP) rights protection and enforcement that enabled innovation by protecting a company's R&D investment.

Even with the enabling environments, the fact is that the primary developer of new traits for developing country needs will probably remain the public sector. However, if a useful trait is developed and protected through IP

protection, an effective partnership could be developed that capitalizes on the private sector expertise in developing and bringing products to market, especially if the regulatory environment is predictable and positive. But public sector funding must address issues recently highlighted in the "ASTI Global Assessment of Agricultural R&D Spending, developing countries accelerate investment" published by IFPRI, ASTI and GFAR (link provided below). This report highlights that developing countries must address both the magnitude of the investment and volatility (periodicity).

Finally, the private sector may also have a role in supporting that research. For example, the Monsanto Fund supports a project at the Donald Danforth Plant Science Center, named VIRCA (virus-resistant cassava for Africa), to develop a cassava that is resistant to Cassava Brown Streak Disease and Cassava Mosaic Disease. In total, Monsanto Fund will provide more than $12M to this project.

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Message links:

www.aatf-africa.org/wema

http://www.gatesfoundation.org/agriculturaldevelopment/Pages/water-efficient-maize.aspx

http://astinews.ifpri.info/2012/10/25/asti-global-assessment-of-agricultural-rd-spending-developing-countries-accelerate-investment/

-----Original Message-----
From: Biotech-Mod2
Sent: 30 November 2012 10:53
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 82: GMO events in the pipeline in Brazil

This is Paulo Ramos from Brazil again. As mentioned in my previous Message (nr. 31), I am a member of the National Biosafety Technical Commission (CTNBio) and cordinator of the Work group on transgenic and agrotoxic at the Brazilian Agroecology Association.

GMOs at pipeline now in Brazil are related to herbicide tolerant and insect resistant Bt traits. As a result of the increasing herbicide resistance most of the new traits tend to be stacked being them in soybean, maize, or cotton. This new trend combine tolerance to one or more herbicides together. Resistance to glyphosate (GLYP) and gluphosinate (GLUF) and to 2,4D or insecticides such as the bacterial toxin bacillus thuringiensis (Bt). The general intent of the chemical companies is to bring new trangenes capable to play against the resistant plants.

Sugarcane and eucalyptus are the new transgenic traits insect and herbicides resistant plants that are in the pipeline. The obvious purposes are more cellulose less lignin in trees for wood pulp and biofuels.

Thank to all for the opportunity in being here together, learning more about GMOs.

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-----Original Message-----
From: Biotech-Mod2
Sent: 30 November 2012 11:53
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 83: GM trees in Brazil

I am Dr. Mike May, Vice President of Public Affairs at FuturaGene (www.futuragene.com), a company with laboratories and field operations in Brazil, China and Israel that undertakes plant genetic research and development for the global forestry, biopower and biofuel markets. Our research and development is focused on three main technology platforms: yield enhancement, biomass processability enhancement and yield protection. FuturaGene's key crops are eucalyptus in subtropical regions and poplar in more temperate zones and its most advanced technologies are for yield improvement in sustainable industrial forestry.

Our focus is on the modification of the plant cell wall to stimulate natural growth processes and our results in field trials in Brazil show significant gains in yield in eucalyptus engineered to over-express an Arabidopsis endoglucanase. In parallel, yield protection strategies through modification of plant responses to biotic and abiotic challenges are needed to provide future resilience to environmental shocks and stresses caused by changing climate and diminishing resources and to enable marginal land usage. GM approaches are widely acknowledged to be the most robust approach to providing resistance to the growing number of pests and diseases that are being recorded in plantations around the world. We also recently announced the launch of a partnership with EMBRAPA (Brazilian Agricultural Research Corporation) to evaluate the potential of an aluminium tolerance gene in eucalyptus in Brazil and to develop new innovations for sustainable agro-forestry to meet the growing agro-ecological challenges related to productivity.

Our most advanced yield enhanced eucalyptus is currently undergoing environmental safety assessment in advanced regulatory trials at a variety of agro-ecologically distinct locations around Brazil and in which we are observing significant increases in yield above the baseline yield of 45 m2/ha/year. Detailed biosafety assessments are being carried out under the appropriate normative of the Brazilian biosafety legislation and we will submit a dossier for approval of commercial launch within 5 years.

Improving the technology base of agro-forestry is a key weapon in fighting climate change and driving socio-economic development. Yield enhancement through genetic modification is an important factor in sustainable intensification of agro-forestry.

Since July 2010, FuturaGene has been a wholly owned subsidiary of Suzano Pulp and Paper, a leading integrated forestry, pulp, paper and renewable energy company in Brazil. We welcome the opportunity to participate in this conference.

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-----Original Message-----
From: Biotech-Mod2
Sent: 30 November 2012 16:19
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 84: Re: Bt brinjal

This is John Samuels (Message 60) again. The first part below relates to Messages 67 and 78 from A. Kumar and Aruna Rodrigues, respectively. The second section expands further upon A. Kumar's comments.

1. Cross-fertilisation between brinjal and its wild relatives cannot be ruled out.

I would like to strongly agree with the first part of Message 67 which says that: "...cross-fertilization between cultivated brinjal and its wild relatives cannot be ruled out." In fact, this phenomenon was proven to be a reality by some of the biosafety risk assessments performed on Bt brinjal in India. Of these, the following two crossability studies performed by the Indian Institute of Vegetable Research (IIVR, 2008, 2009) at Varanasi, Uttar Pradesh are of note. In the first study, cross-pollinations were artificially performed, using nine cultivated lines of brinjal (Solanum melongena) and five species of wild relatives. It was found that the nearest wild relative, S. incanum, was a successful staminate parent, insofaras the setting of fruit with viable seeds by the S. melongena pistillate parents. (This was expected as, sixteen years earlier, the same interspecific cross-combination was shown to produce fruits containing viable seed from which a fertile F1 generation was grown [Lester & Hasan, 1991]). In the second study, the same methodology was used, attempting cross-pollinations between four Bt brinjal hybrid lines carrying the Cry 1Ac transgene, and plants from a single S. incanum accession. In this study, all cross-combinations were successful in both directions. These results were of additional interest because, ten years previously, a one-way fertility barrier (whereby cross-pollinations are unsuccessful when S. incanum is the pollen acceptor) had been demonstrated between S. incanum and S. melongena (Lester & Kang, 1998). There is a strong indication that this barrier was somehow alleviated in the IIVR crosses involving Bt-S. melongena. The implications for transgene transfer to S. incanum are thus considerable, as outcrossing to S. incanum would necessitate S. incanum being the female parent.

In their consideration of Bt brinjal biosafety data, the Expert Committee (EC-II) on Bt brinjal (GEAC, 2009) alluded to the fertility barrier in the first study, but no comment was made regarding the more significant findings of the second study. This may have been because the crucial data from the second study was not available at the time of the EC-II meeting, in January 2009. Furthermore, both studies were limited by the extent to which they examined crossability. To be able to study the true potential for outcrossing (and thus potential introgression of transgenes into the untransformed genomes of wild relatives) it is necessary to take this kind of study further. E.g. similar investigations at Birmingham University, UK (see Lester et al., 2001), during the 1970s-1990s (and elsewhere) took fruit set to be only a preliminary indicator of interfertility. Based on this work, the production of viable, germinable seeds, producing a vigorous, fertile F1 (or subsequent) generation is taken to be a reliable indicator of sexual compatibility. In this light, the two investigations of crossability discussed above can be taken as useful starting points, prior to more detailed and extensive investigations which should follow. To the best of my knowledge, these have yet to be undertaken.

2. Efforts to transfer BFSB resistance to brinjal/other alternatives to Bt brinjal?

Relatively recent efforts to transfer brinjal fruit and shoot borer (BFSB) resistance from wild relatives to brinjal (e.g. Baksh, 1979; Behera & Singh, 2002; etc.) have shown that a good rate of success is achievable. Resistance was reported in the interspecific hybrids formed from crosses between brinjal and both S. incanum and S. violaceum (= S. indicum). Additionally, the biological control option is another avenue that merits more scrutiny. Srinavasan (2008) showed that there are several known natural predators and parasites, such as the Ichneumonid Trathala flavo-orbitalis Cameron, which attack BFSB. Nagalingam et al. (2006) observed its ability to synchronise with BFSB, recognising it as a potential bio-control candidate. For small-scale farmers and producers the logical step of merely isolating the crop from the predator seems yet another option! A recent study by Krishna Kumar et al. (2010) showed that simple physical barriers such as the use of insect-proof netting are very effective in reducing BFSB damage to brinjal crops. They add that this technique remains a clear alternative to GM brinjal. Thus, development of untransformed brinjal with genetic resistance to BFSB, perhaps cultivated with the aid of biological and physical control measures, may provide equally effective means of combatting crop damage.

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-----Original Message-----
From: Biotech-Mod2
Sent: 01 December 2012 06:36
To: biotech-room2-L@LISTSERV.FAO.ORG
Subject: 85: Re: AquAdvantage Salmon

This is Henry Clifford again. I would like to respond to the more egregious claims made by Tim Schwab in Message 80 regarding AquAdvantage salmon.

First of all, the growth performance data of AquAdvantage Salmon that has been widely publicized compares genetically modified triploid Atlantic salmon to diploid and triploid commercial lines (from Atlantic Canada) of domesticated non-transgenic Atlantic salmon, not "wild type" Atlantic salmon, as Tim Schwab disingenuously insinuated.

Secondly, I have seen some of the marketing claims of growth rates in other commercial lines of Atlantic salmon, some of which are impressive, but until our GM salmon are tested side-by-side under identical rearing conditions and diets, it is speculative to claim that one line of salmon can outperform another. We have contacted a number of other salmon breeding companies in an effort to run comparison studies with their salmon lines, and unfortunately many of them cannot meet the stringent zoosanitary standards that Atlantic Canada requires for importation of live salmon products into Prince Edward Island for testing.

Tim Schwab fails to recognize that for fish farmers in developing countries, growth rate is only one of the economic drivers for profitable operation. Feed conversion is one of the most powerful economic drivers, and we have scientific evidence that feed conversions with AquAdvantage Salmon would be 0.1 to 0.2 FCR (feed conversion ratio) units lower than with conventional farmed Atlantic Salmon, especially in the closed systems which are advocated for AquAdvantage Salmon. We also have strong scientific indications that dietary protein is more efficiently utilized in AquAdvantage Salmon than in conventional non-transgenic Atlantic salmon. The combination of lower FCR and improved dietary protein utilization would dramatically lower production costs to the fish farmer.

Further, Tim Schwab made two factually inaccurate statements when he said "Even if GE salmon could demonstrate fast growth rates, which it has not, the product doesn't appear to be an accessible food source in developing nations." If Mr. Schwab had taken the time to examine the findings of the U.S. Food & Drug Administration (FDA)'s analysis of our technical dossier, he would discover that we absolutely did demonstrate fast growth rates, which is one of the underlying claims that was satisfied in our application. Finally, a fast growing genetically modified salmon would be an accessible food source (and source of exports) in any developing nation which possesses suitable rearing conditions for our salmon, which is simply cold freshwater.

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-----Original Message-----
From: Biotech-Mod2
Sent: 02 December 2012 06:53
To: biotech-room2-L@LISTSERV.FAO.ORG
Subject: 86: Re: Selection strategies used to develop new GMOs

This is Behzad Ghareyazie again.

I wish to respond to the question raised by Dr. Didier Breyer in Message 2. "My question relates to the selection strategies that will be (or have been) used to develop new GMOs that are likely to be commercialized in developing countries within the next five years". And "I would be interested to know whether the presence of ARMGs in GM plants to be commercialized in developing countries has been considered an issue and whether alternative strategies have been envisaged and/or implemented".

I agree with Prof. Gupta (Message 3) in that the issue of antibiotic resistant marker genes (ARMGs) has been overblown with no scientific data supporting any harmful effect of these genes on human and/or animal health or the environment. I also agree that this is mainly a European concern but I should admit that it has great influence on developing countries like Iran where there is little or no capacity to differentiate the "true" interest of the opponents of the GM technology from their "excuse" using the unknown risk associated with the use of ARMGs to prevent the application of GM technology in their own country.

In Iran, some of the GMOs in pipeline (e.g. Bt rice) contain ARMGs (hpt). Bt cotton contains Kanamycin resistant gene etc. However, it has recently been decided at the Agricultural Biotechnology research institute of Iran that to the extent possible ARMGs should be avoided not because they pose any risk, but because, as a reality, this is currently a concern raised by some people (influenced by European concern). Therefore, in future there will be no ban on ARMGs in Iran (unless there is a scientific finding against using them), but in developing new GMOs ARMGs will be avoided.

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-----Original Message-----
From: Biotech-Mod2
Sent: 02 December 2012 07:11
To: biotech-room2-L@LISTSERV.FAO.ORG
Subject: 87: Re: Bt brinjal

I am T. M. Manjunath (68) and this is my second submission, but on a different topic. I find there has been an overwhelming submissions on Bt-brinjal on various issues and I would like to offer my comments/clarifications on some:

Safety:
Bt-brinjal has undergone about two dozen prescribed biosafety and environmental tests involving more than 150 scientists from reputed research institutions for 8 to 9 years in India. These tests included allergenicity, toxicity, out-crossing, safety to mammals and other non-target beneficial organisms, agronomic performances, etc. These data can be viewed at http://www.envfor.nic.in/divisions/csurv/geac/bt_brinjal.html. It is only on being satisfied with the reports and recommendations of the Review Committee on Genetic Engineering (RCGM) and two Expert Committees specially appointed for the purpose (http://moef.nic.in/downloads/public-information/Report%20on%20Bt%20brinjal.pdf), was Bt-brinjal approved in October 2009 as safe by the Genetic Engineering Appraisal Committee (GEAC) which is the highest government regulatory body constituted by eminent experts. These members are as much, if not more, responsible and concerned about the safety of humans and the environment as anyone else. Besides, Bt has an impeccable global safety record. In the last 50 years of its extensive use as various spray formulations to control a variety of insect pests all over the world and 16 years in transgenic

crops in about 25 countries, it has not caused any scientifically proven ill effect on humans, animals, plants or the environment. The various allegations made against its safety by certain NGOs have been scientifically examined by the regulatory authorities and found to be baseless. It is a pity that they continue their tirade, disregarding the scientific facts. The prevailing moratorium on Bt-brinjal since February 2010 is not scientifically justified, but it has become more a political issue.

'Super weed?':
The brinjal fruit-and-shoot borer (FSB) (Leucinodes orbonalis) is functionally a monophagous pest on brinjal (Solanum melongena). Although it has been reported on a few cultivated Solanum species, it's occurrence was only incidental and it has not become an economic pest of any of these crops. Further, FSB does not attack any of the wild relatives of S. melongena, for they have been supposed to possess natural resistance and even a few of them have been explored as a genetic source for resistance breeding. So, the allegation that Bt would convert them into 'super weeds' has no scientific basis.

Cross pollination: A lot, really a lot, has been written about the possibility of cross pollination between various species of Solanum and its relatives, both cultivated and wild. I do not understand why there was so much discussion on it in the context of Bt-brinjal. All the wild, weedy and cultivated Solanum mentioned by various authors have been competing and co-existing in nature for decades. If they had the potential to hybridize or to cause any adverse effect on each other or on general biodiversity, it would have occurred long back. Even if it were to occur in future, in what way is Bt gene going to be responsible for it? Bt has no influence on the reproductive behavior of the plants.

Bt imparts only a trait, it is not a cultivar: The action of Bt protein is specific to control FSB. Except for the presence of this deliberately introduced beneficial trait, it has been proved that Bt-brinjal is 'Substantially Equivalent' to its non-Bt counterpart in all respects. Thus, Bt gene only contributes to empowering a native variety or hybrid in terms of combating FSB without affecting any of its original attributes such as growth, yield, taste, flavour, genetic vigour, medicinal quality, etc. Further, since Bt gene will be introduced into the selected local varieties or hybrids (as in the case cotton) that are already being cultivated by the farmers, the question of 'Bt-brinjal' replacing or disturbing native cultivars or affecting biodiversity does not arise. The Bt gene imparts only an insecticidal trait, it is not a variety by itself as mistaken by some.
The opponents have been relentlessly projecting as if Bt technology is a monster and Bt protein a general poison without realizing its host-specificity, safety and benefits. Bt (Bacillus thuringiensis) is a beneficial soil bacterium with global distribution and its insecticidal property was discovered way back in 1901 in Japan. Volumes of safety data are available on its safety and it has been globally certified as one of safest biopesticides ever. The opponents may try to suppress facts, but cannot alter them. I have answered a number of questions raised on Bt crops, including Bt-brinjal, in my book "Q&A on Bt-cotton in India - Answers to more than 85 questions" (2011) which can be accessed by clicking on:
http://ableindia.in/admin/attachments/reports/reports19_Q%20&%20A%20on%20Bt_cotton_Jan%202011_TM%20Manjunath_6.43MB.pdf.

The e-mail conference is a very thoughtful idea which provided an excellent platform for exchange of views. My sincere appreciation to all concerned.

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-----Original Message-----
From: Biotech-Mod2
Sent: 02 December 2012 07:30
To: biotech-room2-L@LISTSERV.FAO.ORG
Subject: 88: Re: AquAdvantage Salmon

This is Tim Schwab again, from Food & Water Watch, responding to some of Henry Clifford's concerns (message 85) regarding the benefit claims of GE salmon, namely its purported fast growth rate.

Henry Clifford acknowledges that commercial (non-GE) salmon growers have impressive growth rates. Are they faster than GE salmon? He says we don't know and we can't know because we can't do the studies because of zoosanitary rules. From both a scientific and risk-assessment point of view, this is unacceptable: if we are going to take the unprecedented regulatory action of approving the first-ever food animal in the world, this fish should be thoroughly studied. We should have answers to fundamental questions like, does this fish offer any benefit to producers/consumers/society. Henry Clifford is right that we can only speculate on which fish grows faster. But it seems wrong-headed and irresponsible to approve this product in the absence of the necessary science. The only way to get beyond speculation is to get the data. In the absence of data, we are also left to speculate on whether GE salmon can really feed the world, revolutionize aquaculture, and improve protein production as the company claims. Again, the growth-rate graph from one commercial grower in Norway, Salmobreed: www.salmobreed.no/newsletters/en/newsletter_5_2011.pdf

On feed conversion, the only study that AquaBounty offered to the FDA in its environmental assessment regulatory filing suffers the same problems with its comparisons--it compared GE salmon to an only "partially domesticated" Canadian salmon, not the fast-growing commercial salmon in places like Norway that have benefitted from decades of selective breeding and which have made vast improvements in a variety of characteristics. This severely limits the value of this feed-conversion data (see: http://www.sciencedirect.com/science/article/pii/S0044848600003318). Moreover, the feed-conversion study was 1) written by AquaBounty employees, 2) published 12 years ago and 3) observed a 10% improvement in gross feed conversion ratio over the very limited period that the fish were studied, from 8g-55g. Given that market weight of Atlantic salmon is, generally, around 4 kg, we should be looking at the entire life of GE salmon. And we should be using a real-world comparator. The limitations of this data are simply too great to make conclusions about GE salmon's feed conversion (or, by extension, to speculate that the feed conversion ration (FCR) will make GE salmon production economically feasible in developing countries).

Finally, Henry Clifford mentions the "strong scientific indications" that GE salmon's maintains advantageous dietary protein utilization, which will also give it a benefit over non-GE salmon. I'm simply not sure how to respond to this, but I would very much like to see whatever published data is backing up these "indications." It sounds like another example where we need further study, just as the growth-rate claims and FCR claims do. So, too, do a variety of environmental risk-assessment questions, which are described in this excellent radio debate between Professors Alison Van Eenennaam and Anne Kapuscinksi. (http://www.npr.org/2011/12/09/143453487/debating-genetically-modified-salmon).

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-----Original Message-----
From: Biotech-Mod2
Sent: 02 December 2012 07:30
To: biotech-room2-L@LISTSERV.FAO.ORG
Subject: 89: Re: AquAdvantage Salmon

I am Saka Saheed Baba, a Professor of Virology at the Faculty of Veterinary Medicine, University of Maiduguri, Nigeria and a former Director/Coordinator of Chevron Biotechnology Centre, Federal University of Technology, Yola, Nigeria.

I am interested in the postings of Henry Clifford with respect to AquAdvantage Salmon and its production in cold freshwater. How can the production of of this genetically modified salmon be exported and facilitated under controlled conditions in tropical environments? Are there GM freshwater fish in the pipeline?

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-----Original Message-----
From: Biotech-Mod2
Sent: 02 December 2012 07:54
To: biotech-room2-L@LISTSERV.FAO.ORG
Subject: 90: Re: AquAdvantage Salmon

This is Carlos Scotto again. I would like to address some of the statements made in Messages 41, 43, 69, 74, 80 and 85 regarding the genetically modified salmon.

The biotechnology has therefore developed GM fish for nearly 30 years, but so far we have not seen any GM fish commercialized in market. Why not yet? And if not sold in the countries that were developed. Why would that be in developing countries in the future? It has been mentioned that the GM salmon is:
A. Are all sterile (triploid) and female, the gonadal atrophication triploidy causes in females with consequent sterility. And that occur in the animal who is not employed in accumulating material reserves for reproduction but is channeled to growth. In the case of males, low fertility occurs but no complete sterility and individuals males can reproduce (Basant K. Tiwary, R. Kirubagaran & Arun K. Ray. 2004. The biology of triploid. Reviews in Fish Biology and Fisheries 14: 391–402). Question: How do you ensure that no low fertility male fish mixed with sterile females in these large batches of transgenic fish?

B. GM salmon will only be reared in land based, contained culture systems with multiple, redundant containment barriers preventing their escape into the wild. Question: If the sterile transgenic fish is why many take containment measures for their safety? Would it work these measures and biosecurity protocols in developing countries where environmental accidents are very common and some punished? And there is a natural thermal barrier (lethal ambient water temperatures - case Panama) preventing the salmon from reaching the ocean. Question: In the case of Peru, this natural thermal barrier would not exist, since it would foster conditions in cold rivers (Peruvian Andes). And if it escapes to the sea, the temperature conditions are too cold, so this environmental containment barrier does not exist as the proposal for Panama.

Most appropriate for developing countries could be:
1. Developing transgenic to solve specific problems of the reality of these countries. For example: To produce a salinity tolerant Nile tilapia, Oreochromis niloticus through genetically modified breeding by introducing a fragmented purified DNA isolated from sea bream, Sparus aurata or Artemia, Artemia salina (Samy Yehya El-Zaeem et al., 2011. African Journal of Biotechnology Vol. 10 (4), pp. 684-695).
2. Have social acceptability or license before being introduced or developed locally. What do you want? What is needed?
3. Ensure sterility (triploid) one hundred percent of genetically modified animals to prevent uncontrolled reproduction or unwanted cross with native species. If GM fish escaped from fish farms, they could further upset the oceans' delicate ecology, causing ecological disruption or species extinction (Devlin R. et al. 2001. Growth of domesticated transgenic fish. Nature 409: 781–782).
4. Assess individually. You can not extrapolate the results of the risk analyzes existing between different transgenes.For example, growth hormone involving faster growth and intended for human consumption versus fluorescent protein that is commonly used for ornamental aquariums and not for human consumption. "Both are genetic engineering in fish but their perception is different to the public." A shining fish in an aquarium encourages

curiosity, but with a bigger fish and intended for human consumption raises fears that must be managed socially relevant information and build trust. "
5. Finally, for developing countries. The question is not whether such risks are acceptable, but if needed in some way to our realities in the future. Continually remind us of the need to feed the world or fill a need beyond our reality with transgenesis, stating that we must necessarily risk. Should we evaluate previously unhurried and cautious way...!

Blgo. Mg. Carlos Scotto Espinoza.
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-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:43
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 91: GM rubber in India

This is E.M. Muralidharan from India, again.

There has not been much mention in the conference about GM trees. Not very surprising if you consider that interest in a long-term crop is fraught with difficulties of field testing, besides the fact that most tree crops are relatively recent in domestication and are rather recalcitrant to molecular and in vitro culture procedures. In the field too, trees are different in the way they interact with the ecosystem. Long-term crops are therefore not very attractive for GM. The fast growing eucalypts, poplars and pines are exceptions.

Although not a forest crop, the only tree in the GMO pipeline in India (although not in the next five years) is GM rubber (Hevea brasilensis) developed by the Rubber Research Institute of India. Permission for long term testing of GM rubber in two locations has been granted by the Genetic Engineering Approval Committee (GEAC) but has not yet been taken up. Genetic modification had been done to introduce drought tolerance and tapping panel dryness by introducing the Manganese superoxide dismutase (MnSOD) gene from the rubber plant itself with CaMV 35S promoter, npt II and GUS reporter genes.

There is opposition, mainly within the rubber growing Kerala State, situated in the biodiversity-rich Western Ghats region. The State has also declared itself a GMO free state a few years back. NGOs have pointed to the dangers of using a testing protocol designed for annual crops in the case of rubber, which grows for many decades and that seeds of the rubber tree and honey from plantations are widely used in India and are likely to be affected by use of GM trees.

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-----Original Message-----
From: Biotech-Mod2

Sent: 03 December 2012 18:44
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 92: Economic and environmental benefits of new traits

This is Jonathan Shoham for the third time.

As this excellent conference closes, one aspect which has perhaps not been covered in detail is the economic and environmental implications of the new traits – the original questions in the FAO Background Document were the following:

"4.2 What are the likely implications of these new GMOs for developing countries?

Specific questions that can be addressed regarding this topic include:
4.2.1 What are the likely implications of these new GMOs on food security and nutrition in developing countries?
4.2.2 What are the likely implications of these new GMOs on socio-economic conditions in developing countries?
4.2.3 What are the likely implications of these new GMOs on sustainable management of natural resources in developing countries?
4.2.4 What are the likely implications of these new GMOs on adaptation to climate change in developing countries"

Most contributions have rightly and necessarily focused on the technical aspects.

It is more difficult to address the socio-economic and environmental dimensions as these depend very much on the country specifics and are intrinsically difficult to quantify. Having said that, it is possible to address this aspect in a generic fashion. The bottom line is that unless a new trait provides the farmer with some economic benefit it is unlikely to be launched, and if it is launched but provides no economic benefit it will fail. Economics 101 tells us that this benefit can come either from an increase in farmer revenues or a reduction in his costs. Deconstructing this further:

Revenue benefits derive from either:
- increased yields – there is much evidence that GM traits launched so far, especially Bt ones, provide yield benefits (e.g. see the work of Brookes and Barfoot: http://www.pgeconomics.co.uk/publications.php)

- or increased prices for the output - these can came from a better quality crop or one which offers a consumer benefit for which a price premium can be obtained – e.g. improved oil quality. There are as yet few examples of this but these types of consumer traits are only now beginning to appear.

Cost reduction benefits can come from decreased use or costs of herbicides and insecticides. For example glyphosate tolerant crops led to considerable reductions in weed control costs.

So the answer to the original questions are that if a new trait is successfully launched it is very likely that it will make a positive contribution to food security (and nutrition in the case of biofortification) and improve the socio-economic conditions in the country by improving farmer incomes. Otherwise it would not be successfully launched. It's a sort of reverse 'Catch 22'

Finally, addressing the last two environmentally-related sub-questions above, the best way to improve sustainability is to increase yields in an environmentally sustainably manner, as this leads to less land and water requirements per unit of output. This is recognised in the FAO's push for sustainable Crop Production Intensification. So any traits which increase yields are also likely to have environmental benefits. Furthermore, traits which lead to a reduction in pesticide use have additional benefits. And on the last question, it is almost tautological that traits developed to address environmental challenges, for example drought, heat, salt tolerance will help with adaptation to climate change.

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-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:45
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 93: Biotechnologies and new GM crops - French Ministry report

This is from Dominique Planchenault. I am currently working for the French Ministry of Agriculture and we made last year a study on new plant varieties that could be in the pipeline, considering a perspective of 20 years. This report could be useful for participants.

The 60-page report, published this year by the Conseil général de l'alimentation, de l'agriculture et des espaces ruraux (CGAAER) of the Ministry, is in French and entitled "Les biotechnologies et les nouvelles varieties végétales". It is available at http://agriculture.gouv.fr/IMG/pdf/CGAAER_10157_2012_Rapport_cle015844.pdf (460 KB) or contact me directly (e-mail address below) to request an electronic copy.

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-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:46
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 94: Significant investments and potential GM crops in developing countries

This is Bhagirath Choudhary again.

As expected, there has not been much contribution except Bt brinjal/GM salmon to the questions set forth for the FAO e-mail conference. Therefore, it becomes necessary for FAO to take a more pragmatic approach and must directly consult its partners in developing countries on the questions posed on biotechnology that undoubtedly remains the key tool for breeding improved crops.

Debate aside, the most notable trend in developing countries that we have witnessed over the years is the deployment of gene(s) using recombinant DNA (rDNA) technology either by transgenic or cisgenic methods for crop improvement. More and more R&D institutions for crop improvement in developing countries are equipped with tools, techniques and expertise to harness the potential of rDNA tools that are more precise and predictable and can significantly reduce breeding cycle by half. For that matter, no crop research institutes under national agricultural research systems (NARS) in India, China, Brazil, South Africa and USA are without the biotech projects that deploy novel gene(s) to develop crops that are immune to insect-pests and diseases, enriched with nutritional components, efficient in weed management, resilient to hardy conditions and rich in heterosis. The new generation biotechnologies are also helping institutions and seed producers not only to maintain purity of seed production but also significantly reduce cost of hybrid/varietal seed productions resulting in the robust supply chain management of high quality hybrid and varietal seeds, and sustainable food production. Developing countries are set to bear the fruits of these ground breaking seed production biotechnologies within a period of 5 years.

In recent years, a significant amount of investment has been allocated particularly to develop transgenic GM crops in India, China, Brazil and Russia. Similar investments corresponding to their research program are being made in other developing countries including South Africa, Philippines, Vietnam, Bangladesh and Indonesia etc. The International Service for the Acquisition of Agri-biotech Applications (ISAAA), that closely monitors the development and deployment of GM crops in the world, reported the following big dollar investments in recent years to develop GM crops;

1) In 2008, the Chinese government rolled out a US$3.5 billion research and development (R&D) initiative on GM plants to spur commercialization of GM varieties. Over the years, China has commercially released half a dozen crops, listed in the chronology of their approval; cotton (1997), petunia (1997), tomato (1998), sweet pepper (1998), poplar tree (2005) and papaya (2006). The most advanced products that are nearing commercial release include phytase maize, herbicide tolerant (HT) maize, HT soybean, Bt rice and fungal resistant wheat.

2) In 2012, Russia adopted "the Comprehensive Program for Development of Biotechnology in the Russian Federation through 2020" and committed a major financial investment of US$6.7 billion to develop GM crops over 2012-2020, double than the Chinese US$3.5 billion. In addition, a similar budget being allocated to develop products in food bio-industry, animal and poultry and forest biotechnology. The most promising biotech crops include disease and fungal resistant potato and wheat.

3) The annual R&D budget of EMBRAPA, the NARS of Brazil, doubled from US$478 million in 2006 to US$1.1 billion in 2010 and 2011, with launching of a comprehensive plan "PAC EMBRAPA" to promote EMBRAPA activities in Brazil and overseas including several programs in Africa. Brazil is the engine of growth of biotech in the world with 30.3 million hectares of GM crops planted in 2011 including HT soybean (1998), Bt/Ht cotton (2005), Bt/HT corn (2007), Bt/HT soybean (2010) and Golden Yellow Mosaic Virus Resistant (GYMVR) Phaseolus beans (2011) - year of commercial release in parenthesis. The commercial release of the GYMVR Phaseolus beans in 2011 is a big step forward by EMBRAPA demonstrating the robustness of public sector R&D to develop and deploy GM crops in developing countries.

4) India, which occupies the world's largest area under Bt cotton, 10.6 million hectares in 2011, is making significant stride in building biotech led R&D institutions to tackle biotic and abiotic stress in various crops with a combined investment in crop biotech estimated to be about US$1.5 billion over the last five years, or US$300 million per year by the Indian Council of Agricultural Research (ICAR), Department of Biotechnology (DBT), Council of Scientific and Industrial Research (CSIR) and state agricultural universities (SAUs). Similarly, private sector investments in India are up to US$200 million per year making the current total of public and private sector investments in crop biotech in India at the order of US$500 million per year. Current R&D in crop biotechnology in India is focused on the development of biotech food, feed and fiber crops that can contribute to higher and more stable yields and also enhanced nutrition. Bt cotton, the first commercial biotech crop released in 2002 followed by rigorous field testing of many crops including Bt brinjal, Bt/HT cotton, Bt/HT corn, high yielding mustard, Bt okra, Bt/HT rice, high iron rice, golden rice, Bt chickpea, Bt pigeonpea, Bt cabbage, Bt cauliflower, HT wheat, nitrogen use efficiency (NUE) cotton and groundnut.

Other agriculturally important developing countries either released and/or field testing GM crops include:
Pakistan - Bt cotton, Bt/HT cotton, virus resistant (VR) cotton, Bt/HT maize, drought tolerant wheat and drought tolerant sugarcane also reported in message 62 (by Yusuf Zafar);
Bangladesh - Bt brinjal, golden rice, late blight resistant (LBR) potato refer to message 73 (by Md. Shahjahan);
Philippines -Bt/HT maize, Bt brinjal, golden rice and Bt cotton;
Indonesia - Bt cotton, drought tolerant sugarcane, Bt/HT maize;
Vietnam - Bt/HT maize and Bt rice and
Argentina- GM soybean, maize, cotton, wheat, rice, potato and sugarcane as reported in message 72 (by Patricia Gadaleta).

A series of GM crops in Africa are at various stages of development as reported in message 49 (by José Falck-Zepeda). ISAAA has also been regularly compiling an up-to-date GM crops approval database that not only includes the approval of GM crops for commercial release/plantings but also those countries that approved importation of GMO grains and field testing of different GMOs in developing countries. The ISAAA GM crops approval database

is a user friendly tool to access regulatory approvals as per gene(s), trait(s), crop(s), country(s) and its combinations and is available at: http://www.isaaa.org/gmapprovaldatabase/default.asp

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-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:47
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 95: Re: Bt brinjal

Hi, I am Wayne Parrott. I have degrees in Agronomy followed by Plant Breeding and Genetics. I have 25 years of working on transgenics at the University of Georgia. The past few years I have been spending ever greater food/feed safety assessment and environmental risk analysis (ERA), most recently having finished an ERA guide tailored for Latin America.

I want to begin by thanking the sponsors of this forum for the opportunity, and the moderator for making it happen. I have belatedly been going through the postings, and have some comments I would like to make.

Although several products have been mentioned as being in the pipeline and potentially available in the past 5 years, regulatory issues will prevent most from leaving the lab. A key topic is gene flow, as illustrated in messages 33, 44, 51, 60 and others on Bt brinjal. The gene flow discussions require some science and objectivity if we are to move forward, not just for brinjal, but other crops that could be useful for developing countries.

Whether or not the crop will cross with its wild or feral relative is really the wrong question, as gene flow is far more complex than just crossing. I just start on the premise that crosses will occur. Thus the relevant question is about the consequences of such crosses.

First it is necessary to remember that transgenes do not flow by themselves-- it is chromosomal segments that flow, not isolated genes. The transgenes are linked to other genes on a chromosome, and the alleles of these genes on the chromosome tend to be for agricultural adaptation. Secondly, it is necessary to distinguish between pollen flow and gene flow.

Technically, gene flow has not taken place unless the gene is present in advanced generations (what breeders call introgression). Introgression tends to occur if there is continued pressure from pollen flow, or if the transgene confers an advantage in the wild. For the latter it is important to note --particularly for Bt-- that the pests that limit a crop under agricultural conditions usually are not the same ones that limit the growth of their relatives in the wild. In addition, any advantage given by the transgene can be counteracted by the other genes/alleles on the chromosomal segment that is flowing (a version of what breeders call 'linkage drag').

Everything needs a point of reference to use as a basis for risk assessment. First, is there anything about the transgene that can increase the ability to participate in crosses, and 2), in what way are the *consequences* of gene flow from a transgenic crop different from the consequences of gene flow from a conventional crop?

Mention is made in message 60 that the cross of conventional brinjal with S. violaceum leads to the production of vigorous hybrids. What is the fate of these? Have they led to new weed problems? Invasiveness? Any adverse

effect? If not, what is it about crossing with transgenic brinjal rather than regular brinjal that can make a difference in the behavior of the hybrids? Most likely, the answer is nothing; regardless, it is an easy test to conduct.

In the end, even if we assume that introgression does occur, "destruction of biodiversity" is by no means an automatic result. After all, all sorts of cultivated and wild solanums have coexisted for millennia without destroying each other, despite any genes that may have flowed from crops into wild and feral relatives. Again, it boils down to whether the transgene would present different issues from the gene flow that has taken place in the past, and thus have detrimental consequences. The answer is specific to each gene-crop combination, so a case by case evaluation is still needed to determine if gene flow could be detrimental.

In the event of gene flow, it is important to emphasize that an extra gene in a genome in no way destroys the identity of that species. Once upon a time we thought that all members of the same species had the same genes in the same order. Perhaps one of the most surprising thing we have learned from all the genome sequencing going on is that the original premise was wrong. Two individuals from the same species can differ by as few as 1 or 2 genes or as many as a couple thousand genes, which keep assorting into different combinations as individuals in the species cross and segregate out. Clearly, species tolerate presence/absence of genes and copy number variation of genes far better than we give them credit for.

So, if gene flow from conventionally bred crops has not destroyed biodiversity, what makes gene flow from a transgenic any different? The answer to that question is what risk analysis is all about. Furthermore, any possible damage must be associated to a biologically possible hypothesis, and based on the weight of the evidence where ever possible, and not on single publications.

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-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:47
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 96: Re: Bt brinjal

This is Wayne Parrott again. For the past few years, we have been looking at some of the issues that Aruna Rodrigues brought up in message 65, as they deserve answers. The latest result should be in the December issue of Plant Physiology, and it addresses the issues of changes in proteins or DNA alterations.

The whole premise behind safety assessment is that if two things are identical, one cannot be said to be safe, and the other unsafe. Thus if there is any safety issue, it must be associated with a difference. Thus, we first look for categorical differences between transgenics and non-transgenics, as such differences are where novel safety issues would be.

1) Differences in identity:
There is a report (Tenaillon et al., 2001) that compares amino acid (aa) substitution in the same proteins from different types of maize. Genes 300-400 aa long *normally* differ by some 15-20 aa's. The difference is even greater if the same protein is compared across different species. Importantly, none of these proteins has acquired toxic or other hazardous traits because of aa substitutions. The reason is that toxins require greater structural differences than are achieved by aa substitutions (Pariza & Cook, 2010). Thus, we cannot see aa substitution as a risk.

2) Presence of multiple inserts of vector DNA:

There are rice varieties where every individual can have 50-60 new transposon insertions per plant per generation, without safety issues (Naito et al. 2006). No two plants have the exact same inserts in the same places. Why would T-DNA be different? There are lots of other examples of DNA that moves around in the plant, and never with a negative consequence (e.g., Lough et al, 2008; Huang et al, 2004; Staginnus & Richert-Poggeler, 2006; Cohen et al, 2008). Thus we cannot see inserts or additional DNA as being hazards per se.

3) Old/outdated construct:
Should not be interpreted to mean unsafe or ineffective. For those who are still not convinced of the safety of Bt, an older construct does have the advantage of having far more data of its safety in the field and in various crops than "newer" constructs have.

4) Novel RNA:
I want to point out that Codex standards are not cast in stone. Accordingly, I want to note the difference between "should be" and "must be" provided. Furthermore, Codex (2003) is a *recommended* Guideline for safety testing, not hard and fast rules. Flexibility is needed in safety assessment; after all science moves faster than law, particularly international law. In the case of RNA, I do not see that one more RNA molecule among the many thousand present in a cell can pose a hazard. Has there ever been any risk associated with longer mRNA molecules in a plant? If so, please let us know. *[I provided references/links to the outcome of the Codex Alimentarius Commission's work on principles and guidelines for food safety assessment of foods derived from modern biotechnology at the end of Message 65. The Codex Alimentarius Commission, established by FAO and WHO in 1963, develops harmonised international food standards, guidelines and codes of practice to protect the health of the consumers and ensure fair trade practices in the food trade. It also promotes coordination of all food standards work undertaken by international governmental and non-governmental organizations...Moderator]*.

Granted, there was a report of rice-derived RNA altering liver function in mice. This report has yet to be repeated, but assuming it is repeated, note the mice had to eat 1/3 of their body weight in dry rice each day to get the effect. If humans also suffered from this effect, we would see far greater amounts of high cholesterol across rice-consuming areas of the world than we do.

Even if the new RNA would result in a fusion protein, it turns out that fusion proteins turn out to be rather common in plants as well. It is not possible to say every fusion protein is automatically safe, which is where compositional analysis comes in. If said fusion protein would reach toxic levels, its presence would be inferred by changes in the relative amounts of other compounds.

In the end, proper safety assessment must be both judicious and based on biologically possible hypotheses. A lot of the concerns about GMOs come from the state of knowledge from a few decades ago. The premise from a few decades ago that insertion of DNA could reactivate dormant pathways for toxic compounds simply has not held up to scrutiny. Many of those concerns have been found to be without a biological basis. Today, those concerns without a plausible and testable biological basis simply serve to block technology and raise costs, while not increasing safety at all.

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-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:48
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 97: Re: Little contribution about GM crop pipeline in Brazil

Here is Wayne Parrott again. I forwarded Message 76 by Mairson Santana on crops in Brazil to a colleague on CTNBio, and here is his response to the many points Mr. Santana is bringing up:

Santana is bringing to the discussion some interesting points, but it is important to discuss each one of them separately, in order to achieve the necessary understanding.

He points to the Brazilian legal framework, including CTNBio (the National Biosafety Commision) as a pivotal element making GMO releases an uncertain adventure. By reading the next lines we come to the conclusion that every GM plant approved by CTNBio immediately enters the market and this may be a real problem in cases of asynchronous approvals (i.e. approved in the producer country but not by the importer). This is not true: CTNBio has the sole task to do risk assessment. Market questions must be considered elsewhere. The Brazilian market is well conscious of the problems generated by asynchrony and that was the reason why Bayer withdrew its request for commercial release of a GM rice. It is the same reason why Monsanto now decided not to market Intacta Pro Soybeans.

Many other corn, cotton and soybean varieties (either single or stacked events) will soon follow, but the same rule (i.e. the market control) will apply: neither the seed companies nor the farmers or the exporters want to have problems. As for a possible segregation, this is fully impossible: therefore, asynchrony should be avoided in every export commodity.

Santana briefly comments two long-debated questions: the food safety of GM rice and other food staples for direct human consumption and the possible contamination of non-GMO fields. Questions on food safety have been adequately answered by CTNBio; on the other hand, the coexistence rules are effectively ensuring that essentially no “contamination” occurs. Only anecdotal reports on alleged contamination are available.

Santana is correct in saying that BGYMV (Bean golden yellow mosaic virus) resistant bean is not important for the Brazilian farmers. However, the reason is that said virus is not found in Brazil! The virus that causes the golden mosaic in this country is the BGMV (Bean golden mosaic virus) which is a distinct species, and it causes major yield losses. BGMV is a very serious problem in Brazil and the GM bean is resistant to BGMV, which will be in the

market late next year, and will certainly be generally adopted and the positive economic impact will be very significant. For this crop asynchrony is not a problem, as Brazil is an importer of beans.

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-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:48
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 98: Re: AquAdvantage Salmon

This is Tim Schwab again, from Food & Water Watch. I want to comment on Carlos Scotto's Message (nr. 90), specifically about sterility (posting 90).

AquaBounty, the company producing GE salmon, openly acknowledges in its regulatory applications that its triploidy sterilization process does not achieve 100 percent sterility. The Food and Drug Administration (FDA), which is regulating GE salmon in the U.S. notes GE salmon's average sterilization of something like 99.7% but concluded that: "We have confidence that the method will provide triploid rates greater than 98% for most inductions."

The FDA has also indicated that, if GE salmon is approved, the company will only need to demonstrate (with a .95 probability) that 95% of eggs are triploid once in commercial production. This point is available in this FDA document at page 58:
http://www.fda.gov/downloads/AdvisoryCommittees/CommitteesMeetingMaterials/VeterinaryMedicineAdvisoryCommittee/UCM224762.pdf *[The link is to a 172-page FDA Center for Veterinary Medicine Veterinary Medicine Advisory Committee (VMAC) 'briefing packet' (2.7 MB) on AquAdvantage Salmon, September 2010...Moderator]*.

Whether it is 95 percent or 98 percent or 99.7 percent sterility, this is not 100 percent. And once millions of eggs are being produced, this could mean tens or hundreds of thousands of fertile GE salmon. And we should consider that even if all GE salmon are sterile, that doesn't mean that they won't still have an environmental impact when they escape. Their presence in a marine environment, even relatively briefly, can still have myriad impacts on native species, competition for food, and, as Carlos puts it, the "delicate ecology" of marine life. Unfortunately, regulators have not comprehensively considered these impacts if there was an escape.

On environmental accidents: Carlos Scotto mentioned environmental accidents being common in developing countries. AquaBounty reported in 2008 that a bad storm damaged its experimental production facility in Panama "with the result that all these fish were lost."
(http://www.aquabounty.com/documents/press/2008/2008_Operations_Update.pdf)

The company claims that the fish suffocated, but there is no obvious record of any independent regulatory body reviewing the details of this event. The FDA has never publicly acknowledged the details of this event. Here is news article examining the details more closely: http://www.outsideonline.com/outdoor-adventure/science/Genetically-Engineered-Salmon-Running-Wild.html

I absolutely agree with Carlos that decisions to accept or deny new transgenic plants and animals should consider whether these products are needed and desired, not simply whether we can appropriately mitigate risk. But I don't think this applies to just the developing world. This applies everywhere. I also completely agree that we must approach new GE animals in an "unhurried and cautious" manner.—asking the right question, getting comprehensive answers, and having meaningful and independent review of the risk-assessment. There are far too many unanswered and unasked questions regarding the environmental, animal welfare, food safety, and societal

impacts of GE salmon to move forward with this product. Clearly we need more science, more data and more independent review.

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-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:49
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 99: Re: Bt brinjal

This is Aruna Rodrigues again and I am rushing to meet the deadline before this consultation closes in order to reply to Dr Manjunath (ref. his post 87 with regard to the health safety testing of Bt brinjal Event EE-1.).

I reply to 3 points in his post. First the historical claim for safety (50 years?) and that Bt has “has an impeccable global safety record”. He then proceeds to draw conclusions from natural Bt sprays and the engineered Bt toxin as though they are no different; second, evidence that “responsible scientists” have examined Bt toxins and Bt brinjal and found it safe; and third the “various allegations made against its safety by certain NGOs have been scientifically examined by the regulatory authorities and found to be baseless”.

These statements are factually wrong; the third falls by the wayside based on evidence forced into the public domain under the Right to Information (RTI). We do not even have the means to test for the Bt toxin as became apparent in the cases of animals which died feeding in harvested Bt cotton fields. As for the integrity of our regulators and public institutions, including the Ministry of Agriculture, let me remind Dr Manjunath that the evidence in the SC (which, taking cognisance of the facts, put Drs MS Swaminathan and PM Bhargava as invitees to the GEAC Meetings to observe their proceedings). And in August 2012, the Parliamentary Standing Committee has unceremoniously indicted our Regulators for a serious conflict of interest calling for a high level inquiry into several matters. It has probed further and uncovered the sheer depth and spread of the conflict of interest that has permeated virtually all public institutions connected with GMOs most especially our agri institutions. In this sorry climate of corruption and it has to be said, of open collusion with the Industry, India exercises only a semblance of regulation to mask and replace fact with a liberal dose of fiction. For whose benefit, is the rhetorical Q?

The risk assessment and quality of testing in the health safety studies is of a pattern with the molecular analyses and environmental risk analysis (ERA) appraisals by Heinemann and Andow respectively (re posts 65 & 78). Thus, in the health studies as well, there is minimal oversight by the regulators, and Mahyco-Monsanto have been accused of studies which have not been adequately performed, or not done and cover-up (Seralini, Carman & Gallagher in their appraisal of the ‘dossier’). There has been no testing what-so-ever for chronic toxicity in long term multigenerational rat feed studies. Instead of this issue being brought up endlessly, why doesn’t the Industry along with its proponents who oppose such testing, instead, move to support such testing: provide the reference materials for some really rigorous, independent and peer reviewed test protocols and testing in independent labs. Is there something to hide? With each passing year, and increasingly, the evidence from independent studies points to serious problems and they are from scientists who have more to lose than gain because of the vilification and persecution by the Industry that follows. It should be emphasized that the majority of this material has been published in peer-reviewed journals and reproduced in more than one laboratory, therefore ruling out the possibility of an individual investigator's bias.

I provide the following evidence to debunk some myths that are used by the proponents of GE brinjal to claim that it is safe (from the submissions by the named scientists to Jairam Ramesh in the review process of Bt brinjal (published in his report and from evidence provided to the Supreme Court of India).

(a) Cry mode of action and non-target effects (Heinemann, Pusztai, Schubert, Seralini, Carman, Gallagher): The claim made by Mahyco is that the safety of Bt proteins (such as Cry1Ac) "is attributed to the mode of action and specificity". These claims are made on page 93 (section 6.3) of the Toxicology and allergenicity studies vol. 1 and elsewhere. The long-accepted version of Cry toxicity is not the actual mechanism. Thus, the range of organisms that will find Cry toxic may not be predicted from knowledge based on toxicity. "In support of the human data, when animals are exposed to Bt toxins, the toxin also acts as a potent immunogen, eliciting responses from both the blood and gut-based immune systems. Based upon these data, the US Environmental Protection Agency (EPA) recommended extensive safety testing of Bt crops for this trait, but due to the lack of required safety testing for GE food crops in the US, this was never done (Freese W, Schubert D. Safety testing of GE food – Biotechnology and Genetically Engineering Reviews). Claims of safety of Cry endotoxins and therefore Bt brinjal may not be based on either cotton, or maize (in the US) because these are primarily animal feeds, even leaving aside the very good evidence that Bt cotton plants have led to serious health problems in farm animals in India. This conclusion of safety is invalid for several reasons:

(b) Ref. Prof Schubert document to Jairam Ramesh in the review process of Bt brinjal: First, in the US the maize containing the Bt protein that is consumed is largely in the form of highly processed corn chips and related snack foods that are not major components of the diet. In contrast, the Bt protein in brinjal will be directly consumed in massive quantities and in an infinite number of ways (because the vegetable is a significant component of the Indian diet) leading to potential chemical changes in the protein causing unknown toxicology and immunogenicity; Second there are no labelling laws in the US. A major concern with the introduction of any GE food is that even if it did cause an illness, it would not be detected because of the lack of epidemiological studies and the technical limitations for detecting such an illness. For example, to detect an epidemic of a disease, an incidence of at least of two fold above the background rate of the disease is required. Therefore, if Bt brinjal were to cause a disease like Parkinson's, which has in an incidence of about 20 new cases per year per 100,000 people, then in India 200,000 new cases per year would have to be diagnosed and tabulated in order to identify a significant increase, and there would still be no way to associate the disease directly with a Bt crop. In addition, many environmentally caused diseases take many decades of exposure to develop symptoms. Clearly, once Bt brinjal is commercially released, there will be no way to monitor adverse health effects caused by the product.

- There are at least four mechanisms by which the introduction of the Bt toxin gene into the Brinjal genome can cause harm. These include (1) the random insertion of the Bt gene into the plant DNA and the resulting unintended consequences, (2) alterations in crop metabolism by the Bt protein that results in new, equally unintended and potentially toxic products, (3) the direct toxicity of the Bt protein, and (4) an immune response elicited by the Bt protein. There are scientifically documented examples of all four toxic mechanisms for Bt crops.
- Allergies are complex responses of the immune system to foreign substances and vary widely between individuals in an unpredictable manner. Bt toxins have long been used as insecticidal sprays on a variety of crops, but the spray is a less toxic form of the protein than that made by GE plants. Even though the spray is not ingested by farm workers, there is solid evidence that the Bt proteins elicit a strong immune response in some workers after a few months exposure, and it is likely that many more workers are affected, but associate their allergic response with the spray and decide to work elsewhere (Bernstein 1999). Since Bt proteins have amino acid sequence homology with known allergens, allergic reactions in some individuals are not unexpected. Most importantly, it should be emphasized that the concentration and amount of Bt toxin protein that people will eat in Bt brinjal will be thousands of times higher than the exposure levels of farm workers.

(c) Allergy studies: Since the test substance was only applied once, they cannot be regarded as allergy studies. Allergies generally require repeated exposure to a substance before an allergy can be developed. The more often the exposure, the worse the allergic reaction tends to get (Carman)

(d) Lou Gallagher: Bt brinjal Event EE-1: The Bt brinjal Toxicology Assessment: She analysed the raw data of the 14 and 90-day studies of the Bt brinjal dossier. She confirms:

- organ and systems damage: Ovaries at half their normal weight, enlarged spleens with white blood cell counts at 35 to 40 percent higher than normal with elevated eosinophils, indicating immune function changes
- toxic effects to the liver as demonstrated by elevated bilirubin and elevated plasma acetylcholinesterase
- International published standards flouted.

Gallagher states: “Major health problems among test animals were ignored in these reports. The single test dose used was lower than recommended by the Indian protocols. Release of Bt brinjal for human consumption cannot be recommended given the current evidence of toxicity to rats in just 90 days and the studies' serious departures from normal scientific standards”.

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-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:50
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 100: Re: Bt brinjal

This is Wayne Parrott again, responding to Message 78 by Aruna Rodrigues.

There is lots of food for thought in this message ! The need for refugia and resistance management is critical, and so is expression level, as asserted. There are, however, some other issues that need further elaboration:

1) Potential negative effects. A lot of things can potentially happen. But, possible and probable are very different things. More properly, during an environmental risk analysis (ERA) we identify the hazards (the things that potentially happen) and then try to estimate whether they are probable or not (risk). So, it is important not to talk about hazards as if they were risks.

2) I would not dismiss hybrids as automatically being inappropriate for small farmers. I teach agroecology in Costa Rica every couple of years. I used to go to small farmer fields and show my students open-pollinated (OP) maize, was it is not common in the US. Then one year, I got there to find they were all planting hybrid maize-- the entire region switched from OP to hybrid in just 2 years. Years later, I keep asking how they like it, and the bottom line is that they still love it and would never think of going back to their old varieties.

I also have witnessed over the years how small farmers (formerly peasants) in the Almolonga/Zunil valley of Guatemala have eagerly embraced all types of hybrid vegetables. Yes, they must buy seed each year, but the extra yield and quality more than makes up for it. Over the years, there has been a noticeable improvement in the quality of the houses and their ability to purchase motor vehicles. They have upgraded from hand irrigation to irrigation pumps, and greenhouses have started to appear.

Something very similar is happening in neighboring Honduras with hybrid GM maize. The market share is growing most rapidly among the small farmers. The yield advantage and ease of management and final quality of product more than makes up for the extra cost of the seed. So, if you want to help peasants, just give them a choice and a chance!!

3) Integrated pest management (IPM): GM and IPM are not an either/or situation. They are complementary technologies. Just because someone is planting GM does not mean they can ignore sound agricultural practices. On the other side, no matter how much IPM one uses, IPM is easier with GM.

Finally,

4) Contamination: According to the Oxford dictionary, a contamination is something toxic or polluting that makes a substance impure. Think of Salmonella or organophosphate residues. Non-transgenes are never called contamination when they flow. Why are transgenes, then, called contamination? They more properly fit in the category of adventitious presence. Using emotionally charged terms such as 'contamination' does nothing to further the discussion, so let's resolve to stick to more accurate, neutral terminology.

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-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:50
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 101: Re: AquAdvantage Salmon

This is Wayne Parrott again.

Tim Schwab brought up the prospect of conventionally bred fish that grow as fast as transgenics in message 80. This brings up an interesting question, regardless of whether such fish exist. The claim is that GM salmon could have adverse impacts on other populations due to their fast growth; yet it is implied that fast-growing but non-GM salmon can be used safely. Why the difference? If both share the same phenotype, then either neither is safe, or both are safe. Hazards come from phenotype, not the way the phenotype was obtained.

As to whether salmon farming contributes to food security, it is necessary to point out 2 things. 1) there salmon serves as proof of concept that can be transferred to more tropical species and 2) there is a lot of work underway to modify crops to make better fish food. In the future (though not within 5 years), it will be possible to raise salmon with a totally land-based diet, which should make fish farming more economical while reducing its environmental footprint even more.

I would also like to address Tim Schwab's concerns that insufficient growth comparisons have been done on GM salmon (Message 88).

I want to point out that not all studies are relevant to the food and environmental safety of the salmon. We do not need to know every possible imaginable aspect of the salmon for decision-making (for that matter, I doubt we know every possible aspect of any animal breed). We just need to know those traits that could result in a food or environmental hazard.

There comes a point where more data does not translate into better decisions or greater safety. It just translates into more costs and delays that will ultimately either simply kill the technology, or as happened in the plant world, make it so that primarily only the largest and richest multinationals can afford the technology.

As far as the call to study the benefits to producers/consumers/society, I do not see any such call being made for conventionally bred fast-growing fish. We really must avoid falling into the trap of product vs process when it comes to regulations. In the end, there have been any number of technologies (canning, freezing, preservatives, waxes on fruits, fertilizing regimes, hybrids, new varieties, selling prepackaged candy bars, selling potato chips, etc etc;) where no one has determined a need to study impact on society at large prior to marketing. So, why the double standard?

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-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:51
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 102: Re: Bt brinjal

Wayne Parrott here, still catching up on the messages. I want to thank John Samuels (Message 84) for the opportunity to to bring up a couple more points.

1) To repeat my earlier message (nr. 95): the ability to cross is necessary, but not enough by itself, for gene flow to take place. Thus crossability by itself is not enough to make an environmental risk analysis (ERA) determination. We need to assess the type of damage that is likely (as opposed to possibly) to happen if the gene introgressed into another population. Such effects have to be both biologically possible and measurable. I have yet to hear a strong biologically plausible reason as to why the presence of the Bt gene would change the coexistence of the various brinjals and related species.

2) The fact that some brinjal relatives have innate insect resistance: This is good news, assuming the resistance in these wild relatives is not based on a toxin that is also toxic to humans. In general, pyramiding "natural" and engineered resistance is a wonderful way to get effective, more durable resistance, as two modes of action are combined in the same plant. A caveat is that insect resistance is difficult to breed for using conventional methodology, and frequently, undesirable traits from the wild species come in with the resistance (what breeders call linkage drag). So, while such breeding is not easy (I have been breeding for insect resistance for more than 15 years now), it is nevertheless a complementary approach much more than an alternative approach.

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-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:52
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 103: Re: AquAdvantage Salmon

This is Henry Clifford again, and I would like to respond to some of the questions and comments posted in Messages 89 and 90.

In Message 89, Professor Baba asked: "I am interested in the postings of Henry Clifford with respect to AquAdvantage Salmon and its production in cold freshwater. How can the production of this genetically modified salmon be exported and facilitated under controlled conditions in tropical environments? Are there GM freshwater fish in the pipeline?"

AquAdvantage Salmon was intended to be grown entirely in fresh water, from egg to harvest. (Most species of salmon will grow and thrive very well in fresh water, and do not require saltwater for normal metabolic processes; they migrate to the ocean generally because of superior dietary options which the marine environment offers.) In fact the formal conditions of use in our FDA application state that AquAdvantage Salmon must be reared entirely in freshwater. There are many tropical countries, which in spite of their latitude, possess highlands and mountainous regions which offer ideal temperature regimens for coldwater fish such as salmon and trout. Therefore, yes,

AquAdvantage Salmon is a “GM freshwater fish in the pipeline.” It is my understanding, that with the exception of several ongoing projects in China, there are no other GM freshwater fish intended for human consumption in the pipeline other than AquaBounty’s salmonids. But I welcome comments or information from others who are currently working with GM freshwater fish.

In Message 90, Dr. Scotto asked a number of questions:

1. "The biotechnology has therefore developed GM fish for nearly 30 years, but so far we have not seen any GM fish commercialized in market. Why not yet? And if not sold in the countries that were developed. Why would that be in developing countries in the future?"

I cannot speak for other developers, but in the case of AquAdvantage Salmon, when the salmon was ready for regulatory review, the appropriate regulatory authority in the USA (FDA) did not have a formal, published regulatory process for review and approval of GM animals intended for human consumption. Considerable time and effort by the FDA was required for them to develop and formalize their regulatory guidelines. Some of the requirements of the FDA regulatory review process, for example demonstrating durability and heritability of the transgene over multiple consecutive generations of the GM animal, cannot be “shortened in time”, and in the case of animals with relatively long life cycles, such as cold water fish, require many years to complete just that one study. In the case of AquAdvantage Salmon, the goal is to produce eggs in a developed country, sell those eggs to local fish farmers in a developing country (in Central America) who will benefit from being able to produce a low cost, nutritious, high protein food, which can then be sold and consumed locally in the developing country, or exported (generating hard currency export income) to the USA, which is one of the largest markets for salmon in the world.

2. "Question: How do you ensure that no low fertility male fish mixed with sterile females in these large batches of transgenic fish?"

Populations of 100% all female AquAdvantage Salmon are produced using neomales (males which are genetically female), which assures that no male chromosomes are present in either the eggs or milt. No male fish can result from this methodology.

3. "Question: If the sterile transgenic fish is why many take containment measures for their safety? Would it work these measures and biosecurity protocols in developing countries where environmental accidents are very common and some punished?"

The ideal biosecurity plan for GM fish is a multi-layered, redundant strategy that combines biological containment (sterility, all female), physical containment (screens, nets, filters, containment devices), and ecological containment (thermal barriers, competitive disadvantages) in one overall master biosafety plan. In the event that one of the containment layers fails, the other containment measures succeed in confining the fish and preventing its proliferation. And most definitely these measures will function well in developing countries, precisely for the reason that there are simultaneous, redundant, multiple containment elements at work, in the event of a human error. Proof of this is our successful containment track record in Central America.

4. "Have social acceptability or license before being introduced or developed locally. What do you want? What is needed?"

You should pose this question to fish farmers in developing countries. Ask them if they would like to switch from their current fish culture candidate to a faster growing version which can be grown sustainably at a lower cost, and provide high value, nutritious, high protein food, for local consumption and/or export. I suspect that they will say “yes”.

5. "Question: In the case of Peru, this natural thermal barrier would not exist, since it would foster conditions in cold rivers (Peruvian Andes). And if it escapes to the sea, the temperature conditions are too cold, so this environmental containment barrier does not exist as the proposal for Panama."

As I stated in Message 74, there is only one country currently under consideration as an FDA approved growout site for AquAdvantage Salmon, and it is in Central America. If we proposed production at another growout site, for example Peru, we would have to submit to the FDA a supplemental application in which a risk analysis of the newly proposed site is examined. Only after FDA approval of the second site, would we even allow AquAdvantage Salmon to be produced there. To specifically answer your question: as described in item 3 above, the other biological and physical and ecological containment layers would function well in the absence of a thermal barrier.

6. "If GM fish escaped from fish farms, they could further upset the oceans' delicate ecology, causing ecological disruption or species extinction."

I cannot speak for other GM fish, but considering the multiple, redundant biological, physical, and ecological containment barriers built into AquAdvantage Salmon and their proposed rearing systems, the risk of them reaching the ocean in sufficient, self-sustaining quantities to "upset the ocean's delicate ecology" is essentially zero. And when you refer to "species extinction", if you are attempting to invoke the Trojan Gene Theory, I suggest you consult with the founder of the theory (Dr. Bill Muir) and his publications to understand why that theory would not apply to our salmon.

7. "The question is not whether such risks are acceptable, but if needed in some way to our realities in the future. Continually remind us of the need to feed the world or fill a need beyond our reality with transgenesis, stating that we must necessarily risk. Should we evaluate previously unhurried and cautious way...!"

The "need to feed the world" is not a trivial matter, which can afford to wait another 50 years while disciples of the precautionary principle anguish over attempts to identify and quantify every known or imaginable risk in innovative food production technologies. Organizations which automatically oppose incorporation of innovative biotechnologies such as GM foods in food production and rarely offers viable alternative options for how we are going to feed 9 billion people by 2050, are performing an alarming disservice to humanity, particularly in developing countries, where malnourishment and starvation is a pressing concern.

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-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:52
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 104: Nutritional enhancement of cassava and grass pea

I am Dr Fernand Lambein, faculty member of the Institute for Plant Biotechnology Outreach (IPBO) in Ghent University (Belgium). The general goal of IPBO is to promote plant biotechnology in developing countries and emerging economies.

As coordinator of the worldwide Cassava Cyanide Disease and Neurolathyrism Network (CCDNN), my specific goal is to prevent the irreversible crippling diseases Konzo (from overconsumption of insufficiently processed cassava, occurring mostly among the poor in Africa) and Neurolathyrism (from overconsumption of grass pea seeds, occurring among the poor in Ethiopia and the Indian Subcontinent) by biotechnological improvement and nutritional enhancement of both cassava (Manihot esculenta) and grass pea (Lathyrus sativus).

Besides the occurrence of cyanogenic glycosides in cassava and the occurrence of a neuro-excitatory amino acid in grass pea, both crops are deficient in essential sulfur-containing amino acids. When consumed as a staple during extended periods, this deficiency can jeopardize the defense against oxidative stress in the consumers. Oxidative stress is a common feature in human neurodegenerations including konzo and neurolathyrism. Both crops are tolerant to drought and are the producer of the cheapest starch (cassava roots) or the cheapest protein (grass pea seed) respectively. Grass pea is also the most efficient nitrogen fixing food, feed and forage legume. In moderate saline soil it even produces a higher biomass. Both crops are ideally suited for marginal lands in the face of global climate change.

Cassava is praised for daily feeding more than half a billion people, although one meal of bitter unprocessed cassava roots can be lethal. On the other hand, grass pea is blamed as the cause of neurolathyrism, but this only occurs during drought triggered famines when, by virtue of its drought tolerance, grass pea becomes the survival food and staple food during several months, and neurolathyrism does not affect longevity. Indeed, in drought prone areas of Ethiopia and the Indian Subcontinent, poor farmers consider grass pea as their life-insurance crop. At a recent international conference at the Indian National Institute of Nutrition in Hyderabad where I gave the keynote lecture, the risk factors for neurolathyrism were identified as poverty, illiteracy, stress and the availability of grass pea as the cheapest food. Balancing the diet with cereals and other foodstuffs richer in the essential sulfur-containing amino acids protects against neurolathyrism and may have health benefits. When grass pea is not the cheapest food available, no new neurolathyrism cases occur in Bangladesh and India.

In contrast to cassava, research on grass pea is greatly neglected and underfunded. A recent paper by two Ethiopian researchers Dejene Girma and Lijalem Korbuon on ‘Genetic improvement of grass pea (Lathyrus sativus) in Ethiopia: an unfulfilled promise’ gave rise to an internet debate on genetic improvement of the crop (http://agro.biodiver.se/2012/01/the-future-of-grasspea-breeding-debated/). Because of underfunding, it may take more than five years before GM grass pea is in the pipeline. As grass pea seed was once a royal gift to the pharaoh in Egyptian pyramids, nutritionally enhanced grass pea can become a wonder crop for marginal drought prone lands.

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-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:53
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 105: Re: Bt brinjal

This is John Samuels (Message 84).

This is a supplementary point to follow on from Messages 60 and 84. The document entitled: “Cultivation of genetically modified food crops - Prospects and effects” (37th Report of the Committee on Agriculture [2011-2012], referred to by S.K.T. Nasar, Message 37) states that the contents of several reports containing information on environmental risk assessment studies on Bt brinjal are under examination as a post-Moratorium follow-up. Some of these reports (e.g. Andow, 2010) reflect on the content of some of the biosafety information found in documents located at http://www.envfor.nic.in/divisions/csurv/geac/bt_brinjal.html (website kindly pointed out by Dr. Manjunath, Message 87). Could I respectfully suggest that, in the advent of a future revision of any such documents, the sections on the taxonomy and previous crossability studies of brinjal and its relatives are amended. Some of the details of these sections are inaccurate and/or refer to out-of-date information that adds to the ambiguity already inherent in the study of such a taxonomically difficult group of species.

I would like to thank the Moderator and the other organisers of this conference for the opportunity to participate in such an important event.

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Reference:

Andow, D.A. 2010. Bt Brinjal: The Scope and Adequacy of the GEAC Environmental Risk Assessment. Department of Entomology, University of Minnesota, USA.

-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:53
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 106: GM plants being developed by Embrapa, Brazil

I am Maria Jose Amstalden Sampaio, from the Brazilian Agriculture Research Corporation (Embrapa), Brazil and as a member of Embrapa's International Relations Secretariat would like to submit a short summary with some information about GM-plants being developed by Embrapa as a contribution to the conference.

At Embrapa, in Brazil, in partnership with Japanese institutions, genetic engineering strategies for drought and heat tolerance are being tested in soybean, cotton, sugarcane, maize and common beans. These strategies involve mainly the over-expression of transcription factors with different promoters. Soybean experiments started earlier and some of the constructs that demonstrated promising results under controlled conditions (greenhouse and growth chambers) are being tested in the field. The first results from the field tests were encouraging and new experiments are scheduled to take place in different agricultural regions of Brazil. The complexity involved in abiotic stress tolerance recommends careful "proof of concept" under field conditions since survival in experimental pots in the laboratory or in the greenhouse does not ensure gains in terms of yield maintenance during abiotic stress events such as drought or heat. Initial field experiments for sugarcane are scheduled to start in 2014.

This follows previous projects in which Embrapa developed two other GM crops – a soybean with tolerance to herbicides of the imidazolinone group and a common beans with resistance to golden mosaic virus. The soybean was developed as a result of a public-private partnership with BASF while the common beans was solely developed by Embrapa.

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-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:54
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 107: Re: Regulatory pipeline for Africa - crops

My name is Elisa Erazo, I am Research Associate in the Pinon (Jatropha curcas) Research Program, Juan Jose Castello Foundation, in Guayaquil - Ecuador.

I would ask José Falck Zepada (Message 49), if there is information such as that issued to Africa, but for Latin America. The information that he provides was complete and will give a broad perspective of the future in developing countries like Ecuador.

In the case of Ecuador there is a moratorium since 2007. However, it is studying the issue within government. There is an open discussion between the government and the scientific community to allow the use of GMOs and the advantages it would bring in the future. Currently there are some preliminary research projects in banana sigatoka control of government research centers.

Thank you very much for the development of this conference, I hope there are more participants from my country.

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-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:55
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 108: Likely impact of GM technologies in the pipeline

This is from José Falck-Zepeda, again. This note is in response to the question of what are the likely impacts of the technologies in the pipeline.

As we have seen in some of the messages, there will likely be an increase in second and third generation GM technologies. These are GM traits focused on addressing nutritional and/or agronomic constraints such as salt and drought tolerance and other addressing climate change and climate risk mitigation. We may also see more of these traits in those crops of interest to developing countries. Although, there have been some literature debating the institutional constraints that may be a binding barrier for the development of so called “pro-poor” technologies, at the heart of the matter is addressing these barriers that include biosafety, intellectual property rights, technology transfer, and seed/vegetative material system issues.

This means in terms of likely impact, that we will need to refine our impact research in terms of methods and approaches as the issues and impacts will likely be nuanced and in desperate need of more analysis. Impacts are not likely to be qualitatively different to the ones described below, yet if more technologies are developed to address binding constraints for crops and traits of interest to developing countries, this fact, opens a significant potential for capturing significant impacts that can benefit resource poor farmers and consumers in developing countries.

As we suggested in an extensive literature review that we conducted at IFPRI of the existing literature on economic impact with an identifiable peer review process and methods (Smale et al 2009), show that “On average LMO crops have a higher economic performance — but averages do not reflect existing variability…too few crops….too early to draw generalizations or fully describe adoption”. This notion is not surprising taking into consideration the heterogeneity we find across crops, traits, producers and abiotic/biotic stresses. These conclusions are based on roughly 187 papers in the literature.

The notion of higher economic performance but quite heterogeneous impact, is supported by a meta-analysis published by Finger et al (2011). Their focus on qualifying their results indicating that higher impacts of Bt or other insect resistant technologies in those countries where there is poor insect management is quite robust based on the experience with integrated pest management and other insect crop management research. The later may be the case in India and other developing countries.

An excellent meta-analysis conducted by Areal, Riesgo and Rodriguez-Cerezo in 2012 concluded that "GM crops perform better than their conventional counterparts in agronomic and economic (gross margin) terms….tend to perform better in developing countries than in developed countries…Bt cotton being the most profitable crop grown". These authors work with the Institute of Prospective Technical Studies (IPTS) one of the EU-Joint Research Centers. The quality of their work is outstanding.

We are likely to see more or less the same qualitative results, but if the technologies indeed address developing countries issues, this quantitative level may increase significantly.

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Special Issue AgbioForum "Farmers and Researchers Discovering Biotech Crops: Experiences Measuring Economic Impacts among New Adopters" Melinda Smale and José Falck-Zepeda, Guest Editors, Vol 15, Num 2, 2012.
- Smale, M. Rough Terrain for Research: Studying Early Adopters of Biotech Crops.

- Zambrano,P, M. Smale, J.H. Maldonado, & S.L. Mendoza. Unweaving the Threads: The Experiences of Female Farmers with Biotech Cotton in Colombia.
- Falck-Zepeda, J., A. Sanders, C. Rogelio Trabanino, & R. Batallas-Huacon. Caught Between Scylla and Charybdis: Impact Estimation Issues from the Early Adoption of GM Maize in Honduras.
- Yorobe, Jr. J.M. & M. Smale. Impacts of Bt Maize on Smallholder Income in the Philippines
- Gouse, M. GM Maize as Subsistence Crop: The South African Smallholder Experience
- Birol, E., M. Smale, & J.M. Yorobe, Jr. Bi-Modal Preferences for Bt Maize in the Philippines: A Latent Class Model
- Smale, M., P. Zambrano, R. Paz-Ybarnegaray, & W. Fernandez Montaño A Case of Resistance: Herbicide-tolerant Soybeans in Bolivia.

-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:55
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: 109: Re: AquAdvantage Salmon

My name is Diane Wray-Cahen. I am a science advisor for animal biotechnologies at the U.S. Department of Agriculture. I am an animal scientist and for my PhD research, I studied the metabolic effects of growth hormone (somatotropin) in pigs. I have been following this conference with interest as an observer.

This is in response to Tim Schwab's Message nr. 88. The focus of my comment is on the biology of growth hormone, rather than transgenic fish. Some of Tim Schwab's comments seem to imply that the effects of growth hormone are uncertain and there has been insufficient research to determine its effects. This is definitely not the case.

The effects of elevated blood levels of growth hormone, whether due to gene engineering or exogenous administration, are well established and are not in dispute. Quite simply, in animals fed adequate nutrition, elevated growth hormone results in enhanced growth rates and improved feed efficiency or feed conversion rates (reference 1). The effect is dose-dependent.

This is extremely well documented in a large number of species, including fish. In fact, trout were used to determine the efficacy of some of the recombinant porcine growth hormone that we used in our studies in the 1980s. This is not a new technology and growth hormone was one of the first genes introduced into mice (2), livestock (3), and fish (4) in the 1980s. Augmentation of the growth hormone/insulin-like growth factor (IGF) axis was a target of many early genetic engineering efforts, for example with pigs (3, 5), precisely because of the well-documented effects of growth hormone on animal growth and feed conversion rates and the impact this could have on animal production.

The AquaAdvantage Salmon is not the only GE fish with a gene for growth hormone. For example, a highly respected research group in China at the Institute of Hydrobiology, Chinese Academy of Sciences (http://english.ihb.cas.cn/rh/rd/center3/201204/t20120409_83602.html) has a GE carp with a growth hormone gene (6). Research demonstrating that inserting a gene for growth hormone (as well as giving exogenous growth hormone) results in faster growing fish with enhanced feed conversion rates is not limited to studies done by Aqua Bounty nor is it limited to salmon. Thirty years of research drawing the same conclusions is not "speculation", but demonstrates an excellent body of evidence, at least in terms of animal growth and efficiency.

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-----Original Message-----
From: Biotech-Mod2
Sent: 03 December 2012 18:58
To: 'biotech-room2-L@LISTSERV.FAO.ORG'
Subject: End of FAO e-mail conference on GMOs in the pipeline

Dear Colleagues,

The last messages (numbers 91 to 109) have now been posted so Conference 18 of the FAO Biotechnology Forum, entitled "GMOs in the pipeline: Looking to the next five years in the crop, forestry, livestock, aquaculture and agro-industry sectors in developing countries", is now officially closed.

FAO established this Biotechnology Forum in order to provide quality balanced information on agricultural biotechnologies in developing countries and to make a neutral platform available for people to exchange views and experiences on this subject. We hope that you found this conference interesting, constructive and beneficial.

The Background Document to the conference is available on the web (at http://www.fao.org/docrep/016/ap109e/ap109e00.pdf - 60 KB) and all of the messages posted during the conference are available on the web, at the searchable website: https://listserv.fao.org/cgi-bin/wa?A0=Biotech-Room2-L . To see the messages from November sorted by date (latest on top), see: https://listserv.fao.org/cgi-bin/wa?A1=ind1211&L=Biotech-Room2-L&O=D&H=0&D=1&T=1 . To see the messages from December sorted by date (latest on top), see: https://listserv.fao.org/cgi-bin/wa?A1=ind1212&L=Biotech-Room2-L&O=D&H=0&D=1&T=1

For your interest, we can provide some figures about participation in the conference. It ran for 5 November to 2 December 2012. A total of 770 people subscribed themselves to the conference and, of these, 59 (i.e. 8%) submitted at least one message. Of the 109 messages that were posted, 36% came from people living in Asia; 26% from Europe; 24% from North America; 10% from Latin America and the Caribbean; and 5% from Africa. The messages came from people living in 24 different countries, the greatest number coming from India (31 messages) followed by the United States (25 messages). A total of 55 messages (i.e. 50%) were posted by people living in developing countries. A total of 30% of messages came from people working in universities; 18% from participants from non-governmental organisations; 17% from people working in research centres; 12% from people working in the private sector; 11% from people working as independent consultants and 8% from people in Governments.

Finally, and most importantly, I wish again to personally thank all of you who participated actively in this conference, dedicating your time and effort to sharing your knowledge, ideas, experiences and viewpoints with the conference.

With best wishes

John

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p.s. This is the 18th conference that has been hosted by the FAO Biotechnology Forum since it was launched in 2000. To be informed about upcoming conferences, for those who have not already done so, we encourage you to subscribe to the Forum. To do so, send an e-mail message to listserv@listserv.fao.org with only the following one line in the body of the message (i.e. leave the subject line blank and have no other text, such as an e-mail signature, in the message):
subscribe Biotech-L firstname lastname

Firstname and lastname refer to the person's first and last name. For example, if the subscriber's name is John Smith, then the line should be:
subscribe Biotech-L John Smith

p.p.s. For those of you who do not know about it, FAO also produces a free e-mail newsletter called FAO-BiotechNews in all six official UN languages. Its main focus is on the activities of FAO, of other UN agencies/bodies and of the 15 CGIAR research centres. News items about new documents are included in the newsletter if the documents are freely available on the web, and for each item an e-mail contact is also provided. The newsletter was launched in January 2002 and all news items (over 850) posted since then are available at http://www.fao.org/biotech/biotech-news/en/ while all events are available at http://www.fao.org/biotech/biotech-events/en/

If you and/or your colleagues wish to subscribe to the English-language newsletter, just send an e-mail message to listserv@listserv.fao.org with only the following one line in the body of the message (i.e. leave the subject line blank and have no other text, such as an e-mail signature, in the message):
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