

***International Workshop on Agribiotechnology
Communication: Addressing the Challenges in
Communicating Agribiotechnology in Muslim Countries***

Langkawi, Kedah, Malaysia
20 -21 September 2011

Edited by:
Maria Christina Stephenson and Mahaletchumy Arujanan



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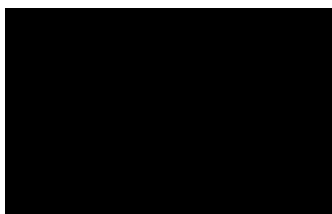


TABLE OF CONTENTS

Contents	i
Foreword	iii
Session 1: Communication in Crop Biotechnology	
Recent Developments on Global Crop Biotechnology Scenario Rhodora Aldemita	1
The ISAAA/KC Model in Communicating Crop Biotechnology Mariechel Navarro, ISAAA	5
Session 2: Country Presentations	
Agribiotechnology Communication Challenges in Malaysia <i>Mahaletchumy Arujanan</i>	8
Addressing the Challenges in Communicating Agribiotechnology in Muslim Countries: The Bangladesh Perspective <i>M. Imdadul Hoque</i>	13
The Development of Agribiotechnology in Indonesia and the Importance of Islamic Perceptions <i>Aris Winaya and Maftuchah</i>	17
Communicating Agricultural Biotechnology: Iran's Experience <i>Behzad Ghareyazie and Naghmeh Abiri</i>	20
Agricultural Biotechnology in Pakistan: A Country Report <i>Anwar Nasim</i>	25
Communicating GMO issues in China, and What We Can Learn from Muslim Countries: A Journalist's Perspective <i>Liu Zheng</i>	31

Communication of Agribiotechnology with Muslims: Thailand's Experience <i>Supat Attathom</i>	34
Uganda Biotechnology & Biosafety Consortium: Experiences, Plans and Challenges of Biotech Communication <i>Nsubuga, E.N. and A.M. Makara</i>	38
Agribiotech Communication in Pakistan <i>M. Iqbal Choudhary and Sammer Yousuf</i>	43
Session 3: Outcome and Resolutions on Identification of Key Communication Components, Issues and Concerns in Muslim Countries	50
Programme	52
List of Participants	54

FOREWORD

Agribiotechnology produces world's major food crops which make up most of the food ingredients for a wide range of staple foods in most parts of the world, and genetic modification (GM) is at the centre of this. However, as an emerging field, agribiotechnology is often clouded with various safety, ethical and religious concerns. As one fifth of the world population (1.57 billion) is made up by Muslim population, it is crucial to ensure that agribiotechnology employed in food production is acceptable to the Muslim community. This can only be done if proper communication strategy is in place to enable key stakeholders to take a lead role in communicating the potential, issues and concerns related to GM technology and the Muslim community.

Challenges faced in communicating agribiotechnology are common among most countries. Among them are lack of trained scientists in biotechnology communication, a void in engagement between scientists and other stakeholders such as the media, religious scholars and the general public, difficulties in getting media support, lack of public interest on agribiotechnology and lack of fund for biotechnology outreach programmes. However, there are specific challenges faced by scientists in Muslim countries. *Halal* issues dominate public concerns in Muslim countries. Engagement with religious scholars (*ulama*) is rare in most countries, except when issues arise. Another major challenge is that it is almost impossible to have harmonisation among Muslim countries on matters pertaining to *Shariah* compliance due to the different sects among the Muslim countries. As all Muslim countries are net importers of food, these challenges need to be tackled to ensure the concerns of Muslim population are addressed and to gain their trust in agribiotechnology.

This workshop is aimed at developing a workable communication strategy for agribiotechnology in Muslim countries. To achieve this, key biotechnology communicators and scientists from Malaysia, Indonesia, Bangladesh, Pakistan, Egypt, Iran, China, Thailand, the Philippines, and Uganda converged to deliberate on the challenges in communicating agribiotechnology in Muslim countries and to propose solutions to address them. Experiences from countries that have commercialised biotechnology crops like the Philippines and China provided valuable lessons for Muslim countries.

Though the papers published in this proceeding are commentary in nature, they present the scenario of agribiotechnology communication in the selected Muslim countries and address the current practice, challenges and provide useful suggestions. MABIC hopes the outcome of this workshop would serve as a useful reference for agribiotechnology communicators and scientists in Muslim countries.

Mahaletchumy Arujanan
MABIC Executive Director

SESSION 1: COMMUNICATION IN CROP BIOTECHNOLOGY

Recent Developments in Global Biotechnology Scenario

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Global challenges in agriculture

Food producers have continued to improve agricultural systems to meet the food demand. A number of conventional agricultural practices has evolved over time that include ways to develop new germplasm such as the use of wild crop relatives, the application of heterosis in the production of hybrids, tissue culture, mutation breeding and others. Crop culture strategies have also improved with the application of fertilisers, improved irrigation and crop protection technologies. The combination of these strategies has efficiently provided enough food a couple of decades ago, but this would not be sufficient for the current and future food requirements.

There is thus a need to utilise biotechnology for a more efficient, productive and sustainable strategy of food production. Research estimates show that biotechnology can contribute more than the one per cent incremental increase in food products, which is the historical improvement in crop production over the past thirty or forty years. A significant increase can be observed by using new tools like molecular marker technology and even more so with the use of modern biotechnologies such as genetic engineering. It is important to know and understand that, when put in the proper context, modern biotechnology is just an additional tool to the many innovative tools that are currently available to agriculturists. It is not by itself the most important technological tool but it serves as the foundation for modern agriculture.

Global adoption of biotech crops

Biotechnology is the best adopted farming technology across the globe. In the fifteenth year of commercialisation, the global area of biotech crops continued to climb at a sustained growth of 10% of 14 million hectares (notably, the second highest increase in the last 15 years) reaching 148 million hectares. Biotech crop adoption has grown impressively every single year for the past 15 years, since commercialisation first began in 1996 with remarkable 87-fold increase since 1996. Importantly, this is a manifestation of the trust and confidence of millions of farmers worldwide, who have consistently benefited from the significant and multiple benefits that biotech crops offered over the last 15 years and has provided farmers with the strong motivation and

incentive to plant more hectares of biotech crops every single year since 1996, mostly with double-digit percentage annual growth.

Three new biotech countries, Pakistan, Myanmar and Sweden (the first of the Scandinavian countries to grow biotech crops) joined while Germany resumed planting. Pakistan has 600,000 farmers planting 2.4 million hectares of Bt cotton and Myanmar with 375,000 farmers planting 270,000 hectares of Bt cotton; This brings the total number of countries planting biotech crops in 2010 to 29 of which 19 were developing countries and 10 industrial countries. The 29 countries planting biotech crops in million hectares, in the order of plot size, include the USA (66.8 million hectares, Brazil (25.4), Argentina (22.9), India (9.4), Canada (8.8), China (3.5), Paraguay (2.6), Pakistan (2.4), South Africa (2.2), Uruguay (1.1), Bolivia (0.9), Australia (0.7), Philippines (0.5), Myanmar (0.3), Burkina Faso (0.3), Spain (0.1), Mexico (0.1) and countries with less than 50,000 hectares include Colombia, Chile, Honduras, Portugal, Czech Republic, Egypt, Slovakia, Costa Rica, Romania, Sweden and Germany.

During the last thirteen years or so, starting with the 1990s a lot of literature indicated that the technology itself offers a broad range of impacts. These impacts can be at the farm level—family-level productivity in the income of farmers and others or at a more humanitarian and developmental perspective such as poverty reduction. Thus, as a result of the consistent and substantial economic, environmental and welfare benefits offered by biotech crops, millions of large, small and resource-poor farmers around the world continued to plant significantly more hectares of biotech crops in 2010. The number of farmers growing biotech crops in 2010 increased again by 1.4 million reaching 15.4 million (up from 14 million in 2009) of which over 90% or 14.4 million were mainly small and resource-poor farmers from developing countries. Over the last fifteen years, farmers have consciously made approximately 100 million individual decisions to plant an increasing plot size of biotech crops year after year because of the significant benefits they offer. Surveys confirm that close to 100% of farmers have decided to continue to plant after their first experience with biotech crops because of the benefits they offer.

Contributions of biotech crops to global food sufficiency and sustainability

Biotech crops contribute to food sustainability and self-sufficiency. The use of biotech crops increases productivity and economic benefits are sustainable at farmer level – thus productivity per hectare while decreasing cost of production has a reduced need for inputs. Economic gains at the farm level approximates US\$65 billion, which were generated globally by biotech crops during the period 1996 to 2009, of which just less than half (44%) were due to reduced production costs (less ploughing, fewer pesticide sprays and less labour) and just over half (56%) due to substantial yield gains of 229 million tons. The 229 million tons comprised of 83.5 million tons of soybean, 130.5 million tons of maize, 10.5 million tons of cotton lint and 4.8 million tons of canola over the period 1996 to 2009.

For 2009 alone, economic gain at the farm level was US\$10.7 billion, of which approximately 25% was due to reduced production costs (less ploughing, fewer pesticide sprays and less labour) approximately 75% were due to substantial yield gains of 41.7 million tons. The 41.67 million tons composed of 9.7 million tons of soybean, 29.4 million tons of maize, 1.9 million tons of cotton lint and 0.67 million tons of canola in 2009. Thus, biotech crops are already making a contribution to higher productivity and lower costs of production of current biotech crops (Brookes and Barfoot, 2011).

Biotech crops are a land saving technology. Approximately 13 million hectares of biodiversity – rich tropical forests are lost in developing countries annually. If the 229 million tons of additional food, feed and fibre produced during the period 1996 to 2009 have not been produced by biotech crops, an additional 75 million hectares of conventional crops would have been required to produce the same tonnage. Some of the additional 75 million hectares would probably have required fragile marginal lands, not suitable for crop production, to be ploughed, and for tropical forest, rich in biodiversity, to be felled to make way for slash and burn agriculture in developing countries, thereby destroying biodiversity. Similarly, in 2009 alone, if the 42 million tons of additional food, feed, and fibre produced by biotech crops during 2009 had not been produced by biotech crops, an additional 12 million hectares of conventional crops would have been required to produce the same tonnage for 2009 alone.

Biotech crops contribute to the alleviation of poverty and hunger. Fifty per cent of the world's poorest people are small and resource-poor farmers, and another 20% are rural landless completely dependent on agriculture for their livelihoods. Thus, increasing their income contributes directly to the poverty alleviation of a large majority (70%) of the world's poorest people.

A World Bank Report recognised that overcoming poverty cannot be achieved in Sub Saharan Africa without a revolution in agricultural productivity for the millions of suffering subsistence farmers in Africa. Africa is home for over 900 million people representing 14% of the world population and is the only continent in the world where food production per capita is decreasing and where hunger and malnutrition afflicts at least one in three Africans. Africa is recognised as the continent that represents by far the biggest challenge in terms of adoption and acceptance. It is noteworthy that there are now three countries benefiting from biotech crops in Africa and that growth was registered in all three in 2010. There is now a lead country in each of the three principal regions of the continent: South Africa in southern and eastern Africa; Burkina Faso in West Africa; and Egypt in North Africa. This broad geographical coverage in Africa is strategic that it allows the three adopting countries to become role models in their respective regions and for more African farmers to become practitioners of biotech crops.

Biotech crops and biofuels. The use of biotechnology to increase efficiency of first generation food/feed crops and second generation energy crops for biofuels present both opportunities and challenges. Whereas biofuel strategies must be developed on a country-by-country basis, food security should always be assigned the first priority and should never be jeopardised by a competing need to use food and feed crops for biofuel. Injudicious use of food/feed crops – sugarcane, cassava and maize for biofuels in food insecure developing countries could jeopardise food security goals of the efficiency of these crops cannot be increased through biotechnology and other means, so that food, feed and fuel goals can all be adequately met. The key role of crop biotechnology in the production of biofuels is to cost-effectively optimise the yield of biomass/biofuel per hectare, which in turn will provide more affordable field. Current molecular biology tools to generate biofuel from biomass are being exploited in identifying sources of enzymes while developing and improving enzymes for biomass metabolism.

Conclusion

Progress was made on several major fronts; accumulated hectares from 1996 to 2010 reached a historic global milestone; a significant double-digit year-over-year increase in biotech crop plot size was posted, as well as a record number of biotech crop countries; the number of farmers planting biotech crops globally increased substantially; across-the-globe growth, reflected increased stability of adoption and that biotech crops. These indicate the growing acceptance of biotech crops worldwide. These are very important developments given that biotech crops already contribute to some of the major challenges facing global society such as food security and self-sufficiency, sustainability, alleviation of poverty and number, help in mitigating some of the challenges associated with climate change and global warming and the potential of biotech crops for the future is enormous.

As adoption of biotech crops advances globally, adherence to good farming practices with biotech crops, such as rotations and resistance management, is a must, as it has been during the first decade. Continued responsible stewardship must be practiced, particularly by the countries of the South in Asia, Latin America and Africa which are certain to be the major new deploys of biotech crops in the second decade of commercialisation of biotech crops, 2006 to 2015.

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ISAAA/KC Model in Communicating Crop Biotechnology

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Introduction

Modern biotechnology is a powerful complement to conventional breeding in developing crops that are high yielding, resistant to pests and diseases and are safe to humans and the environment. In the pipeline are crops that will address nutritional and product concerns including allergenicity, food flavour and aroma. It is not surprising therefore that as of 2011, some 16.7 million small resource-poor farmers from 19 developing countries chose to adopt biotech crops that delivered sustainable and substantial socio-economic and environmental benefits (James, 2011).

Despite the benefits that the technology has demonstrated, debates on issues beyond the realm of science, continue to hound stakeholders and the public. Issues include social consequences and ethical issues, institutional trust and credibility, and the lack of social consensus in using the technology. This environment has made it a rich ground for science communication initiatives in crop biotechnology by both public and private sectors. The International Service for the Acquisition of Agri-biotech Applications (ISAAA) has made knowledge sharing initiatives through science communication a major program in addition to its technology transfer activities.

ISAAA and Science Communication

Science communication is the process of fostering understanding, appreciation, and the application of science and the scientific process that encourages participation by various stakeholders. Scientists, policymakers, media, among others, play critical roles in framing the debate, shaping policy, influencing public opinion and creating greater awareness and understanding about biotechnology. For this to happen, deliberate and planned efforts have to be made to create an enabling environment for its discussion and debate.

The International Service for the Acquisition of Agri-biotech Applications (ISAAA) is a not-for-profit international organisation that shares the benefits of crop biotechnology to various stakeholders, particularly resource-poor farmers in developing countries, through knowledge sharing initiatives and the transfer and delivery of proprietary biotechnology applications.

ISAAA has an information network to facilitate knowledge sharing initiatives between and among countries. This network, composed of the Global Knowledge Center on Crop Biotechnology and the Biotechnology Information Centers (BICs), practice science communication. To guide the network, the following science communication framework for crop biotechnology is proposed:

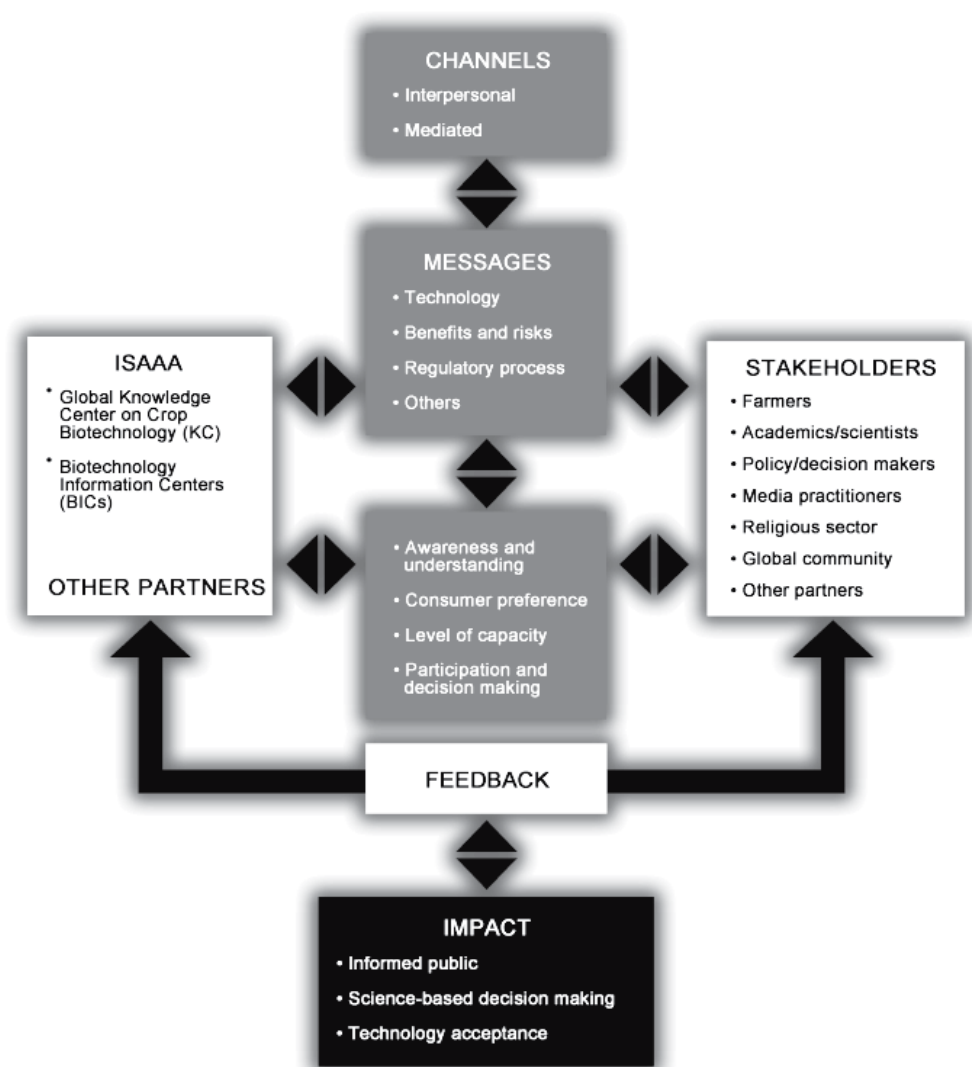


Figure 1. Model for science communication in crop biotechnology

Information providers and different stakeholders share key messages (technology, benefits and risks, regulatory process, etc) through various communication channels (interpersonal, mediated, and social media) with the end goals of having an informed public, science-based decision making, and technology acceptance.

ISAAA has published a Brief on *Communicating Crop Biotechnology: Stories from Stakeholders* to highlight the impact of science communication activities. Farmers, for instance, participated in workshops and exchange visits that enabled them to become the voice of other farmers, be resource persons in workshops and at the same time influence peers in getting interested in adopting the technology. Media practitioners' exposure to field visits and briefings enabled them to shift from a negative to positive tone in their articles on the technology, helped increase media coverage and performed an important role in translating and popularising information. Even the religious sector benefited from science communication initiatives as they became bridges for ethically informed decision-making.

The effectiveness of science communication efforts can be determined through a feedback analysis by answering the following questions:

- Did we reach our priority audiences?
- Did we get our messages across in a believable and accurate manner?
- Did we use appropriate communication channels and strategies?
- Did we create an impact?

A favourable response to the questions posed above signifies the crucial role of science communicators in the biotech debate. They can contribute to consensus-building on science issues and help build capacity in various aspects of science communication – media relations, public engagement, and science popularisation. They can identify key publics and champions who are well informed, have high credibility and are willing to help advance the cause of the technology. In addition, science communicators can assure availability and access to science-based information.

There is a growing appreciation for public engagement in science. Stakeholders are now getting actively involved in the science process through message articulation, intensified use of innovative strategies and communication channels. A holistic, synergistic perspective of the science continuum from development to commercialisation assures a dynamic pathway for a technology's growth and acceptance. Indeed it is no longer a case of Science then Communication but Science Communication.

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SESSION 2: COUNTRY PRESENTATIONS

Agribiotechnology Communication Challenges in Malaysia

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Abstract

Malaysia aspires to be a biotechnology player at the global level and has a number of national policies to transform biotechnology into an engine for economic growth. The ecosystem, however, lacks a national strategy on biotechnology communication, which would provide a synergy among all stakeholders who are currently involved in communicating biotechnology or agribiotechnology to Malaysians audiences. This short paper gives an overview of the agribiotechnology communication strategies and its challenges in Malaysia. It also offers a few suggestions on how the challenges could be addressed.

Introduction

Malaysia spends RM13bil annually on imported food (Ministry of Domestic Trade, Cooperative and Consumerism, 2012). This amount is rising every year and that makes Malaysia a net food importer. Global disasters like flood, earthquakes, and wars have an impending effect on food prices in Malaysia. To address food security issues, agricultural research is made a priority where several universities and research institutes have research projects ranging from food and commodity crops to vegetable and fruits, employing techniques such as conventional breeding, marker assisted selection and genetic modification. Malaysian government too has accorded high priority to agribiotechnology through various policies such as the National Biotechnology Policy, where agribiotechnology is the first thrust to transform and enhance the value creation of the agricultural sector through biotechnology. Other policies are National Biomass Strategy (Agensi Inovasi Malaysia, 2012), Economic Transformation Programme (Performance, Management and Delivery Unit, 2012), and the 10-year Malaysian Plan (Economic Planning Unit, 2012).

In spite of the importance given to agribiotechnology and the food security issues faced in Malaysia, one missing link in the biotechnology ecosystem is the lack of national biotechnology communication strategy. The challenges in transforming agriculture are not just the research but also in communicating the modern technology employed, in particular genetic modification. Genetic modification is part of modern biotechnology which stirs lots of controversies. Main concerns are human, animal and environmental safety. However, activists and opponents do bring up issues related to trade monopoly,

patents, socioeconomics, religious and ethical issues. There are a number of challenges in communicating agribiotechnology to the public and they are common among both developed and developing nations. However, Muslim countries have specific challenges that are related to mainly permissibility of transgenes and the product thereof.

Current practices in communicating agribiotechnology

There are a number of organisations that are involved in public awareness of biotechnology which includes agribiotechnology in Malaysia. They are Malaysian Biotechnology Information Centre (MABIC), Malaysian Biotechnology Corporation, National Biotechnology Division (Ministry of Science, Technology and Innovation), Biosafety Department (Ministry of Natural Resources and Environment), Academy of Sciences, National Science Centre, Malaysian Agricultural Research and Development Institute, and individual scientists from various universities and research institutes (Arujanan, 2012).

The objectives, target audience and messages vary according to the needs of the communicator. Nevertheless, the combined efforts of the organisations mentioned above covers all target audiences ranging from scientists, policymakers, students, media, teachers, farmers, regulators, investors, general public to religious scholars. The objectives for communicating agribiotechnology by these communicators were reported to enhance public understanding and acceptance towards this technology, boost the commercialisation potential of researches that take place in research institutes, encourage young people to take up careers in biotechnology and assist bioentrepreneurs to develop their business (Arujanan, 2012).

Challenges in communicating agribiotechnology

The lack of a biotechnology communication strategy at the national level leads to lack of synergism and integration in the strategy employed by these players. Scientists who are involved in communicating biotechnology or agribiotechnology in Malaysia conduct outreach programmes on a voluntary basis with limited funding or direction at the institutional level.

Some of the major challenges are:

1. Lack of funding and institutional support to organise biotechnology outreach programme.
2. The difficulties in translating technical terms into layman language as scientists are not trained in science communication.
3. The difficulties in attracting public interest towards information on biotechnology.

4. The difficulties in attracting media interest on this subject to get more coverage on agribiotechnology.
5. Lack of trained science communicators.
6. Devoid of science communication modules in science courses in universities that lead to scientists lacking in science communication skills.
7. The diversity of the 'public' which require specific communication strategies and messages.
8. Too much of bad press on agribiotechnology in the mass media and other communication tools.
9. Lack of interest among scientists to communicate and engage with the public.
10. Devoid of science communication policies at the national level.

The main challenges in Muslim countries are:

1. *Halal* issues – the concern on the source of the transgenes.
2. Misinformation that labelling will inform consumers on the *halal* status of the products.
3. Lack of interest among religious scholars to communicate biotechnology (Arujanan, 2012).
4. Lack of collaboration with religious scholars on public understanding of agribiotechnology (Arujanan, 2012).

The key target audience that needs to be engaged is wide and encompasses scientists, policymakers, politicians, teachers, students, media, religious scholars, regulators, investors, farmers, NGOs and general public.

In Malaysia, MABIC plays a key role in engaging various stakeholders to create a better understanding on agribiotechnology that include Muslim religious scholars and also in addressing issues related to biotechnology compliance to principles of *Shariah*.

Fatwa in Malaysia

The *Muzakarah* (dialogue/forum) of the Fatwa Committee of the National Council for Islamic Affairs Malaysia, at its 95th sitting on 16-18 June, 2011, discussed the Rules on the Consumption of Genetically Modified Food.

1. After hearing a briefing and explanation by the late Prof Dato' Dr Yaakob Che Man, Director of the Halal Products Research Institute (IPPH) University Putra Malaysia, and examining the arguments and views expressed, the *Muzakarah* took note that **genetically modified foods involves the transfer of both *halal* and non-*halal* genes, from animals and also plants to provide the desired characteristics as food or medicine.**

2. In this instance, the *Muzakarah* is of the view that **Islam requires its followers to choose good foods (*toyyib*), which are *halal*, pure and does not cause harm to the human soul and mind, and its production process should also not cause harm to humans or the environment.**
3. In relation to this, the *Muzakarah* agreed that, for the production of GM food, the use of materials that are *haram* as well as harmful to human and the environment is prohibited. Whereas the use of *halal* livestock is allowed, as long as the animal is slaughtered according to Islamic rules.

Another *fatwa* issued by the National Fatwa Committee on July 12, 1999 states the following:

1. Any product, food or drink processed using biotechnological methods incorporating swine DNA is against the precepts of *Shariah* and is therefore not permissible.
2. We have yet to reach a stage whereby the rule of "necessities overrule prohibitions" could be applied. As such, biotechnological usage of swine DNA in the processing of foods and drinks could not be justified as there are other viable alternatives.
3. The dangers of using prohibited material are greater than the benefits. Hence, with this *fatwa* as a guide, the issue of using swine DNA in the process of producing GM food is settled. It is clear that as long as there are other alternatives, then the use of swine DNA to modify the genetic make-up of plants is prohibited by Islam.

Suggestions

Experiences from countries that have strong biotechnology communication programmes could serve as models for Malaysia to adapt and adopt. Australia has strong biotechnology communication initiatives that are well coordinated with industry, research and educational groups working closely with government agencies, and this unified message ensures maximum effect with minimal duplication (Cormick, 2011). The "Inspiring Australia" report (Inspiring Australia, 2010) which was an initiative by the Department of Industry, Science, Research and Tertiary Education, proposes a national approach for community engagement with the sciences.

Other suggestions are:

- Scientists and media to play a bigger role in biotech communication;
- Science communication module must be introduced to all science programmes in the universities;
- Allocation of funding for biotechnology communication and public engagement;
- Post graduate degrees in science communication;

- An overarching national policy in science communication that is inclusive of biotechnology and other emerging technologies;
- Best practice for biotech communication;
- Training for media and scientists in communicating biotechnology; and
- Engage ulama and empower them as biotechnology communicators and use their platform to reach out the Muslim community.

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Addressing the Challenges in Communicating Agribiotechnology in Muslim Countries: The Bangladesh Perspective

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Bangladesh is a small country with only 144,000 sq km of land. It has a total of 14 million hectares of arable land and average farm size is 0.5 ha – one of the smallest in the world. It is decreasing by about 1.0% per year due to river erosion and infrastructure development. The population of the country is about 150 million predominantly Muslims (85%), about 10% Hindus and rest are Christians, Buddhists and other minority ethnic groups. Agriculture is the primary base of livelihood and economy of Bangladesh. About 56 per cent of the country's population engages directly or indirectly in agriculture. It provides 65% employment opportunity. Agriculture contributes 25% to the total GDP. Thus, agriculture will remain the dominant factor to the country's economy. The country's population is increasing day by day and it is projected that by 2015, it is estimated to be 160 million.

Bangladesh's agriculture often suffers from natural disasters like floods, droughts, salinity, storm and cyclones. Agricultural productivity improvement is a government's priority to reduce the increasing gap between agricultural production and consumption. To keep pace with the population growth, food production needs to be doubled by the year 2050. Thus, a rapid and sustained agricultural growth through enhanced food and agricultural production will contribute to food security and poverty reduction. Introduction of agricultural biotechnology is considered as one of the options that may help increase farm productivity in the country. The utilisation of agricultural biotechnology techniques is still largely under exploited and therefore, has important potential. Rapid advances of biotechnology in the field of agriculture have been made in the recent past. At present, a number of transgenic crops like, cotton, maize, rice, wheat, potato and several others are in advanced stages of development or being commercially grown in USA, Canada, Brazil, Argentina, South Africa, China, India and other countries.

Status of GM Crops development in Bangladesh

Limited facilities exist in a small number of institutions, for the transfer of foreign genes to important crop plants in order to create transgenic organisms. In these laboratories, techniques for the transfer of some genes such as antibiotic resistant genes used for selection purpose have been developed in some plants but crops with useful agronomic traits are yet to be developed.

Recent development of field trials for GM crops

The National Committee on Biosafety (NCB) has approved the confined field trials of fruit and shoot borer resistant Bt brinjal for the first time in three research stations of Bangladesh Agricultural Research Institute (BARI). BARI has also performed second round of confined trials in seven locations. Besides Bt brinjal, BARI has also obtained permission for confined field trials of Late Blight Resistant (LRB) potato in two locations. BARI performed two rounds of confined field trials in two locations.

Contained greenhouse trial for Golden Rice

Bangladesh Rice Research Institute (BRRI) conducted contained greenhouse trials of 1st generation golden rice rich in pro-vitamin A. Recently BRRI also applied to National Committee on Biosafety (NCB) for the importation of 2nd generation golden rice.

NCB has also approved the application of Lal Teer Seeds a leading private seed production company for the contained greenhouse trials of Bt brinjal. Fruit and shoot borer resistant gene has been incorporated in Bangladeshi brinjal varieties at MAHYCO, India and this will be brought back to Lal Teer for contained greenhouse trial to see the efficacy of the inserted gene.

Although biotech crops are available in the market for more than a decade, there is still a need to communicate its benefits as well as its position in augmenting traditional agricultural systems, especially in Asia and the Pacific.

Communication is needed among stakeholders

Major agribiotechnology stakeholders are farmers, policymakers (legislators at national and local levels, national agencies), media (print and electronics), industry (food/feed processors, food establishments), interest groups (nutritionists, environmentalists, etc.), academicians, students, extension workers, consumers and religious leaders, etc.

Information needs vary from one stakeholder to another. Basically the farmers' group needs to know about the benefits of the new crop, e.g. yield performance, reduced inputs (pesticides, fertiliser, irrigation, etc.), increased income as well as healthier (less health hazard) options, etc.

Current agribiotechnology communication strategy

In Bangladesh both public and private sectors use more or less same strategies in introducing new crop or products thereof. The following activities have been performed to introduce/release/commercialise new crops/products:

- Hold exhibition, agricultural fair, field day, farmers' day
- Study visits, workshops/seminars for the extension workers, training of the sales agents, etc.
- Campaign in the media (newspaper, radio, TV, etc.)

Although there is no biotech crop/product that has been released in the field or market there are debates on the acceptance of biotech derived crop/food. The scientific community of the country is basically in favour of accepting the new technology. The government is also convinced about the benefits of the new technology. On the other hand, some NGO activists and consumer group have been campaigning against the technology by writing articles in the newspapers and holding discussion meetings, etc. time to time, though this has been in a smaller scale.

In fact there is hardly any biotechnology communication activity by the public sector, except few meetings organised by the Department of Environment (DOE). During the development of National Biosafety Framework (NBF), DOE organised some stakeholders' consultation meetings/workshops on the application of modern biotechnology as well as on biosafety. They also published some brochures, pamphlets, posters, etc. on the application and safe use of modern biotechnology.

Bangladesh Biotechnology Information Center (BdBIC) of International Services for the Acquisition of Agribiotech Applications (ISAAA) has organised many consultation meetings with scientists, policymakers, academicians, students. They have also organised some media workshops for the journalists working in print and electronic media. BdBIC also publishes and distributes weekly biotech updates in Bangla.

South Asia Biosafety Program (SABP) has carried out many national and regional workshops highlighting the developments of modern biotechnology and biosafety. They have also sent Bangladeshi scientists, policymakers, private sector people to training workshops abroad related to biotechnology and biosafety. SABP has been publishing monthly newsletters highlighting latest developments on agricultural biotechnology and biosafety.

Agricultural Biotechnology Support Project II (ABSP II), the developer of Bt brinjal and Late Blight Resistant (LBR) potato also organised many consultation meetings/training workshops on the importance of these biotech products and their confined field trials.

Conclusion

Communication is one of key variables needed to create an enabling environment for biotechnology. Hence, various stakeholders need to be involved in the process of science communication. A strategic approach to encourage participation and transparent debate on agribiotechnology would encourage decision making and consensus building on the technology. In Bangladesh we need to focus on the following aspects to meet the communication challenges as well as to develop a cadre of science communicators who not only understand the subject but who also have the skills to communicate information on biotechnology. There is a need for:

- science-based and transparent regulatory system prior to the commercialisation of any biotech crop or any product thereof;
- strengthened capacities of stakeholders who are involved in communicating biotechnology;
- involvement of relevant stakeholders at all stages of the evaluation process;
- integration of communication activities as part of the technology/product development framework;
- strong support and regular funding for biotech communication outreach activities and research for government institutes, NGOs, and other institutions involved in agricultural development; and
- multi-delivery channels and multi-communication approaches to reach various stakeholders effectively.

The Development of Agribiotechnology in Indonesia and the Importance of Islamic Perceptions

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Introduction

Indonesia has been known to have a very large biological diversity. Biotechnology utilises biological organisms to produce useful products for the well-being of humans. It is expected to provide added value to Indonesia. Indonesia has developed a policy to regulate the development of this technology. Bio-resources are available locally and are ready for use for the development of novel products. Development of bio-industries that use biotechnology to process bio-resources into valuable products is expected to support the efforts in promoting economic growth for the nation.

Development of biotechnology in Indonesia

In 1985, the Indonesian government declared biotechnology as a priority area to be considered for national development. This decision was further promoted after the economic crisis (1997). Evidence suggests a close correlation between the increase in agricultural productivity to economic growth in all aspects of the country's economy. In an agrarian country like Indonesia, agriculture is the engine of economic growth. The agricultural sector was able to survive during the economic crisis. Whether biotechnology helps to improve the economy in Indonesia is still difficult to measure. Application of biotechnology in the industrial sector in Indonesia has not progressed significantly. Although agricultural biotechnology has been recognised to have a huge potential market, private companies are reluctant to invest.

It is interesting to note in the Republic of Indonesia, Act No. 18, 2002 it is clearly stated "that the universe and everything in it were created by God Almighty for the benefit of mankind" and therefore man should be responsible in the utilisation, management and promotion of science and technology. This statement implies that scientists are not only accountable to the public but also accountable to the creator of the universe.

The Indonesian government has a strong commitment to the development of biotechnology. Indonesia regards biotechnology as one of the main technologies to be developed, particularly in supporting the development of science and technology in the field of agriculture, food and health (National Research and Technology Program 2001-2005). The Indonesian government has established several biotechnology research and development centres, moreover, private institution support for biotechnology research is also good. There is an increase in the number of courses on this subject in institutions of higher education with more molecular biology laboratories in the field of

agribiotechnology available recently. Scientific information has been generated but the growth of biotechnology in Indonesia has generally not led to the commercialisation stage. As a result biotechnology has not really affected the economy of Indonesian people in a significant way.

Rules and the perception of Islam in the development of biotechnology in Indonesia

Islam is the way of life for the majority of Indonesian people. Laws, rules, and norms of Islam are necessary in various activities in life. If there are no rules and regulations there will be many disruptions in life especially in the nation. Various regulations in Indonesia include provisions relating to natural resources management, environment, development, business and application of agricultural technology. There are still some parameters that are not covered in the regulations and how it affects the community.

Indonesia will need to concentrate on upgrading research and development and information dissemination in the following key areas:

- a) research and development in biotechnology to produce products that are beneficial to humans;
- b) creating awareness that biotechnology activities are not contrary to beliefs, laws and norms of Islam;
- c) incorporating the global opinions on biotechnology and disseminate relevant information on bioethics and social issues with regards to genetic research to pastors, ethicists, lawyers and environmental groups;
- d) creating awareness to the public;
- e) genetic engineering needs to be considered as well as a priority area;
- f) making certain that the products of biotechnology are not used as biological weapons; and
- g) developing agricultural products.

Some of the laws in Indonesia that relate to bioethics include:

- Article 31 paragraph (5) which states "the Government to advance science and technology to uphold religious values and national unity to promote the civilisation and welfare of mankind".
- Law of 2002, Number 18 of the National System of Research, Development and Application of Science and Technology in Article 22 which mandates that the government ensures the interests of the community, nation, human lives while ensuring protection of the environment.
- Act No. 7, Year 1996 on food, Article 13: in anticipation of food products produced through genetic engineering.

- Government Regulation No. 29 of 2000 on Plant Variety Protection: which gives the limits on protection.
- Joint Decree of the Minister of Research and Technology, Minister of Health and Minister of Agriculture in 2004 on the Establishment of the National Bioethics Commission.

The International Workshop on Communicating Agribiotech for Muslim Countries was a stage to share and discuss information among researchers, policymakers and experts to discuss the development of agribiotechnology in Islamic countries. A good understanding of the importance of biotechnology among policymakers, researchers and scholars of religion will allow the dissemination of knowledge to society and to formulate regulations/*fatwa* according to Islamic teachings. It is very important for countries with mainly Muslim population such as Indonesia to benefit from the application of biotechnology while still maintaining their religious beliefs.

Islam does not have constraints on issues associated with biotechnology nor on the people who are involved in developing science. Science and technology issues stated among the verses of God need to be explored more. Islam does not conflict with the development of science and technology intended for the good of mankind.

Conclusions

Bioethics based on norms and values of Islam need to be considered when developing biotechnology research and development programmes in Indonesia. Legality of bioethics should be done so that the government has a strong foundation and authority to regulate and enforce it. Some suggested strategies for developing biotechnology in the Islamic countries in general include:

- a) providing financial support for biotechnology research and development activities in Muslim countries;
- b) empowering Islamic religious institutions to participate and to promote and enhance the public understanding of biotechnology, especially the potential of biotechnology;
- c) support education centres in Islamic countries and their various activities related to biotechnology development;
- d) set up assessment centres on biotechnology in relation to the Islamic perspective; and
- e) establish a forum of experts and developers of biotechnology from the Islamic countries in order to identify common problems that occur in the development and application of biotechnology in the Islamic countries and to develop research collaboration.

Communicating Agricultural Biotechnology: Iran's Experience

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Introduction

Agricultural biotechnology is one of the solutions on the table for combating poverty and hunger for the ever growing world population. By the end of the year 2011, more than 160 million ha of the cultivated land was devoted to biotech crops in 29 countries. The estimated value of these products is US\$ 160 billion (Clive, 2011).

Islamic countries in particular those in the Middle East are net importers of food. Iran imports about USD 10 billion worth of food commodities (mainly soy bean, edible vegetable oil, corn, sugar, rice and wheat). It is estimated that about one third of these is derived from biotech crops such as herbicide tolerant soy bean and insect resistant maize. It is therefore of paramount importance for Iran to produce biotech crops at home. Iran is the first country to commercialise genetically modified insect resistant rice crop in the year 2004 coinciding with the international year of rice (Fig. 1) (Clive. 2005).



Figure 1. A biotech rice grower in the Golestan Province in Iran explaining his satisfaction with the performance of the biotech rice (2005)

Iran's support to agricultural biotechnology

According to the strategic plans set by the supreme leader HE Ayatullah Khamenei, biotechnology is one of the three top priorities in science and technology (information technology, biotechnology and nanotechnology) in Iran. There is strong national financial support for biotechnology research including research and development programmes on biotech crops and transgenic animals for pharmaceuticals. According to the Biotechnology Strategic Plan approved by the government, Iran should use a minimum of 0.5% of its area for the cultivation of transgenic plants (Ghareyazie B., 2011).

Role of scientists in science communication

Iran's Biosafety Law emphasises that "all issues related to production, release, import, export, transit and transportation, commercialisation, use and application of Living Modified Organisms are permitted according to this law and the government should take all necessary actions to facilitate these". The law is the result of the interaction of scientific community (Biosafety Society, Biotechnology Society and the Genetic Society of Iran) with decision makers and politicians in particular with the Parliament and Farmers House.

This achievement that is expected to open the way for commercialisation of biotech crop (in spite of the opposition made by anti-biotechnology activists such as Greenpeace, Genok and Third World Network allies in Iran; referred hereafter as "anti-biotech activists") is a success story indicating the significance of "Science Communication" with the right stakeholders at the right time.

The challenge in developing countries mainly lies in the false and irresponsible information spread by anti-biotech activists against biotechnology as a whole and against foods derived from Genetically Modified Organisms (GMOs) in particular. This false and negative information are usually associated with self-explanatory horrifying images that are easily picked up by housewives and illiterate intermediate technophobic authorities whose economic personal interest are sometimes associated with bulk importation of food commodities and the incentives given to them by agrochemical companies. This is therefore the responsibility of scientific community to share the scientifically justified and supported information and facts with the public as a whole and with certain stakeholders in particular.

Science communication on sensitive issues such as those related to economic and national interests requires knowledge, strategy, tactic, and dedication. Scientific societies have the knowledge but sometimes lack the others. Not all scientists can be good science communicators as well. This is therefore a sensitive issue to identify those scientists who have interest and skills in engaging with the public and other stakeholders. Science communicators need to know what to communicate, when to communicate, how to communicate and to whom to communicate. We explain briefly our experience in science communication, particularly, in relation to the acceptance and use of GMOs.

Strategies for communicating agricultural biotechnology

In Iran, the reference point for all matters is the Holy Quran. It is therefore very effective to use verses from Holy Quran and other religious sources supporting science and innovation. In fact, Islam is supportive to all human endeavours to improve human welfare (Ghareyazie, 2006). Strategic plan for communicating a scientific issue includes the enumeration of the pre-existing wishes, goals and objectives at highest possible level for a country and relating them to the issue of interest. Strategies could be divided in general into several categories such as full support for GM crops, cautionary support to GM crops, pre-cautionary support, limited support or no support. Access to a certain technology requires full support since the outcome of this full support and the opposition made by the opponents will bring the final national decision into balance.

Whom to communicate

Consider communicating with all stakeholders in the society. This includes communicating with politicians and leaders (current administration, potential future administration(s), and parliament members), religious leaders, farmers, journalists (media), scientists, students, non-governmental organisations, activists and consumers. It is important to consider that all of these stakeholders as "important", though priority should be given to different groups of stakeholders at any given time.

When to communicate

Timing is extremely important in science communication. Though communicating scientifically justified information with consumers and the general public is very important from the initial steps of any genetic engineering project, communicating with parliament members should be given more priority before ratification. Objecting and criticising the already passed law has little or no impact on the legal support for agricultural biotechnology. Priority should also be given to communication with politicians before their election. The issue should be followed up after the election. Religious leaders should be approached as soon as possible. It is very important to know that amending fatwa is almost impossible. Therefore, providing scientifically correct and balanced information to religious leaders should not be delayed. Finally, communicating positive issues before commercialisation is of paramount significance to raise acceptance of the public.

What to communicate

Choosing what to share with any group of stakeholders is another important issue. Communicating the molecular details or technical complication with the general public and communicating general positive or negative statements about the technology with scientists are equally wrong. Scientific facts should be shared with consumers and the general public in layman language. Religious principles and support to the scientific innovations with "good will" also should be translated into simple language. One

responsibility of the science communicator is to differentiate between the facts versus myths and explain both. The position of the country, statements from credible national/international organisations, adaptation rate in other countries, environmental safety, food superiority and health benefits of GMOs are some of the issues to be communicated. It should be made clear that Muslim countries are net food importers and that they are lagging behind in accessing and sharing the benefits from the technology, thus they are importing their basic agricultural commodities from countries where almost entire production is based on biotechnology (Table 1).

Table 1. Most Islamic countries import their commodities from mega biotech crop producing countries (<http://www.trademap.org/tradestat/>).

Country	Oil and oil seeds	Cereal
Iran	Argentina, Brazil,	
Egypt	USA, Argentina, Canada, Brazil	
Pakistan	Malaysia, USA, Brazil, Canada	Russia, USA
Turkey	Argentina, USA, Brazil	
Saudi Arabia	Brazil, USA	USA, Argentina
Syria	Argentina	
Jordan	USA	USA, Argentina, Brazil
Sudan	Second	USA (corn)
Oman	Argentina, UAE, USA, Saudi Arabia, Brazil	USA, Argentina Brazil
Algeria	Argentina, USA, Brazil	Canada, Argentina, USA, Brazil

How to communicate

Communication is an art. Science communication in sensitive issues requires more artistic approaches. In communicating agricultural biotechnology, terms and words should be selected carefully. For example, using the term "toxin" for Cry proteins is a mistake since people do not appreciate consuming crops producing "toxins". It will be much better and scientifically more accurate to use the term "protein" instead of toxin. Protein has a positive value embedded in it. Care should be taken to avoid such terms as "genetically modified organisms" since it is not scientifically accurate. In fact, almost everything that we eat to date including those improved through classical plant breeding are truly "genetically modified". In this case it is better to use the term "Modern

Biotechnology" and Biotech Crops. Using the term "natural" or "normal" referring to non-biotech crops is a mistake and erroneous since it implies that biotech crops are not natural or normal.

A successful science communicator should be alert and should monitor all the developments in the field. Communication should be targeted when it is required. General public have good levels of trust on radio and television. Radio has more influence in rural areas and among farmers. Popular newsletters are also effective media for communicating scientific issues. All these facilities and opportunities should be used.

Science communicators should not take political sides. If a scientific issue is heavily politicised (is accepted by one political wing and rejected by another one) its development will be affected by political situation and may be entirely lost when the opposing politicians come to power. Effective science communication requires farmers and consumers to speak out as champions and share their success stories. Involvement of other stakeholders on process of communication will also be useful. It is of paramount importance that communication is made in local languages, if possible in different dialects used in different parts of the country. Finally, visiting experimental farms and wherever possible the commercial production fields will have positive impact on the acceptance of the technology.

Acknowledgement

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Agricultural Biotechnology in Pakistan: A Country Report

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Introduction

Pakistan has a history of activities with regards to traditional biotechnology. It has developed many new plant varieties, some of which are used commercially all over the country. However, Pakistan has failed to substantially benefit from the more recent advances in biotechnology, particularly in the last 25 years with the emergence of genetic engineering and genomic sciences.

Agriculture plays a critical role in the national economy of Pakistan, where most of the quickly increasing population resides in rural areas and are dependent on agriculture for subsistence. Total population of Pakistan is almost 185 million and almost 67.5% of the country's population is living in rural areas and is directly or indirectly linked with agriculture for their livelihood. 43% of the population's occupation is agriculture. The industries in Pakistan which make up 20.3% of the labour force are involved in agriculture. Pakistan exports around 37% of its agriculture produce and this figure is increasing regularly. Major food crops in Pakistan are wheat, rice, maize, barley, gram and banana while cotton, sugarcane and tobacco are the major cash crops in Pakistan.

Land Resources

Out of 79.61 million ha, 22.17 million ha were cultivated during the period 2000-2001 (Table-1) as compared to 8.21 million hectares in 1951.

Table 1. Distribution of land use in Pakistan

Particulars	1990-91 (mha)	Percentage of geographical area	2001-02 (mha)	Percentage of geographical area
Geographical area	79.61	100.00	79.61	100.00
Cultivated area	20.96	26.33	22.17	27.85
Culturable waste	8.85	11.12	9.03	11.34
Cropped area	21.82	27.41	22.00	27.63
Forest area	3.46	4.35	3.97	4.99

*Pakistan Statistical Year book, 2002

Despite impressive growth in agriculture during the past four decades, the national average yield of all crops is still far below their potential yield and the yield harvested by many progressive farmers in the country (Table 2).

Table 2. Average crop yield by various sectors in Pakistan

No.	Crop	Potential yield (kg/ha)	Av. yield with progressive farmers (kg/ha)	National av. yield (2000-01) (kg/ha)
1.	Wheat	6808	4625	2325
2.	Cotton	4326	2642	1835
3.	Sugarcane	124000	94000	45400
4.	Maize	9200	6900	1741
5.	Rice	5150	3830	2021
6.	Oil seed rapeseed/ mustard	3350	1535	836

Cotton is one of the world's most popular fibres, accounting for around 45% of the world's fibre trade. Cotton remains the second most important crop of our country after wheat in terms of area and value addition. In Pakistan, biotechnology is being used to address problems in all areas of agricultural production and processing. This includes plant breeding to raise and stabilise yield; to improve resistance to pests, diseases and abiotic stresses such as drought and cold; and to enhance the nutritional content of foods. Biotechnology is being used to develop low-cost disease-free planting materials for crops such as cotton, banana and potato and is creating new tools for the diagnosis and treatment of plant and animal diseases and for the measurement and conservation of genetic resources. Pakistani biotechnology institutes and organisations have been set up to speed up breeding programmes for plants, livestock and fish and to extend the range of traits that can be addressed. Biotechnology is also being used in disease diagnostics in plants and crops in Pakistan.

It occupies a pivotal position in the national economy as Pakistan is the largest exporter of cotton yarn in the world; almost 67% of Pakistan's annual export income comes from the textile sector. Pakistan is among the three countries where use of cotton has substantially increased during past five years that has positioned the country well to face the challenge of quota free textile exports in 2005.

Challenges in agriculture

Challenges in Pakistan are no different from global challenges. At present, arguably, most important challenges for Pakistan's agriculture are as follows:

- i) worsening shortage of water,
- ii) energy crisis,
- iii) degradation of land resources,
- iv) sub-divisions of agricultural land,
- v) wayward weather conditions,
- vi) deteriorating environment etc.,
- vii) the global challenges identified by WTO, and
- viii) increased population growth.

Biotechnology has considerable prospects for promoting the efficiency of crop improvement, food production and poverty reduction. Use of modern biotechnology began in Pakistan around 1971 through the establishment of Radiation Genetics Institute (RAGENI) later it became the Nuclear Institute of Agriculture and Biology (NIAB). Currently, there are 34 biotech centres/institutes in the country. Nonetheless, few centres have suitable physical facilities and trained manpower to develop genetically modified (GM) crops. Most of the activities have been on rice and cotton, which are among the top five crops in Pakistan. Biotic (virus/bacterial/insect), abiotic (salt) resistant and top quality (male sterility) genes have already been incorporated in some crop plants.

A revolutionary role of biotechnology in Pakistan began in 1981 when a workshop on Modern Genetics was held in Faisalabad. The first national Centre for Excellence in Molecular Biology (CEMB) was established in 1987 at Punjab University & the National Institute of Genetics Engineering (NIBGE) was established in 1992 at Faisalabad. These institutes played a vital role in enhancing biotechnology in Pakistan. The research programmes, national and international training workshops, conferences and symposia organised by NIBGE alone are a source of pride for Pakistan. After nearly two decades it is indeed gratifying to note that among developing countries, Pakistan has done extremely well and a number of research institutes and universities have started to work on this new and exciting research area. Some institutes work specifically on agricultural biotechnology, like Pakistan Agricultural Research Council (PARC) has set number of research centres across the country. These are National Agricultural Research Centre (NARC), Islamabad, Southern Zone Agricultural Research Centre (SARC), Karachi, Arid Zone Research Centre (AZRC), Quetta, Arid Zon Research Institute (AZRI), Bhawalpur, National Tea Research Institute (NTRI), Mansehra, National Sugar Crops Research Institute (NSCRI), Thatta, Mountain Agricultural Research Centre, (MARC), Gilgitl, Research Station Shaheed Benazir Bhuttoabad (RSSBB), Sakrand, Sindh and Summer Agricultural Research Station (SARS), Kaghan.

A great effort to accelerate the biotechnology in Pakistan was the establishment of National Commission on Biotechnology (NCB) in 2001 under the umbrella of Ministry of Science and Technology. The main objective of this commission is to organise the work of existing institutes and establishing new institutes on biotechnology. NCB not only strengthens the exiting institutes it also establishes number of new institutes working for Agricultural Biotechnology. One example is the Pakistan Biotechnology Information Center (PABIC) that was established in 2003 at Latif Ebrahim Jamal National Science Information Center, University of Karachi under the patronage of International Service for Acquisition of Agri-Biotech Applications (ISAAA) and National Commission on Biotechnology. The initiative of the establishment of Pakistan Biotechnology Information Center is an attempt to initiate multidisciplinary research and enhance the awareness and appreciation of biotechnology at the local and international levels.

NCB has funded 34 domestic and international seminars and conferences at various universities and institutes. A National Core Group was constituted in Life Sciences (NCGLS) on January 17, 2002. NCGLS has organised the 36 workshops on different aspects of modern biotechnology across the country and has published Life Sciences Directory. NCB has also developed the Pakistan National Policy and Action Plan for Biotechnology 2003.

Pakistan is the only country among the Muslim countries which has developed the biotechnology education material in its own language for young school going kids. These books include “Biotechnology & Hum”, two volumes of “Biotechnology for Kids” and “Biotechnology a Multidisciplinary Introduction”. These electronic and printed media are used as tools to create awareness in the society. NCB has also used these materials as well as organise a media workshop entitled “Biotechnology in Pakistan, Educating People through Media” in 2006. Pakistan Tele Vision (PTV) telecast different programmes on agriculture, e.g. Gandamke Kashat Sona Chandi ke Sath”. There are a number of local journals and magazines that publish and disseminate agricultural concepts.

Pakistan has strong legislation on life sciences and agricultural research. Biosafety guidelines and guidelines for GMOs by Environmental Protection Agency of Ministry of Environment have been in force since 2005. Code of conduct for life scientists has been developed by Ministry of Foreign Affairs and implemented.

Pakistan is working on many agricultural biotechnology projects in close collaboration with other countries like Germany, Japan, USA, Sri Lanka, Canada, Australia etc. The youth in Pakistan now actively participates in science & technology projects and they are fully aware of their needs and assessments. Establishment of small core groups of young scholars like Pakistan Sciforum, National Academy for Young Scientists (NAYS), and Study Aids Foundation for Excellence (SAFE) are some of the achievements. Some Non-Governmental Individual (NGI) has taken some important roles in this respect. David Suzuki from Canada, the former well known host of the popular and long-

running CBC Television science magazine, The Nature of Things, is an example. His foundation is working towards the protection of environment and nature. A prominent scientist and author of this paper, Dr Anwar Nasim has to be commended for the development of agricultural biotechnology.

During the last few years, the agricultural sector in Pakistan has been badly affected by flood and drought. In order to sustain the pace of development there is need for comprehensive planning of water reservoirs and the genetic engineering of new varieties of crops. Due to unprecedented challenges on the planet as well as an additional 2 billion people to be fed over the next 30 years there is an urgent need to increase food production. More than 842 million people are chronically hungry, most of them in rural areas in poor countries, and billions suffer from micronutrient deficiencies, an insidious form of malnutrition caused by the poor quality of and lack of diversity in their habitual diet. The Green Revolution has taught us that technological inventions such as higher-yielding seeds can bring enormous benefit to poor people through enhanced efficiency, higher incomes and lower food prices. Although this has brought about increased productivity, improved living standards and provided sustainable economic growth many remain trapped in subsistence agriculture.

Recommendations & Conclusions

Scientific endeavours are integral parts of the overall national scenario. Science is not practised in a vacuum and heavily depends on politics and commitment. In this respect, governance is of great importance. The following areas need to be strengthened to fully realise the potential of biotechnology in the field of agriculture.

Human Resource Development

Since biotechnology is a multi-disciplinary subject, apart from a good knowledge of basic molecular biology, a biotechnologist also requires multiple skills, including bioinformatics, information technology, engineering, statistics, genetic epidemiology, business management, product development and legal issues skills.

Creating industrial opportunities

For instance, DNA fingerprinting techniques are used to characterise micro-organisms, plants or animals while threonine is produced using GM bacterial strains. It is the exploitation of modern biotechnology that will lead to sustainable competitive advantage. Consequently, a number of initiatives in this strategy are focused in these areas. Each is given as a subheading. In order to realise the full potential of biotechnology as a frontline area of research and development with an overwhelming impact on society, Pakistan has to nurture biotechnology at two distinct levels (Agriculture & Health) in the beginning and later on extend it to the industry.

Crop improvement

Major thrust will be on increasing productivity, enhanced nutritional value, and developing value added products acting as therapeutics.

Stability against stresses

Insect pests and diseases still continue to cause heavy crop losses. Focusing on specific crops and its associated problems should be the priority. Transgenic and/or marker assisted selection approaches should be developed and used to develop stress tolerant crops varieties.

Nutritional quality improvement

Exotic and indigenously identified candidate genes to be exploited to enhance the level of essential nutrients such as iron, zinc, vitamins, and amino acids, and to eliminate anti nutritional factors known to exist in specific pulse and oilseed crops.

Edible vaccines

Edible vaccines for diseases, particularly for cholera, hepatitis and rabies would be developed and tested for large scale production.

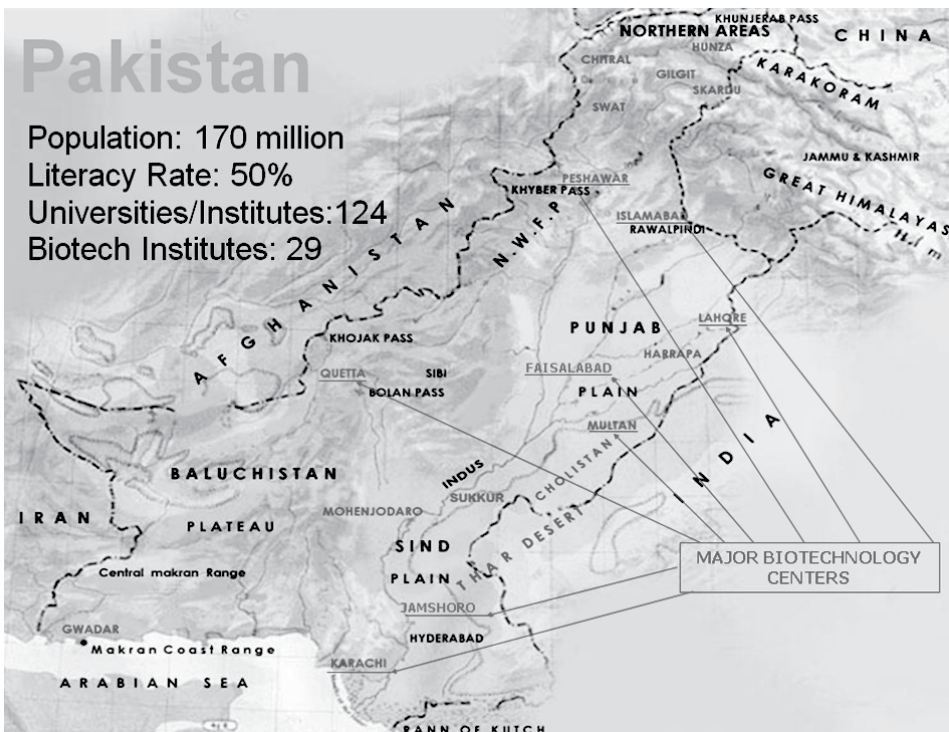


Figure 1. Major Biotechnology Centers in Pakistan

Communicating GMO issues in China, and what we can learn from Muslim countries: A Journalist's Perspective

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Introduction

China has benefited from GM crops significantly and some top leaders have publicly expressed support for GM technology, however, public attitude has been dominated by negative perception. This paper will analyse the reasons behind this reality and what a science reporter could do to deal with this situation and what we could learn from Muslim countries.

GM crops in China

According to the International Service for the Acquisition of Agribiotech Applications (ISAAA), in 2008, Chinese farmers benefited from GM crops, particularly GM cotton, an additional value of US\$859 million and since 1997 when GM cotton was first commercialised an accumulated gain in income was recorded at US\$7.6 billion.

Premier Wen Jiabao was quoted saying “solving food problems need to rely on S&T input, agri-biotech and GM technologies.”

China has developed world-leading technology in GM rice, The Chinese government is currently carrying out systematic field trials on the new rice cultivars, but the commercialisation of GM rice is suspended due to opposition to GM crops.

The public perception on GMOs

The public attitude has been dominated by negative perception. Two polls were conducted in 2008 and 2009 in People.com.cn. Those who opposed to GM accounted for 51.2% of the 3175 online voters in 2008, in comparison to 81.8% of the 300,000 online voters in 2009 (though the polls apparently did not include farmers).

A search for GMO in BAIDU (the counterpart of GOOGLE in China), yields tons of information on "the danger of GMO food."

Why do so many people oppose GM crops in China?

Firstly, persistent manipulation of some anti-GM organisations shape public perception and middle-class conservatism that NATURE IS GOOD, NEW TECHNOLOGY IS BAD. On-going stereotypical depictions of GMO as evil and alien in sci-fi also influence general public's mind.

Secondly, is the reference to the ghost of "Boxer". The Invading of China by Western countries in the 19th century brings painful memory to Chinese. The western countries brought opium traders, political invasion, economic manipulation and missionary evangelism to China. On the other hand, they also introduced modern technology and the art of thinking to China. Many people in China have this idea that Westerners and anything from the west is evil, and should not be allowed into China. Around the year 1900, Boxer became more prominent in China. Boxers declared war on foreign powers. Diplomats, foreign civilians and soldiers, and Chinese Christians were all attacked. The Qing government used Boxers as a weapon to counter the western countries. When the Eight-Nation Alliance brought 20,000 armed troops to China, they defeated the Imperial Army and captured Beijing.

Some people believe GM food is a weapon that the imperialism is using to eliminate Chinese people. GM foods are perceived to be just like opium, which the USA does not consume but sells to developing countries for money. There have been many protests in China against GM crops. In September 2010, many people protested before the gate of the Agricultural Department of China with messages like, "Punish the traitors who want to bring GM crops to China; reject GM foods so that Chinese people will survive."

The third reason is the message from Chairman Mao who is depicted as a great leader who defeated the imperialism in China, and he said: "the American imperialism will overturn the Chinese communism". Some people, led by several followers of the founders of Red China, call themselves pupils of Chairman Mao, who believe GMO is the weapon of American imperialism. Based on the website "utopia", they are the main force of anti-GMO in China in recent years. The "utopia" is another version of the Boxer. Their outspoken attitude is just a way to get more political support.

Fourthly, the continually emerging food safety events in China are big issue. For example, melamine was found to have been added in foods, especially dairy products, so that inexpensive ingredients can substitute the more expensive, concentrated proteins. The combination of melamine and cyanuric acid has been implicated in kidney failure. At least three infants died and 53,000 became ill after consuming Chinese milk contaminated with melamine. The toxic milk powder is not the only toxic food in China. There were incidents of toxic bread, vegetable, meat, oil, and fake mutton, beef, fish and even fake eggs in China. Though some of the events are just rumours, these incidents have eroded public confidence on food safety.

The fifth reason is due to the lack of transparency in the decision-making process. In traditional China, the decision-making process has never been transparent. Thousands of years have passed and China has not changed in many aspects. People still do not know how the government makes its decisions. On 23rd July, two high-speed trains crashed and were derailed in Wenzhou China killing 40 people. Less than one day later, the government tried to bury the train. This is the manner incidents and issues are hushed. The Chinese have very little confidence in what their government states about various issues. The government has not been providing clear information on GMOs to the public which causes fear and distrust.

The sixth reason will be non-effective communication on any issues. GM is often reported as a scientific progress, however, authorities never respond to public concerns. Public trust in government agencies is very low. Misinformation on the subject is not addressed promptly. For example, a story in the International Herald Tribune states that rats were decreasing in a GM corn farm in Shanxi and this could be because the GM corn was poisonous!

What a scientific reporter can do

Jia Hepeng, the leader of Scientific Communicating Centre of China, is dedicated to communicating with the people on GM issues. He is an excellent scientific reporter who has recommended the following suggestions:

1. The benefit of science is not directly understood by the public. It has to be communicated.
2. Messages need to be informative and comprehensive.
3. Explanations are always necessary.
4. Strategic and consistent approach is needed.
5. Scientists need to talk to the public.
6. Make science stories relevant to media's current and hot topics.
7. Actively and timely response to negative claims.

As a conclusion, it will be important for China to engage the media and science communicators so that farmers and consumers realise the benefits of agribiotech taking risk assessment into consideration.

Communication of Agribiotechnology with Muslims: Thailand's Experience

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Introduction

Thailand is one of the countries which can produce sufficient food both for export and domestic consumption taking into account that Thailand has a population of over 60 million. Like other food producing countries, Thai agriculture also faces several constraints affecting its production such as plant diseases and pests, limited fertile farm land and other unfavourable environmental conditions. Agribiotechnology was then identified as one of the key technologies to improve the productivity of agricultural products to cope with these constraints since 1983. Agricultural policy in Thailand has changed from growing rice farming as the only major practice to one that grows diverse crops especially field and horticultural crops. The trend is to be self-sufficient and to export the produce using Good Agricultural Practices (GAP). Plant biotechnology and genetic engineering is part of the modern technology that is currently used to improve agricultural production.

Early development of biotech products

In this respect, the National Genetic Engineering and Biotechnology Center (BIOTEC) under the National Science and Technology Development Agency (NSTDA), Ministry of Science and Technology was set up in 1983. The Plant Genetic Engineering Unit (PGEU), a research unit under the BIOTEC, established in 1995, was assigned to develop agribiotech products using modern products using modern agribiotechnology. PGEU focused its bioengineered products on “*Som-Tom* or Papaya Salad”, a daily vegetable salad consumed by most Thais. Papaya salad contains green papaya, tomato, pepper and yard-long bean as key ingredients. These vegetables are normally badly affected by viral diseases: for example, papaya by *Papaya Ring Spot Virus*, tomato by *Tomato Yellow Leaf Curl Virus*, yard-long bean by *Cowpea Aphid-Borne Mosaic Virus* and pepper by *Chilli Veinal Mottle Virus*. Few years later, agribiotech products such as biotech papaya, biotech pepper and biotech tomato were developed and shown to be resistant to the virus diseases. They were also considered to be the first batch of “homemade” agribiotech products addressing the needs of farmers for disease resistant varieties. Biotechnology is playing a vital role in the country's development in line with the National Biotechnology Policy Framework leading to core technologies such as genomics, bioinformatics, markers to accelerate development in areas of agriculture, food, medical care, environment protection, new knowledge creation for higher value-added products, knowledge-based policy and strategic planning. In order to operationalise this framework, alternative policies were developed

to promote the commercialisation of GMOs and social choice that provide a choice to use the GMOs that pass strict risk assessment processes based on market acceptance and available scientific information. Although Thailand has progressed quite a bit regarding biotechnology, a National Biosafety Law has not been mandated as the progress has been met with various hindrances.

Studies were conducted to find out how the public accepts this new technology when it comes to consumption of biotech products. They showed that level of education played an important role in understanding and accepting this concept. Most respondents were only concerned on the hygiene, pest free and safe, fresh food. They were not concerned about the genetically modified food or how they have been produced. Additionally, expiry date and FDA endorsement on processed and packaged food were of importance. Thailand is moving forward towards educating its farmers, consumers and the general public using well trained science communicators. To date 30 have been trained well to address the public on these topics using the various media available. A large effort has been made such as road shows, visiting schools, using cartoons and holding exhibitions and debates on these topics. Public understanding of GM technology has to be continuously carried out through constant updates and interaction with information sources so that knowledge and not imagination will empower the people.

Issues of concern for some religious groups

Among the population amounting to around 66 million, Buddhism is the most common religion in Thailand the minor religions being Islam and Christianity. Muslims make up the second largest religion in the country making up around 5% of the population. They reside mainly in the southern provinces along the Malaysian border. Thai Muslims like those in any other country have specific requirements. It is important that the process and composition of the food be prepared according to the religion. Thai Muslims are sceptical about biotechnology food products as they might contain genetic material from animals that are prohibited by their religion. They feel that the products may not be *halal* and should be prohibited.

Although awareness programmes are being carried out, NGOs and anti-biotech groups continue to hinder the progress. During the launching of biotech products, there were some concerns from religious groups like Muslims on the agribiotech products which might contain genes from animals unacceptable to Muslims claiming that this technology implicates that humans are playing “God”. This has led Muslim communities to think that agribiotech products cannot be considered *halal*.

Direct communication with stakeholders

PGEU had invited the Central Islamic Committee of Thailand to discuss on the concerned issues. The group was given a briefing on various aspects of agribiotechnology. The concept of “Live Classroom” was introduced to the group to demonstrate that agribiotech products, *i.e.* transgenic tomato and transgenic papaya were developed from the naturally existing varieties. Simple methods of direct gene transfer, transgenic detection and micro propagation of transgenic plants were also performed during the visit. Discussion on the gene construct was also carried out to assure the group that there were no animal genes involved in the process.

After visiting and participating in Live Classroom and discussions, the group has come up with the conclusion that agribiotech crops can be considered as *halal* and they do not pose any conflict with Islamic principles. The group promised to convey the message to Muslim communities and would contact PGEU for more information if needed. Thus far, there has been no such request.

Communication experience and initiative from GM papaya

Although there has been many negative approaches and propaganda by activists in Thailand regarding research on GM papaya, scientists involved in transgenic papaya work are making every effort to take a more active role in science communication. The Biotechnology and Biosafety Information Centre (BBIC) contributes to create greater awareness and understanding of crop biotechnology in Thailand and is rightly based where research on *Papaya Ring Spot Virus* (PRSV) resistant papaya is carried out. It is committed to share this knowledge to various stakeholders – students, educators, farmers, agricultural extension workers, food producers and general consumers. The “live classroom” approach was well received to better understand the biotechnology story. During training programmes to introduce the concept, trainees experienced the process of producing biotech papaya from laboratory to the greenhouse and ultimately the field, ending in a papaya salad tasting session. Briefing on research process up to product development along with benefits of the biotech food showing disease-free produce is a powerful communication approach to update the public on research initiatives on papaya.

Other initiatives by BBIC and other agencies

Recognising how important information dissemination and communication with stakeholders is, BBIC, a member of Knowledge Center (KC), ISAAA, has launched several initiatives to improve public acceptance of agribiotech products. Series of seminars and workshops were organised for students, general public, consumers, local authorities and farmers, regardless their religious background. Information was consistently provided to public via BBIC Newsletter, website, and other media. It is estimated that by the year 2012, total visit of BBIC website will be over 8 million. BBIC has been working closely with Thailand Biotechnology Alliance Association (BAA), a non-profit organisation, to help promote agribiotechnology. BBIC and BAA actively engaged in seminars and workshops organised by the so-called “Technology Advance Farmer Group” to echo their voice on the use of biotech crops. Through their efforts, general public began to understand the benefit of agribiotechnology products that could lead to the healthy food for consumers and better income for farmers.

Lessons learned

Since Thailand has begun to address the biotech issues as a balanced group, the following resolutions were agreed upon:

1. Carry out direct communication with target group.
2. Apply the concept of “seeing is believing” like “Live Classroom” wherever possible.
3. Study carefully the requirements of religious groups concerning food composition and then develop the product according to consumer’s requirements.
4. Prioritise on non-food as a champion “homemade” product to minimise any opposition.

As a conclusion, Thailand has to engage media and science communicators to convince farmers and consumers on biotech, however, all policies and risk assessments should be in place.

Uganda Biotechnology & Biosafety Consortium: Experiences, Plans and Challenges of Biotech Communication

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Summary

Uganda is a land locked country located in the heart of the African Continent to the East of the Democratic Republic of the Congo, to the West of Kenya, the South of South Sudan and the North of Tanzania and Rwanda. It is inhabited by about 33 million people and is predominantly an agrarian economy with over 70% of the population engaged in agriculture as a livelihood. Biotechnology has been embraced as one of the avenues to address the constraints in crop production by adoption of the National Biotechnology and Biosafety Policy in 2008. However, although non-genetically engineered components of biotechnology such as tissue culture are in the hands of the farmer, GM technologies are still at research level. It requires enactment of a biosafety law to move forward this technology. The Uganda Biotechnology and Biosafety Consortium, which is a coalition of different stakeholders aimed at advancing biotechnology including GM technologies, was formed in April 2011 and is helping in advocating for the enactment of the biosafety law to move the technology from research level to the farmers. It has several strategies in place aimed at stakeholder and public sensitisation an engagement but is still limited in its capacity to execute all these plans.

Introduction

Uganda is a land locked country located at the heart of the African Continent to the East of the Democratic Republic of the Congo, to the West of Kenya, the South of South Sudan and the North of Tanzania and Rwanda (Fig. 1), and accesses the Indian Ocean through Kenyan port of Mombasa. It is a multi-cultural country with freedom of worship and many religious faiths with the Islamic faith accounting for about 15% of the population, and joined the Organisation of Islamic Conference (OIC) as a member in the mid-1970's. The Ugandan economy predominantly relies on agriculture with over 75% of the population directly employed and deriving their livelihoods from agriculture. Ugandan agriculture is almost entirely rain-fed and on the basis of small-scale farm holdings. The country is food secure but with un-even distribution of food and a high level of nutrition insecurity, leaving some parts of the country food insecure at times and a number of children and expectant mothers malnourished. The country also faces a number of agricultural productivity constraints such as crop pests and diseases, drought in some parts of the country as well as other effects of climate change such as floods in other parts of the country.

Biotechnology and the role of UBBC in Uganda

Biotechnology, especially modern biotechnology is of great relevance to Uganda and this was recognised by Government when it adopted the National Biotechnology and Biosafety Policy in the year 2008. However, since then, the law has not operationalised to date. Thus, the stakeholders in Uganda have decided to form a coalition to advance this cause.



Figure 1. Map of the African continent showing the location of Uganda.

The Uganda Biotechnology and Biosafety Consortium (UBBC) was formed out of the need to have a strong and unified group of stakeholders in support of biotechnology advancement in Uganda, with a primary focus of supporting the passage of the National Biotechnology and Biosafety Bill into law. It was officially launched on 2nd September 2011. Its membership is comprised of both individual and institutional members. The goal of the consortium is to be a unified body of stakeholders to support the safe and sustainable utilisation of biotechnology for national development and socio-economic transformation of Uganda, while its vision is a prosperous Uganda where biotechnology is used safely and sustainably for improvement of livelihoods and where the public understand and appreciate its importance.

The objectives of UBBC comprise of the following:

- promotion of stakeholder understanding of and support for establishment of a biosafety regulatory framework and overall application of biotechnology for improvement of livelihoods;
- advocating for timely and informed decision making for passage of the biosafety legislation; and
- provide linkages within the biotechnology research and development partners in Uganda for the safe and sustainable utilisation of biotechnology.

Accomplishments of the UBBC

The UBBC is a young organisation but within a short time, it has already gained recognition both in Uganda and the region due to clarity of its focus on biotechnology and biosafety matters and being a unifying force of action. In the short term, the UBBC is focused on advocating for enactment of the national biotechnology and biosafety bill into law. It has devised a strategy of one-on-one meetings with key Government officers charged with moving the bill forward and has produced simple info-materials clarifying why Uganda needs a biotechnology and biosafety law. The UBBC also writes letters and updating briefs to different Ministers and members of Parliament to get them on board or to clarify on issues of biotechnology and biosafety. It has made presentations at high-level offices such as Office of the Prime Minister and contributed to getting the principles of the bill approved by cabinet in June 2011. The drafting process of the bill is currently with the Solicitor General's office (Fig. 2) and the UBBC is keenly following this process.

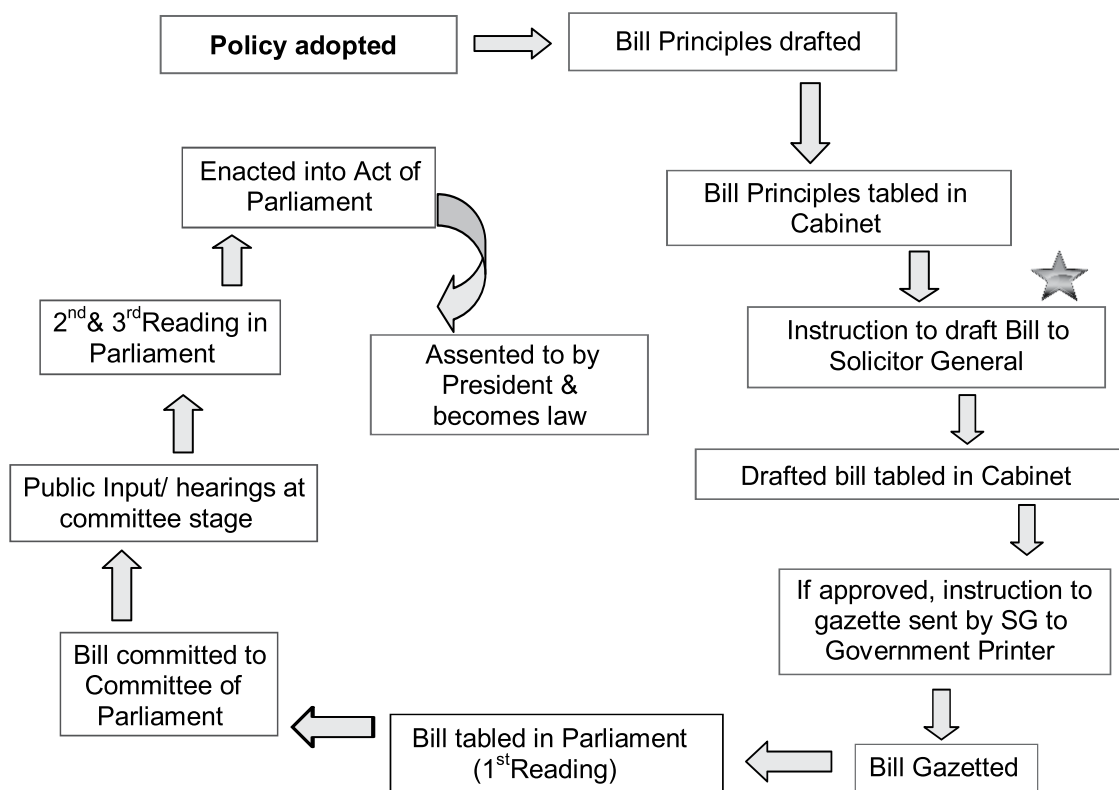


Figure 2. Schematic Diagram of the Bill Process in Uganda, showing (by a star) the stage at which it has reached as of September 2011

Overall approach of the UBBC is diplomatic approach, focused engagement and creation of champions, especially at high-level, joint strategy (working together with others as a team) and strategic and sustained advocacy.

How the partnership is working out?

The UBBC is a coordinating secretariat of different stakeholders in the country that focuses on biotechnology. It targets to seek contribution in terms of ideas and resources from different projects, programmes and agencies involved in biotechnology and biosafety in the country. It has a multi-stakeholder Executive Committee selected by the members themselves and it is on the strength of this wide array of stakeholder base that the UBBC sets its foundation for growth. It contributes to these programmes and projects by helping in strategic policy advocacy which will help, at least in the long run these projects to work in a favourable legal and regulatory environment. It holds quarterly planning and strategy meetings to agree on how to move forward with biotechnology communication.

Future plans

Future plans include strengthening the Secretariat with more equipment and staff, establishing an information collection and dissemination centre of excellence (have written a proposal to the Pakistani Biotechnology Information Centre requesting for support on this), building more champions of biotechnology in Government and Parliament and continuing with strategic advocacy at different levels.

Challenges

The challenges of the UBBC include the following: resources for a young organisation are difficult to secure, slow and bureaucratic government processes are a bit of a frustration, low stakeholder and public awareness of biotechnology makes the bill process move rather slowly, religious leaders are yet to understand and appreciate the role of biotechnology and importance of a biosafety law in Uganda, and yet we need to make them champions too.

Acknowledgements

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Agribiotech Communication in Pakistan

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Introduction

Pakistan has an agriculture based economy as two thirds of the population resides in the rural areas. Pakistan is the sixth most populated country in the world and expected to be fourth by 2030. Careful planning and effort are therefore required to cater the present and future needs of the increasing population. Many nations are already harnessing the fruits of human ingenuity in the field of science, technology and engineering. One of the most exciting developments in science and technology is biotechnology. Biotechnological innovations spread over every sphere of human needs, including health, environment, agriculture, and industrial applications.

Modern agricultural biotechnology helps many nations in the developing world to fulfil the needs of growing population and thus to overcome poverty and help improve the livelihood of the farmers by using disease and drought resistance crops, high yielding varieties with some even enriched with essential nutrients. However, the greatest challenge is to develop educated workforce, upgrade required infrastructure and devise right policies so that these varieties can make their way to farmers' fields and benefit the farmers and the nations alike. Therefore, there is a need for the availability of the required information in the right format and language for various stakeholders. Information and communication network play a strategic role in economic, political and cultural development. The discovery, publication and application of new knowledge, the dissemination of information concerning best practices and the exchange of views and opinions effectively facilitate the objective, understanding and judicious application of new technological innovations.

Current status of agriculture biotechnology in Pakistan

Pakistan is among those countries in South Asia who adopted the "Green Revolution" for the major crops namely, wheat and rice. Currently, the improvement of crops using modern biotechnology tools is mainly focused in cotton and rice. The initiatives for other crops, including sugarcane, cucurbits, potato, *Brassica*, chickpea, chilies, tobacco, and tomato are also in the pipeline. In past three years, Pakistan had made remarkable progress in the agricultural biotechnology sector. However, there is a need to develop capacity building relevant to plant breeding rights and biosafety rules. Although Pakistan has realised the importance of biotechnology in the late 80s, it took several years i.e. 2005 to develop biosafety regulations by the Ministry of Environment and until 2009 no GM crop was approved for commercial cultivation. This resulted in illegal spread of Bt cotton and resulted in economical loss and pest resistance

development. In 2009, Government of Pakistan allowed the cultivation of eight Bt cotton varieties officially. In addition to public sector, private sector also took an initiative and many multinational companies, especially Monsanto, have now entered the market under the new conducive regulatory regime. Therefore, capacity building in regulating authorities along with strict legal control is a prerequisite for safe and sustainable use of agricultural biotechnology in Pakistan.

Agri-biotech communication in Pakistan

Food, fodder, and fibre are the most important needs to human in everyday life and all these come from the agriculture sector. Therefore the agriculture sector is, and will remain the most important sector in the economy of any country including Pakistan and effective applications of modern agriculture biotechnology can thus, play an important role in the sustainable agriculture development. However, application of modern agriculture biotechnology requires an efficient and compatible communications networks for stakeholders to shift laboratory findings towards the real users. In Pakistan the agribiotech communication is an area that needs to be further strengthened by an effective collaboration between science communicators and the stakeholders.

Major strengths of agribiotech communication in Pakistan

Supportive government: Pakistan is among very few countries in the world which has realised the importance of biotechnology in the early 70s, for the sustainable development of different areas especially agriculture. Pakistan is the 6th most populous country in the world with more than 180 million people. The imbalance of the food intake and the crop production ratio is a big challenge to the government, in addition to the heavy use of the pesticides and insecticides and the low yield of the crops that are contributing a vital role to the poverty of the farmers. The government is fully aware and convinced that the GM crops are the main solution to overcome these challenges.

Political acceptance: A supportive government and a positive will to adopt modern agribiotech technology is another major support for the agribiotech communicators. Many leading politicians are also main growers/farmers in their respective areas. Biotech products and applications help to reduce costs and increase the production in agriculture. The government reaches out to small farmers to make them aware of this.

General acceptance of biotechnology: Using agribiotechnology saves time and increases yield. Reduction in the production cost (reduced use of pesticides) and increased yield contribute to reduction in poverty and in turn boost the economy of the country. The 80-87% increased production of Bt crops per hectare contributes towards the general acceptance of biotechnology making it easier to communicate with the stakeholders.

Strong research based institutional strength: Pakistan has several good institutions currently working on various aspects of biotechnology. There are a number of universities which offer degrees in this discipline. A large number of institutions such as NIAB (Nuclear Institute for Agriculture and Biology), NIBGE (National Institute Biotechnology and Genetic Engineering), CEMB (Center of Excellence in Molecular Biology), Husein Ebrahim Institute of Chemistry, Dr. Panjwani Center for Molecular Medicine and Drug Research, etc. were established. NIAB (Faisalabad) is involved in plant biotechnology and saline agriculture, while production of biofertilisers for rice, chickpea and soybean is studied in NIBGE (Faisalabad). The CEMB Lahore is focusing on recombinant DNA biotechnology of agriculture and health relevance. Various institutions in the University of Karachi, such as the Halophyte Research Center, Biosaline Agriculture Research Unit and Biotechnology division of the H. E. J. Research Institute of Chemistry are all collaborating with institutes in Syria, Morocco, Jordan, United Arab Emirates, Egypt, Qatar, Azerbaijan, Kuwait, Saudi Arabia, Sudan and Bahrain.

Weaknesses of agribiotech communication in Pakistan

Poor extension services: The weakest link in agriculture related services and information dissemination is the poor extension services. Agriculture extension departments have been historically treated as mass employment department. The personnel lack both skills and motivation. It is not uncommon to find “ghost” employees in extension services. As a result many of the initiatives never reach to the end users i.e. farmers.

Illiteracy and lack of awareness among farmers: The main bottleneck, not only in Pakistan but in many other developing countries, is the poor understanding of the biotechnology due to the high rate of illiteracy and lack of awareness among the end users (farmers). With an adult literacy of less than 60%, effective communication about agriculture related issues, particularly modern biotechnology is certainly a challenge.

No Government strategy for biotech communication: Unfortunately in Pakistan there is no government policy to alert the farmers about the recent trends in agriculture or the dissemination of information at the right time. Many of the institutions especially Agriculture University Faisalabad, National Institute of Biotechnology and Genetic Engineering Faisalabad, Pakistan Central Committee Research Institute Sakrand and Pakistan Biotechnology Information Centre are working in their own capacity to promote the understanding of agribiotechnology among the farmers by organising seminars, field trips, training workshops etc.

Defunct national biotech communication: The National Commission for Biotechnology (NCB) established in 2002, by the Ministry of Science and Technology with a mandate to promote biotechnology education, research, application and

communication is defunct due to complete withdrawal of government support. With the demise of NCB, Pakistan has no official institution to objectively communicate biotech issues to the stakeholders. In this situation, Pakistan Biotechnology Information Centre (PABIC) remains as the only organisation to fill this major vacuum.

Poor understanding of media about agribiotechnology: The information and communication networks always play a significant role in economic, political and cultural development. The discovery, publication and application of new knowledge, the dissemination of information concerning best practices and the exchange of views and opinions effectively facilitate the cross-border flow of information and promote international trade. In Pakistan the poor science/agribiotech understanding of media is another area that needs immediate action. PABIC is the only organisation working to enhance the capacity of electronic and print media to objectively cover the biotechnology-related issues, such as GM crops, food security, biosafety, etc, by organising many media workshops, training courses and field trips.

Opportunities

Despite the above mentioned weaknesses related to science communication in Pakistan, there are numerous opportunities in order to improve the agribiotech sector through effective communication.

Farmers and malpractices: The smallholder farmers of Pakistan are willing to venture in the new time saving, high yield and environment friendly seed varieties. These farmers are motivated to adopt any technology which is affordable and can increase the yield substantially. However, due to lack of awareness and slow implementation of government policies the farmers opt to grow illegal Bt seeds.

Pakistan as the bread basket for West and Central Asia: Pakistan with long tradition of agriculture, large irrigation infrastructure, track record of major success in green revolution and traditional role as agriculture heartland for neighbouring nations, has the capacity to serve as the bread basket for the West and Central Asia. The agribiotechnology can play an important role in this process.

Media: The media in Pakistan works towards disseminating the right information at right time using the best opportunity effectively. There is a need for communicators to use science communication strategies effectively. This is possible by training the media and making them understand science in a simple manner.

Threats

Anti-biotechnology groups: In Pakistan the anti-biotech organisations especially anti-GM ones try their might to misguide stakeholders and end-users by claiming GMOs are hazardous to the environment and cause various health issues. They make up a small quota of the public and are not as organised as they are in Europe and other parts of the world. However, the growing misconception would be a major threat if it is not controlled by using effective and proactive communication strategies.

Well-travelled bureaucrats develop misunderstanding about biotechnology. The well-educated but often non-technical bureaucrats, who have travelled extensively to Europe, are slowly developing a hostile approach towards biotechnology in Pakistan. This is unfortunately growing with time. This seems to have become a visible hurdle to the industry.

Suggestions

Developing champions for biotech communication: Pakistan has an agro-based economy and biotechnology has an immense potential to enhance agriculture productivity and livelihood of people associated with farm based businesses. There is a growing realisation that biotechnology can play an important role in increasing production, decreasing production costs and improve the living standards of general people. Despite this realisation the level of biotechnology communication is at a fairly low level. Therefore, a need for developing better science communication network is critically important.

Developing easy to understand biotech information: In order to promote the understanding of the biotechnology and related biological sciences, literature needs to be easy to understand. Biotechnology related material, new methodologies, books and other literature has to be translated into local languages and distributed to the stakeholders, school students and colleges to create the awareness and enhance basic knowledge of biotechnology as a tool to obtain the benefits.

Reaching the masses: The key to effective communication is to reach out to the masses. With a population of 185 million, most of them being agriculture community in rural Pakistan, this is indeed a major challenge which requires innovative approach. The most effective way of reaching out the masses is as follows:

- a) Radio programs in local languages;
- b) Newspapers in national and local languages;
- c) Training and sensitising primary school teachers, local religious leaders and extension workers; and
- d) Existing network of local governments and village committees also used for reaching out the masses.

Sensitising and training of media: In order to enhance the capacity of electronic and print media to objectively cover the biotechnology-related issues, such as GM crops, food security, biosafety, proper training of media is urgently required. PABIC is regularly organising media workshops and training courses in order to build the media capacity, but a proper government policy for this is necessary.

Recommendations

Despite the facts outlined, there is a need for a network which can serve as a hub to disseminate information to support the collaborative efforts and to develop a network among institutions and individuals working in this field especially in agribiotechnology. PABIC is working with a mandate to create an effective network to create awareness in people about the recent advancements in modern biotechnology which can help alleviate the increasing food and feed demand especially in rural areas of the Pakistan. However the targets cannot be achieved without proper government policies and a well-defined framework. Following are few recommendations to promote the agribiotech communication in Pakistan to address poverty and growing demand of food, feed and fibre:

- to identify key stakeholders
- comprehensive agribiotech communication plan
- revitalising National Commission of Biotechnology
- involving scientists at agriculture research institutes in biotech communication
- key decision makers and journalists to visit major GM crop growing countries
- developing strategic partnership with farmers associations
- engaging school teachers and religious leaders in biotech communication
- sustainable budget support for biotech communication

- establish a biotechnology working group to harmonise biotechnology, biosafety, and biotechnology product distribution policies.
- conduct activities that will promote the transfer of biotechnology that would benefit farmers

In addition to writing, discussions can be held on the internet. The internet has been the top channel for anti-GMO voices. The internet could also be an effective channel to convey the positive message of GMO. A lie, if repeated often enough, will be accepted as truth. So the quantity of message is often more important than the quality in the case of misinformation of GMOs. Therefore, the internet could be an effective media used by scientific community to counter misinformation on GMOs.

Science reporters need to be activists. Many anti-GMO people are activists, but almost all scientific reporters stay home and write for the editor. Scientific reporters should be more active in the society, touch base with more channels and more people. If scientific reporters are more active, the anti-GMO activists would have little chance to win the battle against GMO communicators.

SESSION 3: OUTCOME AND RESOLUTIONS ON IDENTIFICATION OF KEY COMMUNICATION COMPONENTS IN MUSLIM COUNTRIES: ISSUES AND CONCERNS

Strategic Communication Paradigm for Communicating Agribiotechnology

- Participants from 10 OIC countries emphasised the importance of modern agricultural biotechnology as a powerful tool to address food security, poverty alleviation and social economic transformation in developing countries, particularly in Muslim countries.
- Science communication is a crucial component of the agribiotechnology ecosystem that would enhance acceptance and adoption of GM technology in agriculture. It engages and brings together stakeholders for knowledge creation, aggregation, and exchange.
- It appeared to the participants that the advancement of this technology in the Islamic world is significantly affected by insufficient communication efforts that support its understanding and acceptance. The participants wish to request their respective governments through their policymakers to consider the proposed strategies for consideration (Table 1).
- Islam supports scientific innovations and human endeavours. Modern biotechnology is not an exception. Both scientists and Ulama have been supportive of the development and use of modern biotechnology for human welfare. Continued dialogue among scientists and Ulama is however required for better understanding and timely implementation of the technology.

Table 1: Proposed Agribiotechnology Communication Strategies for Muslim Countries

Challenges	Stakeholders	Messages	Strategies
Understanding of technology	Policymakers, media, scientists, civil servants, farmers	Science based information	<ul style="list-style-type: none"> • Seeing is believing – within the country organised by government institutions and scientists • Briefing for identified stakeholders
Misinterpretation of religious tenets (misinformation)	Islamic scholars, scientists	Science based information	<ul style="list-style-type: none"> • Note: do not engage if there are no public concerns • Update/develop capacity of young scholars to empower them as science communicators

Media coverage on agribiotech	Media practitioners and scientists	Benefits of technology; relevance to national issues; success stories	<ul style="list-style-type: none"> • Updating of media by scientists • Training for scientists on handling media and science journalism • Brief/train/ provide info to opinion writers/editors in simplified forms • Identify media champions
Lack of farmer engagement and participation	Farmers, scientists	Benefits of technology	Empowerment and engagement of farmers through farmers organisations
Presence of anti-technology groups	Scientists, biotech communicators	Science based info	<ul style="list-style-type: none"> • Proactive measures to reach to wider community • Close collaboration with media to dispel misinformation
Lack of access to information (language, literacy, availability of channels and tools)	Farmers, Consumers, Students, Policymakers, Scientists	Key technology messages	<ul style="list-style-type: none"> • Provide info in local languages and simplified formats • Identifying suitable tools (electronic/tri-media) • Use case studies, and success stories
Lack of involvement and commitment from scientists and related stakeholders to be science communicators	Scientists, Policymakers	Participation of scientists in popularising technology to stakeholders	<ul style="list-style-type: none"> • Training and skill development • Make public engagement part of research culture • Provide funding for public understanding of science

PROGRAMME

19 Sept 2011 (Monday)

Arrival of guests

6.00pm: Welcome reception (Seashell Restaurant)

Day 1: 20 Sept 2011 (Tuesday)

Session I: Communication in Crop Biotechnology

8.30am: Registration

9.00am: Welcome and Introduction
(*Dr. Rhodora Aldemita, ISAAA*)

9.15am: Recent Developments on Global Crop Biotechnology Scenario
(*Dr. Rhodora Aldemita*)

10.00am: The ISAAA/KC model in Communicating Crop Biotechnology
(*Dr. Mariechel Navarro, ISAAA*)

10.30am: Tea break/ Group Photo

Session II: Country presentation (Moderator: Dr. Rhodora Aldemita)

11.30am: Malaysia: *Mahaletchumy Arujanan, MABIC, Malaysia*

11.45pm: Bangladesh: *Dr. Imadatul Hoque, University of Dhaka, Bangladesh*

12 noon: Egypt: *Dr. Hisham El-Shishtawy, AGERI, Egypt*

12.15pm: Lunch

2.00pm: Indonesia: *Ir. Aris Winaya, University Muhammadiyah Malang, Indonesia*

2.15pm: Iran: *Dr. Behzad Ghareyazie, IrBIC, Iran*

2.30pm: Pakistan: *Dr. Anwar Nasim, COMSTECH, Pakistan*

2.45pm: China: *Liu Zheng, Science Media China*

- 3.00pm: Thailand: *Dr. Supat Attathom, Biotechnonology and Biosafety Information Centre, Thailand*
- 3.30pm: Uganda: *Eroetus Wilberforce Njuki, Uganda Biotech and Biosafety Consortium*
- 3.45pm: Tea break
- 4.15pm: End of day I
- 7.00pm: Barbeque Dinner (Seashell Restaurant)

Day 2: 21 Sept 2011 (Wednesday)

Session III: Breakout session on Identification of Key Communication Components, Issues and Concerns
(Moderator: Dr. Behzad Ghareyazie & Dr. Mariechel Navarro)

- 9.00am: Group discussion (Two groups: Planting and Non-Planting Countries)
- 10.30am: Tea break
- 11.00am: Group presentation
- 12 noon: Lunch
- 2.00pm: Development of Strategic Communication Paradigm for Communicating Agribiotech
- 4.00pm: Tea break
- 4.30pm: Consensus on Strategic Communication Paradigm for Communicating Agribiotech in Muslim Countries
- 5.30pm: End of workshop

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