ISAAA
International Service for the Acquisition of Agri-biotech Applications

ISAAA Briefs

BRIEF 40

Communicating Crop Biotechnology: Stories from Stakeholders

Edited by
Mariechel J. Navarro
Manager, Global Knowledge Center on Crop Biotechnology

No. 40 - 2009

BRIEF 40

Communicating Crop Biotechnology: Stories from Stakeholders

Edited by

Mariechel J. Navarro
Manager, Global Knowledge Center on Crop Biotechnology

AUTHORS

Margaret Karembu • Daniel Otunge • Mahaletchumy Arujanan • K. Cheng Liew • Bhagirath Choudhary • Kadambini Gaur • Muhammad Iqbal Choudhary • Bambang Purwantara • Jenny Panopio • Rochella Lapitan • Noel Amano, Jr. • Ismail Abdel Hamid • Khondoker Nasiruddin • Supat Attathom • Tian Zhang • Hongxiang Zhang • Mariechel J. Navarro • Sonny Tababa • Hien Le

No. 40 - 2009

Published by: The International Service for the Acquisition of Agri-biotech Applications (ISAAA).

Citation: Navarro, Mariechel J. (Ed.) 2009. Communicating Crop Biotechnology: Stories from Stakeholders. *ISAAA Brief* No. 40. ISAAA: Ithaca, NY.

ISBN: 978-1-892456-47-8

Info on ISAAA: For information about ISAAA, please contact the Center nearest you:

ISAAA *Ameri*Center
417 Bradfield Hall
Cornell University
Ithaca NY 14853, U.S.A.

ISAAA *Afri*Center
c/o ILRI
PO 25171
Nairobi
Kenya

ISAAA *SEAsia*Center
c/o IRRI
DAPO Box 7777
Metro Manila
Philippines

Electronically: or email to info@isaaa.org

E-copy also available at http://www.isaaa.org

Contents

Authors

Mariechel J. Navarro is Manager of the International Service for the Acquisition of Agri-biotech Applications' (ISAAA) Global Knowledge Center on Crop Biotechnology (KC). She has a Ph.D in Development Communication from the University of the Philippines Los Baños. She has been with the KC since its inception in September 2000. Her internship at the CAB International in the United Kingdom on managing a biotechnology information system on the Internet led to the development of the weekly e-newsletter Crop Biotech Update.

Margaret Karembu is Director of ISAAA's AfriCenter based in Nairobi, Kenya. She holds a Ph.D in Environmental Science Education from Kenyatta University and has over 10 years of experience in University teaching. She has wide experience in participatory training and technology diffusion research on small-scale agriculture and gender dimensions of agri-biotechnologies. A science communication educator, Margaret oversees the Africa-based Biotechnology Information Centers in East and Central Africa (Kenya), Francophone Africa (Mali/Burkina Faso), and Egypt.

Daniel Otunge is Project Officer of the Biotechnology Information Center in East and Central Africa. He completed his Master of Arts in Philosophy and undergraduate degree in mass communication from the University of Nairobi, Kenya.

Mahaletchumy Arujanan is Executive Director of the Malaysian Biotechnology Information Center (MABIC) in Petaling Jaya. She holds a Bachelor of Science degree in Microbiology and Biochemistry, and a Master degree in Biotechnology. She is currently pursuing her Ph.D in Science Communication at University Malaya. She has been with MABIC since 2003 and is a strong advocate of biotechnology.

K. Cheng Liew is a Science Writer with the Malaysian Biotechnology Information Center (MABIC) in Petaling Jaya. He holds a Bachelor of Science in Biotechnology and a Postgraduate Diploma in Science from Monash University, Malaysia Campus.

Bhagirath Choudhary is the National Coordinator of the South Asia Office of ISAAA based in New Delhi, India. He obtained his Bachelor in Agricultural Engineering and Masters of Business Administration in Technology Management from Asian Institute of Technology in Thailand. He is currently pursuing his Ph.D from the Ghent University, Ghent, Belgium.

Kadambini Gaur is Scientific Officer of the ISAAA South Asia Center based in New Delhi, India. She is a biotechnologist by profession and has worked with the Biotech Consortium of India Ltd (BCIL) on many projects and biosafety/regulatory-related activities in India. She obtained a post graduate degree from Thapar Institute of Engineering and Technology, Patiala, Punjab. She has been actively involved in many activities and programs on biotech outreach and communication in India.

Muhammad Iqbal Choudhary is the Director of the Pakistan Biotechnology Information Center and concurrently, Director of the International Center for Chemical and Biological Sciences (H.E.J. Research Institute of Chemistry), Dr. Panjwani Center for Molecular Medicine and Drug Research of the University of Karachi. He has a Ph.D in Bioorganic Chemistry from the University of Karachi and completed his Ph.D research at the Pennsylvania State University, USA, as a transfer student on a National Science Foundation Fellowship.

Bambang Purwantara is the director of the Indonesian Biotechnology Information Center and concurrently director of SEAMEO Regional Centre

Authors

for Tropical Biology (BIOTROP), Bogor Indonesia. He is also a faculty member of the College of Veterinary Medicine, Bogor Agricultural University (BAU). He obtained his Doctor of Veterinary Medicine degree from BAU and pursued advanced degrees at the Royal Veterinary and Agricultural University in Copenhagen, Denmark.

Jenny Panopio is the Network Administrator of the SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA) Biotechnology Information Center in Los Baños, Laguna, Philippines. She holds a Master of Science degree in Molecular Biology and Biotechnology from the University of the Philippines Los Baños.

Rochella Lapitan is Project Management Associate of the SEARCA Biotechnology Information Center. She earned her Bachelor of Science degree in Computer Science at Trace College in Los Baños, Philippines.

Noel Amano Jr. is ISAAA Program Associate. He obtained his Bachelor of Science in Biology, major in Cell and Molecular Biology, from the University of the Philippines Los Baños.

Khondoker Nasiruddin is the National Coordinator of the Bangladesh Biotechnology Information Center hosted by the Bangladesh Agricultural University. He obtained his Ph.D from London University and Postdoc from International Centre for Genetic Engineering and Biotechnology. He is concurrently a professor and founder/head of BAU's Biotechnology Department with 21 years teaching and research experience. He is the General Secretary of Bangladesh Association for Biotechnology and Genetic Engineering and Editor of Molecular Biology and Biotechnology Journal.

Ismail Abdel Hamid is the Director of the Egypt Biotechnology Information Center in Cairo. He holds a Master of Science degree in Biological Control from the Faculty of Agriculture Cairo University and a Ph.D in Molecular Virology from the same University.

Supat Attathom is the Director of the Biotechnology and Biosafety Information Center based at the College of Agriculture, Kasetsart University in Nakhon Pathom. He holds a Ph.D in Plant Pathology from the University of California at Riverside, USA.

Tian Zhang is an Assistant of the China Biotechnology Information Center (ChinaBIC), and the Editor of *China Biotechnology*. She earned her Master of Science degree in Biochemistry and Molecular Biology from the Graduate University of Chinese Academy of Sciences.

Hongxiang Zhang is the Coordinator of China Biotechnology Information Center (ChinaBIC) , Executive Editor-in-chief of *China Biotechnology*, Deputy Secretary General of Chinese Society of Biotechnology (CSBT) and the Director of Science Communication Committee of CSBT. He is also a research fellow (professor) of the National Science Library of Chinese Academy of Sciences and has over 10 years experiences in strategy and policy research of biotechnology in planning and management.

Sonny Tababa was the former Network Administrator of the SEARCA Biotechnology Information Center in Los Baños, Philippines. Sonny earned her Master of Science degree in Agriculture from the University of the Philippines Los Baños.

Hien Le was a former Senior Assistant of Agbiotech Vietnam. She obtained her undergraduate degree in Foreign Trade, major in Journalism, from Hanoi Foreign Trade University.

Preface

The attraction for storytelling is universal and pervasive – it appeals to all ages, cultures, and perspectives. Stories do not discriminate, rather they allow readers to get into the minds of other individuals or groups to better understand how they think, feel, and dream. In the process, readers are able to process the experiences of others and reconcile them with their own thoughts and feelings. Stories give readers new ideas and ways of viewing things, provide opportunities for synthesis and analysis, facilitate change in mind sets, and stimulate innovation or creativity. Narratives bring life to often nameless clients who are the reasons for what we do.

Stories or narratives are used as an effective communication technique in this Brief to humanize the different stakeholders of the International Service for the Acquisition of Agri-biotech Applications' (ISAAA) knowledge sharing network composed of the Global Knowledge Center on Crop Biotechnology (KC) and Biotechnology Information Centers (BICs). ISAAA is proud of this unique network that spans Asia, Africa, Europe, and Latin America, one that is believed to be the only one of its kind in the world today. It is the collective efforts of the network that bring about greater awareness and understanding of crop biotechnology across the regions of the world. Discussions about ISAAA's audiences are often mired in statistical numbers losing a certain connectedness and affinity with them. Individual narratives thus allow ISAAA to better know and understand its clients and determine how institutional impact is being realized if at all.

What makes this Brief unique is that this compendium of stories is authored by representatives of our network. The contributors interviewed different audiences from all walks of life and answered the questions: Who are our stakeholders? What do they think about science in general and crop biotechnology in particular? How have they benefited from ISAAA's knowledge sharing initiatives? How have these initiatives helped them to contribute to greater public awareness and understanding of the technology? What future is there for crop biotechnology? Articles showcased the people that the network touched and also provided gems of learnings from the collective stories of other cultures. After all, the stories are not just about people but also focus on the communication strategies and activities implemented to reach them.

More importantly however, the stories brought people together – writers and stakeholders, story tellers and specific audiences across cultures. Together they provide a clear picture of what is out there and allow us to empathize with and share experiences with one another. Hopefully, one's story will inspire another on the potentials and exciting field of science communication, and contribute to a greater realization that for all our efforts and time, impact is being made on those who need it most.

RANDY A. HAUTEA
Global Coordinator, ISAAA

Introduction

Crop biotechnology is one of several agricultural strategies to address problems of food and energy, poverty, and environmental degradation. This technological innovation has sparked worldwide interest and discussion.

Stakeholders or the so-called attentive publics are critically involved in framing the debate, shaping policy, influencing public opinion, and creating greater awareness and understanding of crop biotechnology. Together these stakeholders – farmers, media practitioners, policy makers, scientists, academics, religious leaders, industry sector representatives, students, and other partners, determine the direction and depth of the biotech debate, and ultimately the acceptance, adoption, and sustainability of technology. The International Service for the Acquisition of Agri-biotech Applications (ISAAA) facilitates knowledge sharing among these stakeholders to build a collective voice on crop biotechnology.

ISAAA is a not-for-profit international organization 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.

To complement its technology transfer program, ISAAA has an information network to facilitate knowledge sharing initiatives between and among countries. This network is composed of the Global Knowledge Center on Crop Biotechnology (KC) and the Biotechnology Information Centers (BICs).

The KC was established in September 2000 in response to an urgent demand from senior policy makers in developing countries for an entity that would make authoritative information available to facilitate and support transparent decision-making process regarding crop biotechnology. Based at the ISAAA Southeast Asia Office in the Philippines, the KC has an overall facilitating role of providing services and resources to complement local initiatives by the BICs. With its global mandate, the KC critically scans global and regional developments and analyzes issues and concerns that affect developing countries. This information is transformed into prototype communication strategies that the BICs adapt for their clients' specific information needs. Specifically, its activities span global knowledge networking; information needs analysis and strategy design; information repository building; and information packaging.

The heart and soul of the KC is its growing network of BICs or country nodes in Africa, Asia, Europe, and Latin America. The BICs are at the forefront of responding to science-based information needs, and in promoting and advancing a broader public understanding of crop biotechnology in their respective countries.

How have stakeholders benefited from the communication initiatives of the network? Feedback generated from personal interviews, workshop questionnaires, electronic surveys, emails, and the like provide a variety of examples to demonstrate the ways by which the network has responded to stakeholder need for accurate, science-based information on crop biotechnology. Unfortunately, not many of these stories are documented or available in a form that others can vicariously learn from. Brief 40, entitled **Communicating Crop Biotechnology: Stories from Stakeholders** will attempt to answer this need.

The collective stories of the KC and the BICs attempt to capture and profile the network's various stakeholders and how they are affected by deliberate communication efforts. Stakeholders were interviewed and additional information was obtained through email correspondence and available write-ups or public documents. The stories of specific stakeholders are grouped together by work sector. Each story unfolds to show similarity and contrast of respondent's profiles and

insights. Background information on the respondents humanizes the real life characters.

Individual narratives have the power to transcend time, language and culture. They also have the unique power to share experiences, appeal to emotions, and have the capacity for empathy. Farmers from Burkina Faso are thousands of miles away from colleagues in Bangladesh, India, Indonesia, and the Philippines. Yet they have similar experiences, face common problems, and share a hope for themselves and their families. Academics and scientists as well as media practitioners from different geographical zones have their respective activities and concerns, but are linked by a commitment to help others learn about the technology. Other stakeholders from China, Egypt, Ghana, Kenya, Malaysia, Pakistan, Thailand, Uganda, and Vietnam have their unique stories to tell but interface to form a common voice. Lessons can be derived from these stories and retold across cultures, thus immersing readers in what psychologists refer to as "narrative transport."

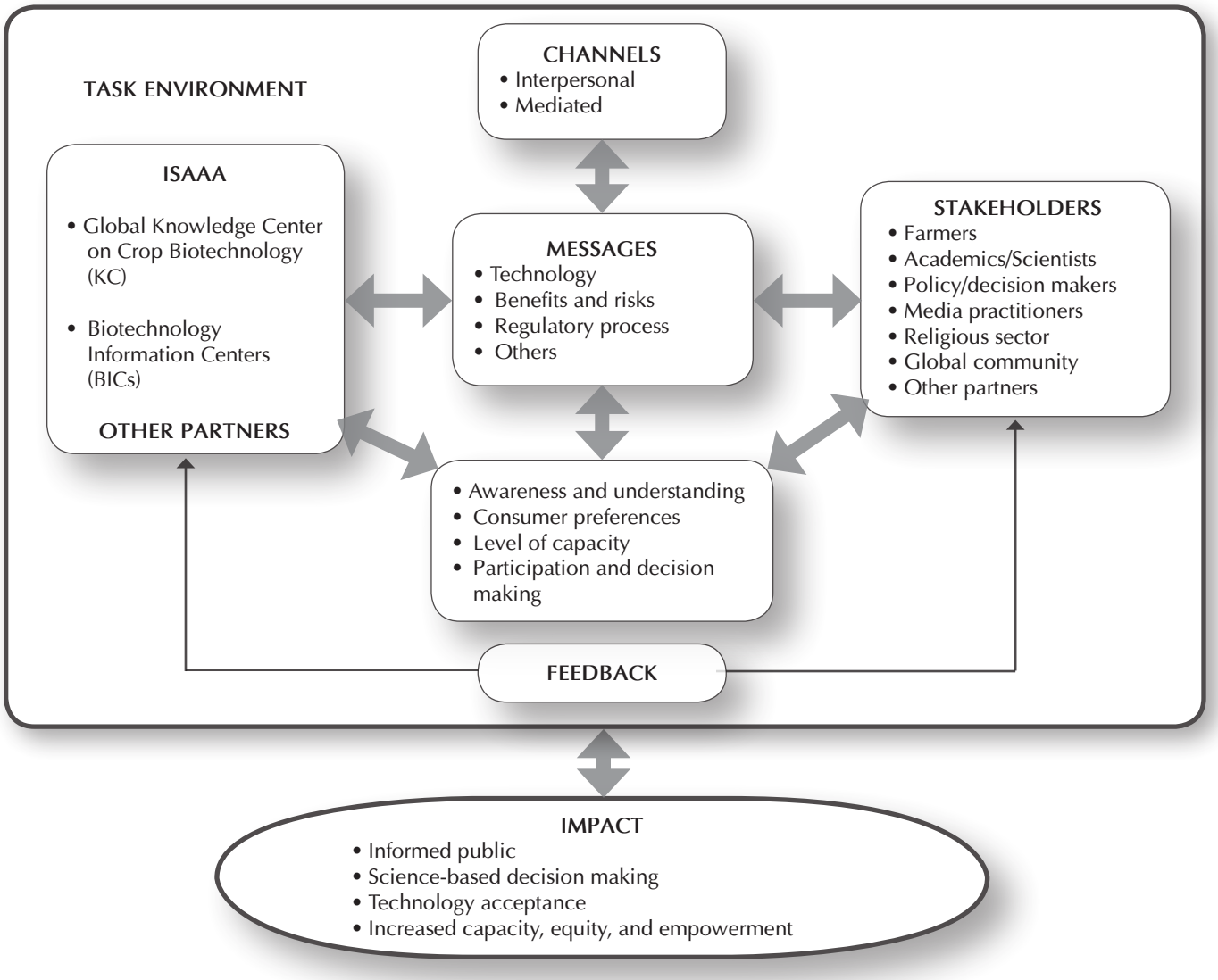


Figure 1. Science communication framework for crop biotechnology.

Introduction

Stakeholder stories are complemented by experience sharing on communication strategies that were implemented by the network. These give an idea of activities that specific stakeholders can participate in or use to better understand the technology.

These 49 stories by 19 authors from 14 countries are more than just a chronicle of events, insights and answers to specific guide questions. From these personal accounts unfold distinct patterns of experiences, culture, behavior, and perceptions that highlight their uniqueness yet converge to form a common thread to show the impact of efforts by ISAAA's global knowledge sharing network.

Science Communication Framework

The case studies enrich our understanding of how science communication works in crop biotechnology. The communication process is a complex one involving interfaces between a number of publics or stakeholders, different messages, a wide variety of communication channels, and varied outcomes. Adding to this complexity are intervening variables that affect the communication process.

Figure 1 is a schematic diagram of the science communication framework for crop biotechnology synthesized from inputs provided by the case studies. It illustrates how knowledge management and the tasks of identifying, creating, distributing and enabling adoption of information, insights and experiences (hence, knowledge) is done. Key information providers and different stakeholders exist in a task environment and are affected by variables such as the biotechnology landscape, culture, socio-economic/ political milieu, and communication environment. These conditions influence and put pressure on how people provide, react and respond to information on crop biotechnology. Experiences of farmers planting biotech crops, religious views about the technology, the political will of government to endorse its use, and the credibility of information sources, for example, all contribute to how stakeholders ultimately participate in the biotech debate. Limited or low awareness, lack of capacities, as well as inadequate support of policy making bodies and non-involvement of important actors in the generation to utilization of technology affect multi-stakeholder participation. Communication by itself can result in many possible barriers: stakeholders' preconceived ideas, personalized meanings, motivation and interests, communication skills, organizational climate, and complexity of channels.

Clear and concise key messages are framed by and with stakeholders. These messages are a synthesis of experiences and science-based information generated, validated, and shared through networking. Promoting an open and transparent debate about the potential risks and benefits of a new technology, for instance, guarantees responsible use and assures stakeholders of having a choice or say in its adoption. Messages are packaged through a strategic, appropriate and complementary combination of interpersonal and mediated channels based on best practices. The choice of and combination of communication strategies is determined by specific information requirements and needs.

Any deliberate communication act is rationalized by a specific or combination of objectives/ purposes. These intentions are: awareness and understanding, consumer preferences, level of capacity, and participation and decision making. Increased awareness leads to information updating; consumer preferences result in informed choices; level of capacity adds new skills and techniques; participation enhances deliberation and transparency of communication; and decision making leads to ability to influence policies. All these impact on the process through an informed public, science-based decision making, technology acceptance, and stakeholders with increased capability, equity, and empowerment. The feedback mechanism highlights the cyclical and synergistic process that makes science communication a dynamic and evolving activity.

Farmers

Planting the Seeds of Empowerment

About 13.3 million farmers in 25 countries have planted biotech crops spread across 125 million hectares. Of these farmers, over 90 percent or 12.3 million are small and resource-poor farmers from developing countries such as China, India, Philippines, and South Africa. The high adoption rate reflects the fact that biotech crops have consistently performed well and delivered significant economic, environmental, health and social benefits to both small and large farmers. The International Service for the Acquisition of Agri-biotech Applications (ISAAA) projects that the number of biotech crop countries, hectarage and beneficiary farmers would significantly increase by 2015 particularly with the impending approval of biotech rice (James, 2008).

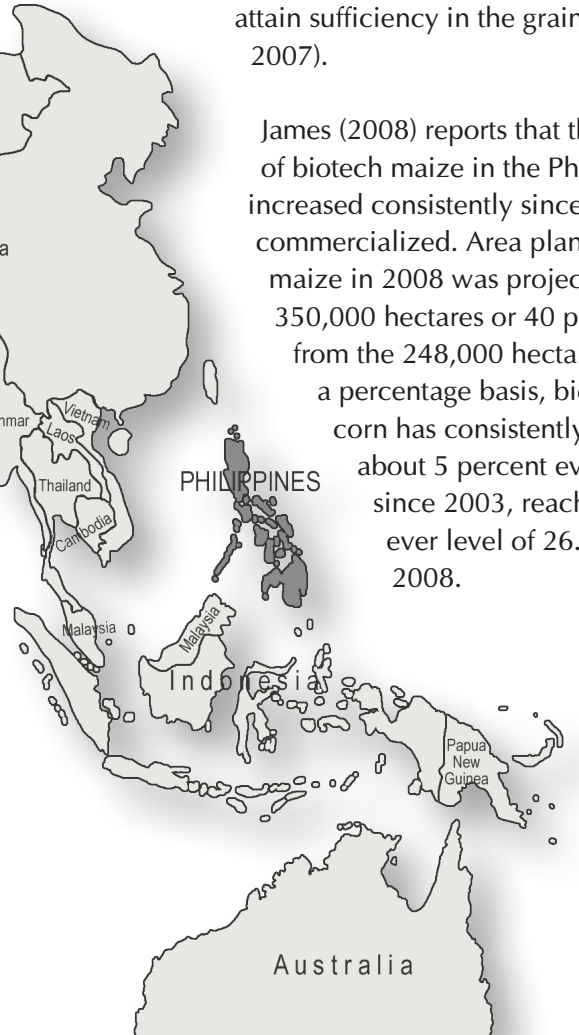
Providing an environment where farmers can share information and experiences with other farmers about biotechnology is an activity of the International Service for the Acquisition of Agri-biotech Applications (ISAAA) through its Global Knowledge Center on Crop Biotechnology and its network of Biotechnology Information Centers. The network sees the positive acceptance and/or adoption of a technology by farmers as a vindication of its contributory efforts at increasing awareness of and understanding of biotechnology. In countries where biotech crops are already being commercialized, efforts are geared toward sustaining interest and use. In countries where they are not yet being grown, farmers are being oriented and updated on biotechnology developments with the hope that they would be positive to the idea of modern technology once commercialized in their own country.

Rosalie Ellasus

Lady Corn Farmer Goes International

By Mariechel J. Navarro and Sonny Tababa

The Philippines is the first country in Asia to have a biotechnology crop for food and feed approved for commercialization. It was able to initiate commercial planting of Bt corn in 2003. This is a significant development since next to rice, corn is the second most important crop in the country, with yellow corn accounting for about 70 percent of livestock mixed feeds. The Asian corn borer has done extensive damage and Bt corn is expected to provide another option for farmers to obtain better yields and help the country attain sufficiency in the grain (Navarro et al. 2007).



James (2008) reports that the adoption of biotech maize in the Philippines has increased consistently since it was first commercialized. Area planted to biotech maize in 2008 was projected to reach 350,000 hectares or 40 percent higher from the 248,000 hectares in 2007. On a percentage basis, biotech yellow corn has consistently increased by about 5 percent every single year since 2003, reaching the highest ever level of 26.8 percent in 2008.

Enjoying the benefits of biotech corn and a leading advocate of agricultural biotechnology is Rosalie Ellasus, a 49-year old lady farmer from San Jacinto, Pangasinan. From tilling only 1.3 hectares of agricultural land in 2002 which she acquired from her savings from being an overseas Filipino worker, she now has a six hectare farm. From just being an "outsider" hiring farm helps to till her small farm land, she is now a hands-on farmer active in helping other farmers use modern agricultural production practices through the San Jacinto Kasakalikasan Multipurpose Cooperative. Not only did she become president of PhilMaize in 2006 but also won as town councilor in the 2007 local elections (Paredes, 2007).

To add a feather in her cap, she was internationally recognized as the first recipient of the Kleckner Trade & Technology Advancement Award in 2007, named for Truth & Technology (TATT) Chairman Dean Kleckner, a past President and a well-known international farm leader. Chosen by Board members, the award is given for "exemplary leadership, vision and resolve in advancing the rights of all farmers to choose the technology and tools that will improve the quality, quantity and availability of agricultural products around the world." John Reifsteck, an Illinois farmer who serves on the TATT Board, says Rosalie was selected because "she represents what TATT represents. It's a disservice to farmers like Rosalie to say that biotechnology and trade issues are only about large farmers; those issues affect all farmers." Rosalie was commended for using biotechnology to solve her production challenges on the 1.3 hectare farm she owned. "Biotechnology can be used by any size or type of farmer in the world. It's a very portable

technology. And Rosalie is a great role model to demonstrate this," adds Reifsteck. She received the award during a farmer-to-farmer roundtable sponsored by TATT in Des Moines, Iowa, USA (Truth About Trade & Technology, 2008).

From Obscurity to Prominence

Like many Filipinos, Rosalie started with trying to fulfill a major dream – to help her family lead a decent life and be able to send her three sons to college. "I decided to go abroad and become a domestic helper in Singapore and Canada. I eventually found a market executive position in Singapore. Unfortunately, my husband died and I decided to return to the Philippines to take care of my sons," she says. From her savings she bought a small farm land and tried unsuccessfully to coax a bountiful harvest from it. Corn with aflatoxin contamination as well as pests and weeds that reduced her yield made it impossible to sell her produce. Unfazed, Rosalie attended a 16-week Integrated Post Management-Farmers' Field School on corn in 2001 by the Department of Agriculture. From her learnings, she changed her farm practices and after seeing a demonstration Bt corn farm, she decided to adapt the technology to compare it with conventional corn. Rosalie was able to sell her Bt corn produce to feedmills and corn husks for local craft production because they were flawless and sturdy. The venture proved profitable – she was able to expand her 1.3-hectare farm to six hectares (Fernandez, 2007).

The TATT website says that Rosalie has been getting a 125 percent return each year. She has adopted corn "stacked" with both a Bt gene and a herbicide resistant gene. "I was truly convinced that a marginal farmer can improve his lifestyle only if he will adopt biotechnology," she says. As a consequence, it has been easy for Rosalie to convince other farmers in her town as well as other colleagues to go the biotech corn route, especially when farmers see that she is able to have an average yield of 7.8 tons, up from 3.2 tons when she first started to plant corn.

Attendance in Workshop

In September 2006, Rosalie attended a workshop on biotech issues and communication followed by a similar one three months later. She was one of 34 participants of a four-day workshop on *Farmer Biotech Outreach: Strengthening the Competitiveness of Small Farmers* held in Manila, Philippines. The workshop was implemented by the International Service for the Acquisition of Agri-biotech Applications (ISAAA), the SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA), and the Asian Farmers Regional Network (ASFARNET), with support from the US Government, under the auspices of the Asia-Pacific Economic Cooperation (APEC). As a follow-up of the December 2003 APEC Farmer Biotechnology Outreach Program held in Manila, this workshop aimed to: increase Southeast Asian farmers' awareness of the challenges facing agricultural biotechnology as well as its benefits; enhance farmers' knowledge of policy issues;

Rosalie with other workshop participants during a Bt corn field tour in the Philippines.

"Updates about biotechnology are important because I am often asked about issues and concerns by colleagues."

provide first hand experience through visits to local farms, and research and development institutes; explore effective communication techniques for farmers; facilitate sharing of experiences in using modern biotechnology; and discuss and recommend more sustained activities among farmers. Participants came from China, India, Indonesia, Malaysia, Philippines, Thailand, USA, and Vietnam.

The workshop involved discussion of issues, sharing of farmers' experiences, field tours, and planning for the next set of activities. Topics included an overview of agricultural biotechnology, and the global status of developments in crop biotechnology adoption and applications, market access of agri-biotech products, and market acceptance/concerns. Farmers from China, India, Philippines and the US shared experiences on planting biotech crops like cotton, corn, and papaya. Farmers from Southeast Asia discussed country case studies with regard to farmers' networks such as ASFARNET and related groups. Communication theory and skills were shared with participants to enable them to be effective disseminators of information to varied audiences. Farmers discussed strategies and plans to foster communication and information exchange among farmers in their respective countries. Capping the various activities was a tour of farmers fields planted to biotech corn in Mexico, Pampanga; and research and development agencies like the University of the Philippines Los Baños Institute of Plant Breeding, and the International Rice Research Institute.

Rosalie discusses biotech communication issues in a Manila workshop.

Participants declared that accurate information on modern agriculture in general, and crop biotechnology in particular, are needed by farmers to constantly update them about agricultural options, and to enable them to make informed choices. During the brainstorming session, farmers voiced out the need to continue the goals of ASFARNET, and suggested strategies by which farmer groups could either set-up a similar entity or imbed objectives of activities currently being done by existing systems in their respective countries. Sustainable, workable plans were formulated by farmer groups to enable the realization of these objectives. A central theme of the farmers' presentations was the importance of access to adequate information for farmers regarding agricultural practices. The workshop was perceived to be "trail blazing and very informative" and that there should be more of these workshops as "learning is a continuous process" (Report: Farmer Biotech Outreach: Strengthening the Competitiveness of Small Farmers, 2006).

Rosalie speaks highly of this workshop. "Updates about biotechnology are important," she says, "because I am often asked about issues and

concerns by colleagues. I am able to inform other farmers about research developments such as biotech papaya and Bt eggplant as well as developments outside the country which might impact on local conditions." She found the interaction with other international farmers very enriching. It was her first time to share experiences with other farmers who like her were excited about the prospects of using modern technology. It also was a dry run for her future attendance in international fora where she would represent small farmers.

"The principles and techniques for effective biotechnology communication session that I got from attending other SEARCA Biotechnology Information Center (SEARCA BIC) workshops proved useful in enhancing my interpersonal skills. Whenever I am confronted by people who are against biotechnology I remember the role playing in the communication session where we had to answer questions from different stakeholders. I am able to answer in a nice way by being diplomatic and without getting antagonized by those who are anti-biotech. I am also conscious about the principles of body language, the need for voice modulation, and continuity in explaining my messages even when interrupted by other people. I observe other resource persons and adapt techniques that are useful." Rosalie avers that her confidence comes from "talking from the heart, actually doing the things I talk about, and being inspired by and being able to relate with other farmers."

Rosalie Goes International

It was ISAAA which recommended Rosalie to other international workshops in Indonesia and Australia where she spoke on her experiences as a small farmer from a developing country. Farmers that she meets in these international gatherings email her and ask her opinion about issues that are written in media. For example, she

Rosalie with other farmer participants during a seminar on agricultural biotechnology in Tiera Medan, Indonesia.

cites the case of a negative view espoused by a journalist and a civil society group in Indonesia that a farmer had emailed her about. "I asked the assistance of the BIC in the Philippines and the Biotechnology Coalition of the Philippines, added my thoughts, and consolidated the information for my Indonesian colleague. Other farmers voiced their problems and I encouraged them to set up a farmers' organization or get political support that would enable them to gain access to new technology." She says that when she was in Mexico a Senator listened to the discussion and showed interest in helping farmers. "I never imagined I would also be consulted by farmers overseas. I continue to get updates from participants about developments in their countries and we discuss opportunities through email."

She received other invitations later, including the Des Moines roundtable discussion on agricultural biotechnology, the Minneapolis conference of the Western Canada Wheat Association, one in Mexico sponsored by its Department of Agriculture, and another farmers' forum in Medan, Indonesia. When Peruvian and Vietnamese government officers and scientists visited the Philippines, she was tapped to talk to them. In all these venues, she gave a straight from the heart account of her biotech farming experiences.

"I never imagined I would also be consulted by farmers overseas. I continue to get updates from participants about developments in their countries and we discuss opportunities through email."

In February 2008, Rosalie was the featured lady farmer during the international launch of the 2007 Global Status of Commercialized Biotech/GM Crops report by Dr. Clive James, chair of ISAAA and report author. She was a member of a panel of experts that gave a "face" to the growing number of farmers benefiting from biotechnology.

The lady farmer is constantly invited to grace farmers' festivals organized by the provinces of Pangasinan, Cavite, Isabela, and Cotabato City to help spread the "good news" around and convince more farmers to adopt the technology. These festivals, she adds, attracts even old farmers who are hesitant to try new technology. She is a much sought out resource speaker by the Department of Agriculture and gets engaged in policy and planning with non-government organizations. In addition, she has been interviewed in both television and radio programs where she talks about farming and the opportunities it has brought her. She is amazed by those who have heard about her and was particularly thrilled when she was asked to "Google" her name on the Internet. "So much has been written about me. It really inspires me."

Rosalie notes that recently there was a problem regarding the availability of biotech corn seeds in the market and even Congressmen had to intervene for their constituents. "It was a demand problem. Private companies make seasonal forecasts about how much seeds are needed. They did not anticipate the huge demand for the seeds. They did not think that many farmers would embrace the technology," Rosalie explains. Hence, she is now into seed production to assure steady supply for farmers. It is a challenge, she states, as the seed companies demand 98 percent seed purity. However, farmers are assured of a high quality product. "It's hard work but fun." Her eldest son, one of three she sent to college on her biotech crop harvest, is now coordinator of seed production.

Beyond Bt Corn

The lady farmer has expanded her interests to include domestic animal production as the corn she harvests is mixed with her own feed formulation. She now has 30 fattening pigs and 6 sows in her backyard as well as a few cows and goats. To cope with the work, she has 'adopted' some out-of-school youth between the ages of 18 and 21 to help her with what she called her 'integrated farm'. She provides housing and allowance for these young men. She spearheaded the training of farmers who observed her production techniques for possible adoption in their own farms. She continues to attend workshops sponsored by public sector groups such as the Mariano Marcos State University and the Philippine Rice Research Institute. These venues are a fora to network and meet other experts and co-farmers.

"Here in the Philippines, many farmers lower their heads because they're not proud of their job. But I want to see them shine. I'm just a small candle", she says, "but even the weakest flame can spread fire" (Biotech Brasil, 2007). Life has just begun for Rosalie. ❑

Raosahib Devrao Ingole

Leading Farmers by Example

By Bhagirath Choudhary and Kadambini Gaur

Raosahib Devrao Ingole is a cotton and vegetable farmer and owns 10 acres (4 hectares) of land. He is the *Sarpanch* (political head) of Dharkalyan village in Jalna district of Maharashtra State, western part of India. The village has 1,500 people and farming is an ancestral occupation and also a source of livelihood for majority of the rural population. He continued the family tradition of farming on inherited land to feed his five children. He went to school until seventh standard (grade) and understands the importance of education. He wants his children to study and at the same time help him in various farming activities. The income he gets from his Bt cotton harvest enables him to send his children to school. Apart from cotton, the farmer grows brinjal, cabbage and grapes.

Overcoming Apprehensions

Raosahib learned about Bt technology for the first time from Maharashtra Hybrid Seeds Company (Mahyco). He was informed about the benefits generated by the use of biotech crops such as Bt cotton. "Initially I was very reluctant to plant Bt cotton as I had apprehensions that planting Bt crops could be harmful to my health and that of my children and cattle, and also unsafe to the environment. After continued assurance from the seed companies, I was convinced and planted Bt cotton for the first time in 2003-04. I noted the benefits of planting Bt cotton and continued every year thereafter," Raosahib recalls. Being ill-informed, he was denied the benefits generated from planting Bt cotton for one year. Adopting Bt cotton proved to be a wise move. This changed his perception regarding the safety of Bt crops and he was convinced that Bt technology is safe and better than the conventional alternative. Other farmers in his village also reaped similar benefits after planting Bt cotton. Before, the cotton crop faced severe damage from bollworms. In the recent past however, Bt cotton has changed the face of cotton production in his village. Bt cotton offers attractive incentives to both large and small farmers because of significant yield gains and enhanced productivity in a sustainable manner.

Participation in Brinjal (Eggplant) Video

In October 2008, the International Service for the Acquisition of Agri-biotech Applications (ISAAA) organized field visits to various states to capture first hand experiences of farming communities in India. Experiences of farmers were documented in the Bt brinjal video so that their learnings can be shared with different stakeholders. During the field visit to Maharashtra, as head of the village Dharkalyan, Raosahib was involved in the video production as he was a strong advocate of Bt technology. He was very keen to share his experiences in cultivating Bt cotton. The Bt brinjal video shoot was a good experience as he wanted to be part of the awareness program to promote the use of Bt technology so that more farmers could reap the benefits of Bt crops instead of being misguided by false apprehensions. He is hopeful that Bt brinjal will emulate the success of Bt cotton and help vegetable farmers

save brinjal crops from being destroyed by the deadly insect pest, fruit and shoot borer (FSB). "Bt cotton has proved to be a boon for cotton farmers. If the same technology is replicated in vegetable crops such as brinjal, it will be extremely beneficial for poor farmers", he says.

Press Conference on Biotech Crops

In February 2009, Raosahib was invited to attend the press conference in New Delhi for the launch of ISAAA Brief 39 by Dr. Clive James on the global status of commercialized biotech/GM crops in 2008. During the interaction with media personnel, he spoke about his experience in planting Bt cotton. He voiced the great success of Bt cotton and talked about the support of farmers for the technology. He also discussed the challenges cotton farmers faced prior to the introduction of Bt cotton. Lok Sabha TV of the Indian Parliament, interviewed him in its most viewed program *Surkhiyon Se Parey* (Beyond Headlines). In the interview he shared his Bt cotton farming experiences that led to improved yield and productivity, increased farm income, and reduced exposure to insecticides.

Spirit of Sharing and Caring: Moral Responsibility

Being the leader of the village of over 1,500 people, Raosahib felt the need to enhance trust in Bt technology to improve agricultural production. Along with other farmers who were already benefiting from Bt cotton, he encouraged farmers growing conventional non-Bt cotton to plant Bt cotton. The awareness about the success of Bt cotton seeds soon spread throughout the farming community. Since 2003, he has been actively promoting the use of Bt technology and is now the model for inspiring other farmers. "After experiencing the benefits of Bt cotton, not a single farmer of my village is planting non-Bt cotton. It is easier for them to sell cotton at a competitive rate. The Bt technology can help farmers to be more competitive in the market. There is no need now to tell farmers what to plant; everyone is buying Bt

Raosahib Devrao Ingole, Farmer and Sarpanch (political head) of Dharkalyan, Maharashtra (left) with a fellow farmer in his brinjal field.

cotton seeds. A farmer no longer asks whether Bt cotton seeds are safe and will give more yield." The farmers of his village learned by experience. "Farm income increased, yields went up and insecticide sprays were drastically reduced. What more can farmers ask from using Bt cotton?" he asks.

Raosahib thinks that it is vital to increase acceptance of biotech crops and clarify various issues and concerns pertaining the use of Bt technology. "Majority of farmers are illiterate and poor. We do not know science. Although we are convinced about the safety of the technology, organizations such as ISAAA can take the lead in organizing public awareness workshops. Dissemination of science-based information will help farmers make well-informed decisions," he adds. Raosahib firmly believes that commercialization of other biotech crops such as Bt brinjal will bring prosperity to his village.

Challenges in Agricultural Production

"Farming is an input intensive activity. Apart from laborious farming activities, it requires lot of inputs such as water, fertilizers, and pesticides.

The major constraints being faced in farming are insect pest infestation and diseases which lead to substantial yield losses. Water for timely irrigation is another problem. I feel it is advantageous to accept new technology in agriculture as traditional methods have met with limited success in solving many problems. New technology is needed to sustain agriculture," Raosahib explains. Bollworm infestation and frequent insecticide sprays were major constraints during many years of cotton cultivation. Conventional non-Bt cotton required a large numbers of insecticide sprays. This was significantly reduced with the introduction of Bt cotton which increased yields significantly. A farmer was able to harvest 8-10 quintal (800-1,000 kg) per acre and sell cotton at Rs 2,800 (US$62) per quintal. "I had to spray 14-16 times depending on infestation levels for non-Bt cotton as compared to 3-4 sprays on Bt cotton for controlling minor insect pests. Insecticide sprays were not required for bollworms. It is like a blessing. We are happy as we utilize the increased farm income in other activities such as drip irrigation."

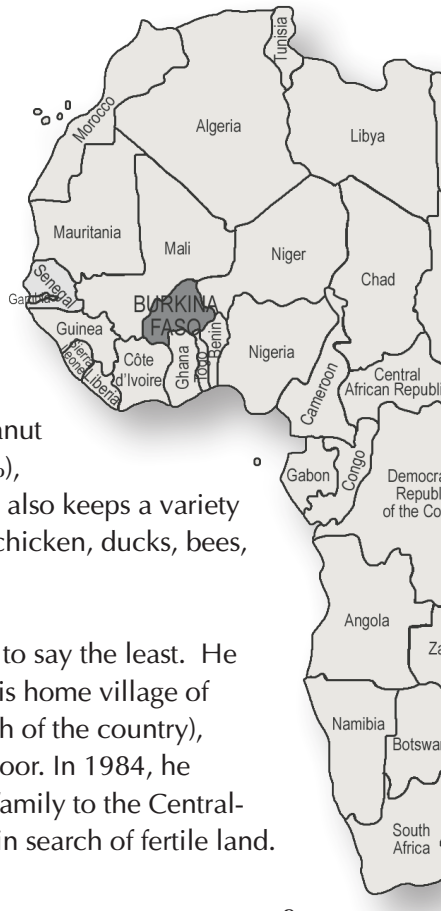
Crop Biotech: Bright Future

"The future of crop biotech is indeed very bright. Farmers will readily adopt other biotech crops after gaining considerable experience in planting Bt cotton. In fact, we are eagerly waiting for the commercialization of other Bt crops such as Bt brinjal," says the Indian farmer. Bt cotton planted on 5 acres of land is enough proof that Raosahib is truly convinced with the technology. ❑

El-hadji Karim Ouédraogo

Champion Bt Cotton Farmer in Burkina Faso

By Margaret Karembu and Daniel Otunge



In the Sapouy town of Ziro Province, 100 kilometers from Burkina Faso's capital city Ouagadougou, a cotton field extends as far as the eye can see. Its owner is El-hadji Karim Ouédraogo, President of the Provincial Union of Cotton Producers. This field is one of the key Bt cotton seed producers in the country. With a countrywide membership of 325,000 farmers in the Cotton Union and the majority being small farmers (less than 10 hectares), Karim's farm of approximately 20.35 hectares could best be described as a "model farm". Cotton occupies 34% or 7 hectares (ha) of his land, in which 4.5 ha is planted to conventional cotton and the rest of 2.5 ha to Bt cotton. The diversity of farm enterprises is striking. Apart from growing other food crops like maize, 6 ha (29.5%), sorghum, 4 ha (19.7%), peanut and cowpea, 2.5 ha (12.3%), sesame, 1 ha (4.9%), Karim also keeps a variety of livestock – cows, goats, chicken, ducks, bees, name it!

Karim's story is fascinating, to say the least. He started to farm in 1978 in his home village of Sanmentenga (Central-North of the country), where the soils were very poor. In 1984, he migrated together with his family to the Central-South part of Burkina Faso in search of fertile land.

He settled in Sapouy area where he acquired the land he currently farms and quickly put it under cotton and cereals production.

Ladji, as Karim is affectionately known in Sapouy village, has three wives and 17 children. Five have finished secondary (high school) education while the rest are enrolled in Madrasas, also locally known as the Koranic Schools, in Ziro town. Despite having attended rural schools, Ladji speaks very fluent French in addition to his native language of *Moore*.

Karim in his Bt cotton farm.

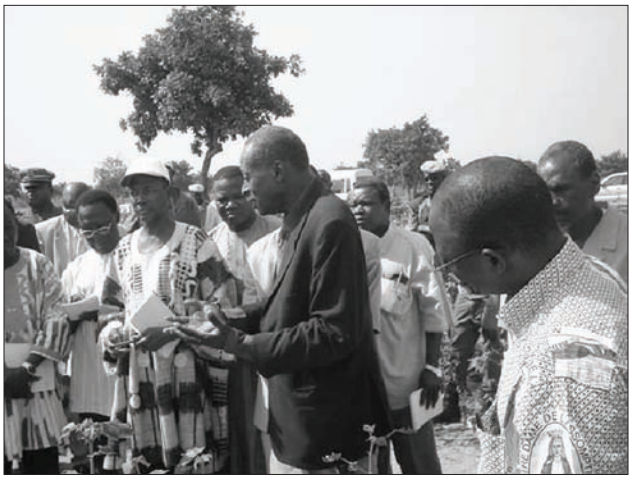
Revealing his passion for agriculture, the president of cotton farmers of Ziro declares: "We must do our best here in Ziro and in Burkina Faso in general, so that we can produce enough food for everyone." On average, Ladji produces seven tons of cotton and four tons of assorted cereals (maize, sorghum, cowpeas, peanuts, sesame) annually. In the same period, he also produces six tons of cotton seeds. The produce from his 20-hectare farm earns him over one million FCFA, (approximately USD 2,000) a figure he says is enough to feed, clothe and educate his family. But he is quick to add that the farm could give him more if he had access to better seeds.

And he couldn't be more precise. Since he was chosen to become one of the pioneer farmers to plant Bt cotton for seed multiplication by the *Institut National de l'Environnement et de la Recherche Agronomique* (National Institute of Environment and Agronomic Research) or INERA, the Sapouy farmer has received better results: vigorous plant growth, over 50% reduction in pesticide applications and more time to attend to other equally pressing duties. And, with a broad assuring smile, Ladji affirms "I expect a bumper harvest, the first time in so many years."

Pioneer Bt Cotton Farmer

Ladji owes his being chosen to be among the first farmers to grow Bt cotton to a series of workshops and exposure study tours (seeing-is-believing visits) organized by the International Service for the Acquisition of Agri-biotech Applications (ISAAA) *Afri*Center in collaboration with INERA and the Burkina Biotech Association (BBA) that he participated in between 2006 and 2008. For instance, in early 2008 he was among the few farmer group leaders who toured Bt cotton field trials in Mouhoun in the western region of Burkina Faso, which is 337 kilometers from his farm. The trials were being conducted by the national research institute INERA and SOFITEX, one of the seed companies operating in the country. "This tour opened my eyes to the high potential of Bt cotton because I saw clearly the difference between the new variety and the traditional one. Since then, I resolved to be among the first farmers to try the new technology," he recalls.

The two-day seeing-is-believing travelling workshop aimed at providing an opportunity for farmers to interact with scientists undertaking the research on Bt cotton and also get first-hand science-based information about the benefits and potential risks of genetically modified crops from other experts. Travelling workshops have been found to be very



Prof. Alassane Sere, President, Burkina Biotech Association (center), briefs farmers and parliamentarians about Bt cotton.

useful in demystifying modern biotechnology concepts and promoting meaningful dialogue as the participants are able to see the scientific infrastructure in place, touch the product, mingle freely with the researchers and those responsible for policies (legislators and regulators) as well as those actually growing the crops. The Burkina Faso travelling workshop included introductory talks on the broader field of biotechnology after which the farmers toured the research station (INERA) to see the scientific capacities present in the country and eventually visited the Bt cotton trial sites.

"I was able to understand what this technology is all about and to hear from the experts on the ground how the technology, if adopted, could benefit not only my country Burkina Faso but other cotton growing countries in West Africa. In addition to what I saw, I also learned from international speakers that Bt cotton has been growing in other countries such as South Africa, China and India. I was particularly amazed at the socio-economic and environmental gains that farmers in those countries have realized. I had a lot of questions on the safety of the Bt cotton and how we, small farmers are going to access the seed. This workshop was an eye-opener and it clarified the many questions and concerns that I had."

"Debates on GMOs are unnecessary because pesticides make many people sick and pollute our environment."

In July 2008, he planted his first Bt cotton seeds, supplied by INERA, thereby realizing his dream of being a pioneer Bt cotton farmer in Burkina Faso. He can already foresee the wisdom in making the decision to become an early adopter of a technology that many in Africa are still unsure about, thanks to the innovative spirit running through the veins of Burkinabe authorities and scientists. Meanwhile, Ladji says he will be growing conventional cotton varieties as he awaits for the Bt cotton seed distribution system to be fully activated in his home town of Ziro expected in 2009.

Reaching Out to Fellow Farmers

Equipped with the correct information and first-hand experience with Bt cotton, Karim says he has used his position as president of the Cotton Union in his province to reach out to more and more farmers. "My being selected as one of the pioneer Bt cotton seed producers has made my work easier. I am able to explain to the many stakeholders who visit my farm about the technology. I am imparting knowledge to other farmers in my Union and applying what I was taught. My farm now serves as a "classroom" for the many "seeing-is-believing" tours being organized by other stakeholders in the country and the region. Every farmer who comes here goes back with one message – "I will emulate my president," says Ladji with pride.

Perhaps, the advantages of the new cotton variety is best illustrated by Ladji's observations: "I have spent less energy on the farm and less money on inputs and other costs with Bt cotton compared to the

conventional one I have been planting that require up to 12 sprays of pesticides and fungicides to get a decent harvest."

GMO Debate Unnecessary

He wonders why the polarized debate on genetically modified organisms (GMOs) still rages on even when the benefits of such crops are there for all to see. "Debates on GMOs are unnecessary because pesticides make many people sick and pollute our environment," he adds.

Ladji is thankful to the government, the national research institute INERA, the Burkina Biotech Association and ISAAA *Afri*Center for ensuring that information on the technology is freely available to the farmers and the general public. Even so, he recommends that a lot still needs to be done to create awareness on the potential of biotechnology to many more Burkinabes especially farmers in rural areas given the importance of the crop to the country's economy.

Cotton is an incredibly important crop for the rural economy of Burkina Faso where approximately 3 million people (out of a total population of 14 million) rely on activities related to cotton production and processing for their livelihood. Further, cotton contributes 55 percent of the country's exports. It is noteworthy that Burkina Faso is the second largest cotton seed producer in the whole of Africa and commercially planted biotech cotton for the first time in 2008. It is estimated that the 8,500 hectares of Bt cotton crop planted in 2008 will provide enough seed for approximately 150,000 hectares in 2009, equivalent to about one third of the total cotton in Burkina Faso. ❑

Edwin Paraluman

Walking Tall in the Biotech Debate

By Mariechel J. Navarro

Edwin Paraluman is a slightly built farmer from Barangay Lagao, General Santos City, South Cotabato, Philippines. But in recent years he has stood tall in the local and international community as he squarely faced skeptics about biotech crops. "Many anti-biotech groups are neither farmers nor have direct experience in agriculture. I started planting cotton ever since I was a small boy. I have been planting corn for a long time, even before the advent of Bt corn. I know how it feels to be at the mercy of the Asian corn borer and reaping almost nothing from a corn field due to its infestation. My family always got poor grain quality and small milling recovery with traditional corn due to the corn borer. Even rampant spraying did not solve the problem. Yield reduction with non Bt-corn is around 70 percent. I also had health problems because of what we spray. We found it (pesticides) really hazardous. Farmers' health suffered. I tried Bt corn and my yield increased from 3.5 tons per hectare to a high of 8 tons per hectare. My life changed," Edwin

reminisces. "I speak from experience and when I talk, those who oppose the technology literally shut up."

Edwin comes from a family of farmers. Even if he finished a Bachelor of Science in Commerce degree from the Southern Island College, he opted to continue the family tradition of cultivating the soil for "planting is in our blood."

Edwin is an active advocate of biotech crops, particularly Bt corn. Naturally curious, he heard about Bt corn from farmers' testimonials which he read about in farming magazines. He was among the first to inquire about the technology when Monsanto began its field trials in South Cotabato. Since then he has not turned back. Currently, he is the chairman of the Regional Farmers Action Council for Region XI and a member of the Philippine Farmers Advisory Board. As former federation president of Saranggani and General Santos Irrigators Federation, Inc., president of the Nursery Farmers Irrigators Association in General Santos City, and chairman of the City Agricultural and Fisheries Council, Edwin inspires fellow farmers with his success story.

In December 2003, the International Service for the Acquisition of Agri-biotech Applications (ISAAA) organized a pilot capacity-building workshop for farmers in collaboration with the University of the Philippines Los Baños (UPLB), SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA), Cornell University, and the United States Government for farmers from five Asia-Pacific Economic Cooperation (APEC) member economies in Southeast Asia. It was held at the Asian Institute of Management in Makati, Philippines with field visits to Cagayan de Oro City and Los Baños, Laguna. Specifically, the workshop aimed to: increase Southeast Asian farmers' awareness of the challenges facing agricultural biotechnology, as well as its benefits; enhance farmers' knowledge of policy issues, based on stakeholders' experiences with agricultural biotechnology in the Philippines; provide

"Biotechnology has changed many farmers' lives. Let farmers decide for themselves what crop to plant. It is their choice."

first hand experience through visits to local farms planting traditional varieties and Bt corn; discuss farmer-level experiences with biotechnology crops; consider the potential role of the farmer or farm-level groups in technology adoption; explore effective communication techniques for farmers to communicate with specific audiences (other farmers, policy makers, regulators, media); and discuss possible formation of a Farmer-to-Farmer Regional Resource Network. Edwin, one of five farmers from the Philippines, was joined by other farmers and media representatives from Thailand, Malaysia, Indonesia, Vietnam, India, and the United States. In the group were community leaders who had won national awards as farmers.

Asian Farmers Network

Topics presented by various international experts were on genetically modified crops, myths and facts about biotechnology, global status of biotech developments, and regulatory process in commercializing biotech crops, while farmers from the Philippines, India, and the U.S. shared their experiences in growing GM crops. Field trips to corn farmers' fields, a grain processing center, and research institutions, and panel discussions were held with farmers, local government leaders, and individuals doing biotechnology advocacy. A major output of this session was the consensus among the participants to establish a regional farmers' network to promote the active exchange of experiences and knowledge on alternative modern farming technologies. It was agreed that the network would be called Asian Farmers Regional Network or ASFARNET. Edwin was designated as ASFARNET Coordinator. The network was expected to engage in activities that would ensure responsible

Edwin facilitates discussion regarding the Asian Farmers Network.

farming, accelerate transfer of appropriate modern technology, and ensure community participation in these activities.

The workshop provided participants with insights on GM technology and gave them an opportunity to observe first hand farmers' experiences with Bt corn. "We were unanimous in saying that farmers should be given the right to choose what crop to plant and having alternative crop varieties is important to allow us to make the right decisions," says Edwin. A follow-up workshop was again held in Manila, Philippines in 2006 *(see related article on page 3)* which further honed Edwin's communication skills in delivering key messages of crop biotechnology.

Eventually, Edwin was invited to share his experiences as a corn farmer in many fora around the world. Among them include a World Summit meeting in South Africa where he had his baptism of fire in facing anti-biotech groups. He disarmed them by simply stating that "I am a corn farmer from the Philippines. This corn is good for the farmers."

In 2004, The United States Embassy to the Holy See sponsored an international conference in Rome to examine the potential of biotechnology to help solve the challenge of hunger. An article in the International Herald Tribune notes that "the best assessment of biotechnology's potential came from farmers themselves. Sabina Khoza, a South African maize farmer, and Edwin Paraluman, a corn farmer in the Philippines, told us that their yields and incomes are up, and their use of harmful pesticides is down" (Nicholson, 2004).

Edwin represented ASFARNET in various gatherings where he emphasized the importance of a farmers' network. These include a workshop in Zamorano University, Tigucigalpa, Honduras, and a BIO (Biotechnology Industry Organization) meeting in San Francisco, California, USA where he was subsequently interviewed by several international journalists. A year later he participated in a symposium that was held during the International Day of Maize in Cremona, Italy. "I shared the benefits of Bt corn, particularly the gains on the environment, farmers' health, and better harvest." In a meeting of the Conference of Parties (COP) of the Cartagena Protocol on Biosafety that was held in Brazil, Edwin again shared small-farmer experiences on biotech crops in improving grain yield, reducing pesticide exposure of farmers, and preserving the environment (Asian Farmers Regional Network).

Edwin continues to reap the benefits of being a biotech corn farmer. Aside from higher yield, he notices the significant less use of pesticides and labor. "Bt corn provides me with good quality grains. The cob is really clean and the profits are good. I get satisfied comments from feed processors and animal raisers who buy my corn which has consistently shown low levels of aflatoxin contamination. Biotechnology has changed many farmers' lives. Let farmers decide for themselves what crop to plant. It is their choice." Indeed the man walks tall. ❑

Agusdin Pulungan

Hoping to See Indonesian Farmers Benefit from Biotech

By Mariechel Navarro and Bambang Purwantara

The Republic of Indonesia is the world's largest archipelagic state with 17,508 islands. It is the world's fourth most populous country with an estimated 237.5 million people in 2008. The agricultural sector employs about 42% of the total workforce. Major agricultural products include palm oil, rice, tea, coffee, spices, and rubber. Rapid economic growth has transformed Indonesia's food consumption pattern into one characterized by wider variety and greater food demand (CIA, 2008; Bond et al. 2007). The farmer is thus an important contributor in Indonesia's economy.

Wahana Masyarakat Tani Dan Nelayan Indonesia is an organization that represents the interests of an estimated 800,000 to 1 million farmers and fisher folk in 34 regencies of Java, Sumatra, Sulawesi, and Kalimantan. Based in Cinere Raya Depok, West Java, south of the capital city Jakarta, the organization was established in 1994 to engage in policy advocacy with central government on farmers' issues such as rice importation subsidies, fake fertilizers and pesticides, price ceilings, irrigation, and agriculture budgetary allotments. The organization is the 'voice' that farmers use to have their demands brought up to government. It also serves as a venue for updates on technological innovations and techniques.

Agusdin Pulungan, chairman of the farmers and fisher folk organization, says that they are also involved in rice seed production which is centralized in Sulawesi and Subang. "We produce stock and extension seeds which we sell to farmers on a commercial scale. Parent seed is produced by research centers of the Ministry of Agriculture which we buy to produce the stock and extension seeds. The organization supplies two percent of the country's seed requirements particularly in Sulawesi, Java, and Sumatra. It is involved in farm to market activities for fruits and vegetables, hence, it facilitates the process by which farmers are able to market their produce wholesale."

The organization is tapped by non-government organizations such as those in Europe to provide information on potential beneficiaries or farmer groups who are given assistance or grants. "We help identify, select, evaluate, and monitor beneficiaries. In one instance, the organization was consulted by the New Zealand Minister of Trade and Agriculture for the farmers' views/position on the DOHA Round to help them negotiate on World Trade Organization issues," says Agusdin.

Farmers, Agusdin explains, are still faced with many problems such as land ownership, fragmented and decreasing farm size, and low productivity of land dependent on inputs. "Farmers remain poor. Nevertheless, farmers are open to new technologies as long as they provide opportunities to improve farm productivity. They do not know much about new technology. They just do the

routinary farming activities. It is organizations such as ours which provide updates on new scientific techniques such as biotechnology to our fellow farmers."

Farmer-to-Farmer Workshop

The 46-year old Agusdin who finished a degree in agriculture from West Sumatra University in 1986, was updated about the potentials of biotechnology when he was recommended by the then Farmers Union (*see related article on page 19)* chairman to attend the first Farmer-to-Farmer workshop in the Philippines in December 2003. He was one of several farmers who banded themselves to form the Asian Farmers Regional Network or ASFARNET. They agreed to strive to become a collective voice that advocate for "responsible farming and policies toward improving the quality of farmers' lives and environment." ASFARNET coordinators of whom Agusdin is one, participated in various activities to fulfill its mission of "sharing information, knowledge, skills and technologies in agriculture and other relevant fields of disciplines to enhance traditional farming, improve agricultural productivity, assure a safer environment, and promote rural development."

Agusdin at a Farmer-to-Farmer Workshop.

On hindsight, Agusdin says "the farmer-to-farmer workshop enabled me to be updated on latest information about biotech crops and see actual farmers' biotech corn fields in the Philippines. Farmer leaders were able to interact and exchange information." He feels that the objectives of ASFARNET are commendable but "opportunities are not maximized because funds are unavailable to push more activities. He noted, however, that the network met its objective of increasing awareness and understanding of the benefits and risks of biotech. We heard from farmers who planted the crop. There should be more opportunities for Indonesian farmers to visit Filipino corn farmers to see how they are doing. It is difficult for governments to collaborate and exchange resources. However we should increase opportunities by which we can rely on the strengths of each country and benefit from them," the farmer leader elaborates.

The Philippines and Indonesia eventually organized their own country and regional activities to operationalize the goals of the network. ASFARNET Indonesia in collaboration with other partners such as the Indonesian Biotechnology Information Center held a workshop on *Technology Promotion and Exchange of Agricultural Biotechnology* in Bogor, Indonesia in 2004. The workshop aimed to: increase farmers' awareness of the challenges facing agricultural biotechnology, as well as its benefits; and enhance farmers' knowledge of policy issues, based on stakeholders' experiences with agricultural biotechnology in Indonesia and the Philippines.

Participants were able to discuss various views on agricultural biotechnology; exchange experiences and lessons between farmers who have tried, adopted, or marketed biotech crops with farmers who have not yet tried the technology; learn from biotech scientists and industry practitioners; attend field observations to biotechnology research centers (Biotechnology Research Center in Cimanggu, Bogor) and a private company; and discuss and firm

"It (agriculture) is no longer attractive to many young people. However, I still see hope and other opportunities."

up plans for ASFARNET networking in Indonesia. A resolution was made: Farmers should be able to participate meaningfully in the identification, development, piloting and or transfer of appropriate agricultural biotechnologies as well as in the formulation and advocacy of policies that will affect their lives. Majority of the participants found the workshop useful in helping them to understand benefits and risks of genetically modified (GM) crops as well as policy issues concerning corn crops (SEARCA BIC, 2004).

Agusdin eventually represented ASFARNET in several international meetings and conferences. He attended the Asia-Pacific Economic Cooperation High Level Policy Dialogue on Biotechnology (APEC HLPDB) meetings in Santiago, Chile in 2004 and Seoul, South Korea in 2005. He shared his views about introducing biotech crops to farmers and how they respond to the technology. He appealed to government representatives to allow farmers to use modern technology and gain the benefits experienced by other farmers who have adopted it.

In 2006, Agusdin attended the Association of Southeast Asian Nations – United States Roundtable on Agricultural Biotechnology Policy and Strategy in Bangkok, Thailand. He spoke about ASFARNET during the event that provided an opportunity for ASEAN and U.S. officials to engage in issues pertaining to agricultural biotechnology and economic development. The program emphasized dialogue among the delegations to share their respective positions, clarify goals, and identify potential areas of cooperation on agricultural biotechnology (ASEAN US Roundtable on Agricultural Biotechnology Policy and Strategy).

That same year he was also invited to participate in the Annual General Meeting of the Consultative Group on International Agricultural Research (AGM CGIAR) in Washington, DC. In particular, he attended the first ever Civil Society Forum for civil society organizations (CSOs) where group discussions aimed at identifying lessons learned and new avenues for improved collaboration. CSOs as partners of the CGIAR are perceived to help "shape the agenda of research for development and by enhancing its effectiveness and impact, contribute vitally to accomplishing our shared goals of combating hunger, poverty, and environmental degradation in the developing world" (CGIAR, 2006).

Opportunity for Biotech

The Indonesian farmer continues to be updated on biotechnology. In 2007, he attended the presentation of the global review of commercialized biotech crops at the Ministry of Agriculture which was presented by ISAAA's chair, Dr. Clive James. Other information sources are the news from the information exchange through an e-group put up by the BIC in the Philippines.

"Biotechnology is a potential opportunity for farmers. Productivity is a farmer's issue. Hence, any technology that can improve productivity can be considered. We need to keep looking for other high value crops such as corn since rice as a commodity will always be a political issue controlled by government. There will always be concerns such as whether farmers will be able to afford the price of corn seeds. It is also difficult to change the culture of farmers to plant corn instead of rice. Corn is not our staple food so farmers prefer to grow rice," Agusdin explains. "There is a future for agriculture in Indonesia as it is a lifestyle. It is no longer attractive to many young people. However, I still see hope and other opportunities. We are starting to organize an organic coffee business with a potential to export to Europe. There is a market waiting for our produce." ❑

Md. Shahjahan Ali Badsha

Ready for Biotechnology

By Khondoker Nasiruddin

A farmer in Bangladesh is eagerly waiting for biotech crops to be commercialized in his country. In fact, he is ready to help organize a workshop with the International Service for the Acquisition of Agri-biotech Applications (ISAAA) for progressive farmers to make them aware and be motivated to adopt high-tech innovation including genetically modified crops. "Our farmers are ready to receive the message of their benefits and I hope that they accept biotech crops like they did with new technology during the Green Revolution," says Md. Shahjahan Ali Badsha.

Md. Shahjahan Ali Badsha is the farmer proprietor of Maa Moni Agricultural Farm in Cholimpur, Bangladesh. The 48-year old farmer comes from a farming family. Fighting against poverty, he successfully completed a commerce degree from Jagonnath College at the University of Dhaka in 1990. After graduation he took the challenge of improving farming conditions by adopting advanced technologies. He is popularly known as *Pepe Badsha* (Emperor of Papaya) for his success in papaya cultivation and obtaining the highest production in Bangladesh. His farm is planted to other crops such as rice, wheat, maize, pulses crops, oil seed crops, spices, vegetables, and fruits. He was awarded the "Presidential Bronze Medal" in 1991 and the "Bangabandhu Silver Medal" in 1997 for the highest papaya yield in Bangladesh.

Pepe Badsha is greatly recognized for his achievements, hence, several government bodies have made him a member of their committees to provide a farmer's perspective to push agricultural development in the country. These include the Bangladesh Agricultural Research Council, Bangladesh Sugarcane Research Institute, Sher-e-Bangla Agricultural University, and Agricultural

Md. Shahjahan Ali Badsha in his papaya farm.

Technical Committee. He was also tapped to be on the selection committee for the Prime Minister Award in the field of forestry, as well as committees on fertilizer monitoring and irrigation.

The Bengali farmer initially started farming on 0.34 hectare of land when he was a student in 1979. Now his farm is 20 hectares and diversified to include dairy, fisheries and nursery components. He hires about 50 laborers for farming activities. Visitors to his farm include the Agricultural Minister, Secretary of Agriculture Ministry, scientists, professors of different universities, officials of different organizations as well as farmers of different localities in Bangladesh.

Nowadays he is keen on adopting modern technologies, such as tissue culture and biotechnology for product development and marketing for higher profit. He is aware of the need for clean and vigorous seeds, seedlings and sapling production. Some diseases and insect pests are seriously hampering his farm production, thus decreasing his profit. He feels that "biotech crops

against insect pests and diseases would be very helpful in saving the environment from harmful pesticides."

Awareness About Biotech

Pepe Badsha attended training awareness programs, workshops, seminars and press conferences held on biotechnology. He learned about the technology from ISAAA booklets and leaflets translated into Bengali by the Bangladesh Biotechnology Information Center. He was one of the special guests at the launching of the ISAAA global biotech crops status report at the National Press Club. Since he uses the internet, he is able to access information about the status of biotechnology and biotech crop cultivation in the world as well as in Bangladesh. "I have been planting papaya and I am aware that viruses are a great threat. While attending an ISAAA workshop, I learned about the Papaya Ringspot Virus Resistant (PRSV-R) papaya program of ISAAA in Southeast Asia. I will adopt this crop once released and I will motivate other farmer leaders to do so too."

Looking Forward

His future thrust is to make agriculture a profitable business in Bangladesh through agro-based industries that use biotech crops and advanced technologies. He recommends agro-based infrastructure development, domestic and international trainings, and marketing facilities development in Bangladesh. "My Maa Moni Agricultural Farm is a proof that farming can be a successful profession. Bangladesh farmers and the country can benefit by adopting biotech crops in the future." ❑

Ir. Rachmat Pambudy

Partnering with Government on New Technology

By Mariechel J. Navarro and Bambang Purwantara

Dr. Ir. Rachmat Pambudy is the Secretary General of the **Dewan Pimpinan Nasional, Himpunan Kerukunan Tani Indonesia (DPN-HKTI**, National Leadership Council, Indonesian Farmers Union), the oldest and biggest farmers association in Indonesia. It is a fusion of 14 big farmers' associations excluding those from the Communist Party. The Chairperson of HKTI is Mr. Prabowo Subianto.

The union "strives to enhance the dignity of farmers as the agricultural primary producers, villagers and other agribusiness actors through the development of a people-oriented agribusiness system." Among its concerns are: farmer empowerment, agribusiness development advocacy, campaign for the establishment of pro-farmers development policy, and enhancing the bargaining position of farmers (HKTI, 2008).

Dr. Pambudy notes that Indonesian farmers who come from an agrarian country have a comparative advantage in the agricultural sector. "As a developing country, however, the endowed comparative advantages in agriculture do not immediately reflect on its economic competitiveness. It is quite a challenge for Indonesia to achieve its competitive advantage in agriculture through development of upstream industry, on-farm agribusiness, downstream industry, and other supporting service industries."

He adds that "As a highly populated country, Indonesia has the potential domestic market for agriculture and food products. However, the large population is a burden for the nation to provide adequate amount of quality food." Food security therefore becomes the main issue in both agricultural and national development. "To push agriculture in the country especially during a food (rice) crisis, the government needs a partner in achieving its agricultural program and development. It needs to educate farmers, provide assistance in the diffusion of technology, and deliver inputs such as seeds, fertilizers, pesticides, and new cultural management. Our organization can partner with the government to provide these services to farmers. In addition, farmer leaders are also community leaders. We can use our organization to work together. When there is a national agricultural program, the government seeks our help," Dr. Pambudy explains. From 2001-2004, Dr. Pambudy was adviser to the Minister of Agriculture and remains vigilant and actively committed to let authorities know about issues that affect farmers.

Dr. Pambudy notes that in the globalization era, many developing countries, including Indonesia, are obligated to perform certain actions for trade liberalization. However, developed countries, endowed with ample resources, still implement a protection policy to support their agricultural sector by giving substantial amounts of aids and subsidies. "As a result, the developed countries can sell their agricultural products to the international market under a competitive price. Moreover, developed countries implement many trade barriers for agricultural products imported into those countries."

Facing such an unfair international trade situation, the government has to implement a protection and promotion policy for agriculture. The promotion policy increases efficiency and competitiveness of domestic agricultural production including the use of high technology such as modern biotechnology. Meanwhile, the protection policy is needed to give "the same playing field" for Indonesian farmers with respect to the international market competition. "These two policies should be done simultaneously, because only by implementing protection can we promote national food development; on the other hand, promotion without protection is the same as doing nothing about unfair trade to farmers. Hence, HKTI also fights for unfair trade and unfair competition in the World Trade Organization forum (HKTI, 2008).

Exposure to Agriculture

A scion of a military officer, Dr. Pambudy's family had a one-hectare land devoted to vegetables, orchids, fresh water fish, poultry, and quail birds which eventually expanded to plantation crops, shrimp production, and forest trees. This exposure to the farm inspired him to take an agriculture course at the Bogor Agricultural University which he eventually joined as faculty in the College of Agriculture. He also worked with the Minister of Agriculture where he was involved in agribusiness development, and later in institutional relations. He joined the Union nine years ago and easily grasped the problems and concerns of farmers and Indonesian agriculture (Tani Merdeka, 2008).

Ir. Rachmat Pambudy (left) represents Indonesian farmers in biotech workshop.

Since Dr. Pambudy represents the interests of farmers, he travels around Indonesia and other countries such as the Philippines, Thailand, Vietnam, Australia, China, Japan, the United States, European and African countries to compare different strategies for agricultural development. He is often invited by the Indonesian Biotechnology Information Center (IndoBIC) as a resource person to talk about the conditions and concerns of farmers. One such workshop was on the use of biotechnology in solving the food crisis which aimed to explore available technological possibilities. "I often tell workshop participants that farmers are eager to know more about new technologies, about better crop varieties that can give better profits and yields." He adds that "farmers are very innovative, ready to change, and want to know what's new. They only need a guarantee that a new product can pay the cost of production and they can get some profit. That is why the introduction of biotechnology should not be a problem." He notes however that sometimes "farmers use illegal seeds since they do not have access to good seeds. They want to use fertilizers but are unavailable. This could also be a problem with biotechnology if the supporting system is inadequate."

Information for Farmers

Farmer leaders are updated about new technologies such as biotechnology from publications and the radio. "That is why the role of IndoBIC is very important in getting the message out about biotechnology. We have a farmers' magazine *Tani Merdeka* (Independent Farmers) which contains articles about various technologies and farmers' issues and concerns that we distribute to farmers in Indonesia. IndoBIC can also use this publication as a channel to update our farmers," says Dr. Pambudy.

The Secretary General believes there is still much to be desired in forging a viable partnership between the government and farmers' associations. "I would like to see that farmers' organizations will one day have their own modern and advanced seed industry, fertilizer and processing plant so they can eventually be self-sufficient. In addition, I hope that farmers will have direct access to information that will help them improve production on their farms and the quality of life for their families. Government and relevant agencies have to help make this possible." ❑

REFERENCES

Asian Farmers Regional Network. http://www.bic.searca.org/asfarnet/. (Accessed October 21, 2008).

Association of Southeast Asian Nations –United States Roundtable on Agricultural Biotechnology Policy and Strategy. http://www.biotec.or.th/roundtable (Accessed October 21, 2008).

Biotech Brasil. 'Excluded Farmers Want Transgenic Plants. October 25, 2007. Agricultural Biotechnology News. http://www.biotechbrasil.bio.br/en/categories/agricultural-biotechnology/ (Accessed September 5, 2008).

Bond, Russel, Gil Rodriquez, and Jammie Penm. 2007. Agriculture in Indonesia: A Review of consumption, production, imports and import regulations. Australian Bureau of Agricultural and Resources Economics. http://www.abareconomics.com/publications_html/conference/conference_07/CP07_06_indonesia.pdf (Accessed October 29, 2008).

Central Intelligence Agency. The World FactBook. 2009. https://www.cia.gov/library/publications/the-world-factbook/geos/id.html#Econ (Accessed November 11, 2008).

CGIAR Meetings and Events. 2006. http://www.cgiar.org/meetings/agm06/agm06_stakeholder_cso.html (Accessed November 11, 2008).

Fernandez, Rudy. 2007. Former Pinay DH Wins International Award for Biotechnology. The Philippine Star. October 20, 2007.

Himpunan Kerukunan Tani Indonesia. 2008. http://www.hkti.or.id/dsp_home.php/dsp_home.php?fuseaction=hkti.staticfront&setLang=id&contentID=19 (Accessed November 7, 2008).

International Service for the Acquisition of Agri-biotech Applications (ISAAA). 2003. Workshop Highlights: Farmer to farmer: Sharing experiences related to agricultural biotechnology. http://209.85.175.104/search?q=cache:bMbE4_0WbO8J:203.127.220.112/content/apec/apec_groups/other_apec_groups/agricultural_biotechnology.downloadlinks.0001.LinkURL.Download.ver5.1.9+farmer+to+farmer+workshop+Manila&hl=en&ct=clnk&cd=1 (Accessed October 29, 2008).

International Service for the Acquisition of Agri-biotech Applications (ISAAA). 2004. Asia's First: The Bt Corn Story in the Philippines video.

James, Clive. 2008. The Global Status of Commercialized Biotech/GM Crops: 2008. ISAAA Brief 37. ISAAA: Ithaca, New York. 278 pp.

Navarro, Mariechel, Margarita Escaler, Ma. Inez Ponce de Leon, and Sonny Tababa. 2007. The Bt Maize Experience in the Philippines: A Multi-stakeholder Convergence. *In* the Public, the Media and Agricultural Biotechnology. CAB International, United Kingdom. Pp. 327-337.

Nicholson, Jim. 2004. Biotech food for the hungry. International Herald Tribune. http://www.iht.com/articles/2004/10/02/ednicholson_ed3_.php. (Accessed January 7, 2009).

Paredes, Joel. 2007. Rosalie Ellasus: Working Mom's Success Comes Easy with Biotech Farming. Biolife. Biotech for Life Media and Advocacy Resource Center, Quezon City, Philippines. Pp. 8-9.

Report: Farmer Biotech Outreach: Strengthening the Competitiveness of Small Farmers, 2006. International Service for the Acquisition of Agri-biotech Applications (ISAAA) Southeast Asia Office, Los Baños, Laguna, Philippines.

SEARCA BIC. 2004. Introducing: The Asian Farmers Regional Network (ASFARNET). http://searcaweb.org/pipermail/bic_searcaweb.org/2004-February/000014.html (Accessed September 5, 2008).

Tani Merdeka. 2008. Jakarta, Indonesia.

Truth About Trade & Technology. Rosalie Ellasus- First Recipient of Kleckner Trade and Technology Advancement Award. http://www.truthabouttrade.org/content/view/11698/75/ (Accessed September 5, 2008).

Media

Spreading the Word

The communication practitioner's role in the biotechnology arena is a significant one. Surveys show that much of the information that consumers have of science and to make sense of scientific breakthroughs is based on what they read in newspapers, watch on television, listen over the radio, and view on the Internet.

Among Americans, main information sources on science and technology (S&T) are television, newspapers, and the Internet. People in other countries including the European Union states, Japan, Russia, South Korea, and China identified television and newspapers as primary sources. India indicated television as the dominant source of S & T information with radio and friends/ relatives ranked ahead of printed materials (Science and Engineering Indicators 2008). Juanillo (2003) reports that for countries like Indonesia, Malaysia, Philippines, Thailand, and Vietnam, mass media was favored for information on science in general and biotechnology in particular.

Few people have direct experience with agricultural biotechnology or even direct exposure to scientists and researchers working in the field. Hence, media play a crucial role in providing people with the information necessary to make decisions about technology options and their potential risks and benefits. Another important role for media is that they allow citizens to gauge the climate of opinion around them which in turn influence what people will think about a certain issue (Scheufele, 2007).

The agenda-setting function of mass media postulates that media do not tell people what to think, but rather what to think about. The intensity of media coverage on a topic correlates with the public agenda, hence the level of importance of an issue

can be gauged by media coverage. Another theoretical perspective is the second-level agenda-setting process. It states that if media coverage concentrates exclusively on a certain topic (positive attributes of a technology, for example), these messages will activate positive rather than negative images and will be used by people to evaluate the concept of biotechnology. As a result of intensified media coverage and even if the amount decreases, the personal relevance of biotechnology as an echo effect will stay high (Bonfadelli, 2007).

A five-country monitoring survey of 46 national papers in five Asian countries, namely India, Malaysia, Philippines, South Korea, and Vietnam in 2002 and 2003 showed sustained media coverage on crop biotechnology. Navarro and Villena (2005) reported that local journalists were writing about biotechnology and followed developments of important newsworthy milestones such as the approval of a GM crop as in the case of the Philippines and India.

These theoretical perspectives and real case scenarios highlight the media practitioner as a key actor that can help increase awareness and understanding of biotechnology among various stakeholders and interest groups. As early as 2000 when initial Biotechnology Information Centers (BICs) were established, communication practitioners and/or government information officers were already identified as key stakeholders in the knowledge sharing initiatives. Aside from regularly networking with them by providing news updates and articles for publications, the BICs also invite them to media workshops to be briefed on latest issues and concerns; get updates on local research and development efforts; visit laboratory, field trials, and farmers' fields; and share experiences in communicating biotechnology. Exchange visits of journalists are also facilitated where they interact with colleagues from other countries as they visit research facilities and farmers' fields.

Writers from Egypt, Ghana, and Kenya in Africa; and Philippines, China, India, Pakistan, and Vietnam in Asia; share how they got interested in writing about crop biotechnology.

Linda Asante Agyei

From Negative to Positive Views About Biotech

By Margaret Karembu and Daniel Otunge

Like most journalists in Ghana, Linda Asante Agyei, a senior journalist with the Ghana News Agency (GNA), confesses to having held very negative views about biotechnology. Her negative perceptions were largely built on opinions and positions expressed by foreign news sources, mainly European, and other anti-biotechnology non-governmental organizations that have been very visible in the area. "I must admit it was very difficult accepting the truth that the application of biotechnology was not a ploy by the Americans to wipe out Africans from the earth using biological means."

Linda, who is currently pursuing a Bachelor of Arts Degree at the University of Ghana is a specialist in Science, Technology and Health reporting. She studied journalism at the Ghana Institute of Journalism from 1994-1996 and took up Advanced Reporting at the Africa Institute of Journalism and Communication in 2001. With over 12 years of experience in journalism, and heading the health desk of Ghana's only wire service, Linda's confessions cannot be taken lightly.

"While working at the health desk five years ago, I became very interested in science communication in general. This was triggered by an invitation to an international workshop on cowpea by the then Director General of Ghana's Council for Scientific and Industrial Research (CSIR), Professor Emmanuel Owusu-Bennoah. The interest deepened after attending subsequent meetings on biotechnology and agriculture. I learned that reporting on emerging, complex issues and technologies can be a daunting task for a budding journalist," she narrates.

Participation in Study Tours

After participating in two study tours to Burkina Faso and South Africa, and covering the Second Economic Community of West African States (ECOWAS) Ministerial Conference on Biotechnology held in Bamako, Mali in 2005, Linda became completely convinced about the potential benefits of modern agricultural biotechnology.

"In November 2004, I was lucky to be nominated by the Program for Biosafety Systems (PBS) to participate in a "seeing-is-believing tour of Bt cotton field trials in Burkina Faso," says Linda. The study tour, which was organized by PBS and the International Service for the Acquisition of Agri-biotech Applications (ISAAA) aimed at exposing the media to real products of biotechnology and forge linkages with local researchers as important sources of information on biotechnology in Africa. At the time, media reporting was fraught with highly sensational stories and foreign-based articles with inaccurate representation of the real aspects of the technology. An important outcome of this tour was improved and balanced reporting of biotechnology in Africa in view of media's acknowledged role as a popular source of biotechnology information by a majority of stakeholders. The study tour was also meant to prepare journalists for the Ministerial

Participants of the seeing-is-believing tour visit a cotton farm in Burkina Faso.

meeting on Biotechnology for ECOWAS States that was to be held the following year.

"Contrary to what I had thought would be giant cotton plants at the trial sites, I was amazed to see ordinary but very healthy cotton crop like the one I always knew and on touching and feeling it, I started questioning the motive behind some foreign articles I had read earlier portraying biotech products as monsters. I was also able to raise many of the questions I had about biotechnology to the local researchers and by the end of the three-day tour, my perceptions totally changed. Based on what I saw in Burkina Faso, I published many press articles that I strongly believe helped to re-focus the thinking of authorities in Ghana on the need to enact laws to facilitate research on modern biotechnology," she says.

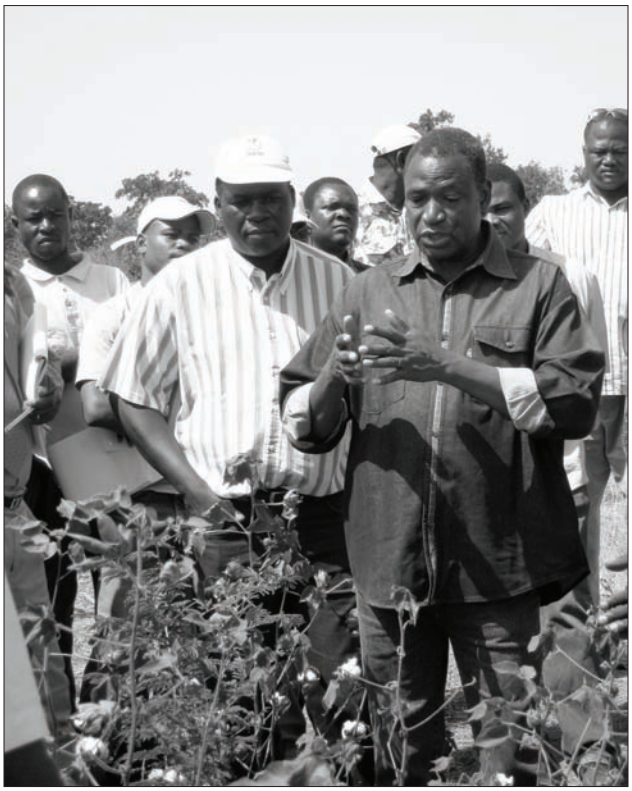
Coordinator of Journalist Network

Linda's prolific writings on biotechnology enabled her to be elected as the first Ghana Chapter Coordinator of a network of journalists for Communicating Agricultural Biotechnology West Africa (RECOAB or *Reseau des communicateurs ouest Africain en Biotechnologie*).

RECOAB is an outcome of a media training workshop held in Bamako, Mali in 2005, in preparation for coverage of the Ministerial Conference on Biotechnology for ECOWAS states. ISAAA, in partnership with the Agricultural Biotechnology Support Project (ABSP II), the national institute of Mali - *L'Institut d'Economie Rurale* (IER) and USAID Mali, sponsored and organized the three- day workshop titled *Communicating Agricultural Biotechnology: Theory & Practice*. The workshop aimed at providing journalists with an understanding of the science behind agricultural biotechnology as well as an overview of the African agricultural biotechnology environment. The journalists also had the opportunity to interact with scientists and other representatives of the biotech sector in the sub-region. Participants left the workshop with a good amount of scientific background information, a briefing on the Ministerial event, and an introduction to West African spokespersons. The activity aroused great interest among the journalists who requested the organizers and other partners present for more capacity building events in the area. There were approximately 15 participants from the Malian media sector while ISAAA sponsored seven journalists from Burkina Faso, Cote d'Ivoire, Niger, Benin and Senegal.

The ECOWAS Ministers and senior policy-makers examined and adopted strategy documents for the development and use of agricultural biotechnologies at the country level. These documents focused on: an action

"Contrary to what I had thought would be giant cotton plants at the trial sites, I was amazed to see ordinary but very healthy cotton crop like the one I always knew and on touching and feeling it, I started questioning the motive behind some foreign articles I had read earlier portraying biotech products as monsters."



Prof. Konaté (right) and Dr. Ouola Traore (left), cotton specialists, talk to participants about cotton farming.

plan on biotechnology for the sub-region; the creation of Biotechnology Centers; the setting up of partnerships and cooperation between the North and the South; the framework for harmonizing biosafety regulations; the setting up of a Biotechnology Information/Communication System; and finally, the institutionalization of the Ministerial conference for West African countries.

In forming RECOAB, the journalists defined the aim and roles of the network thus: to provide a forum through which they (journalists) can share biotech information sources; discuss the credibility of sources, and receive feedback on their work from their peers. Country coordinators for Mali, Burkina Faso, Cote d'Ivoire, Niger and Senegal were also identified. RECOAB has

"Exposure study tours and hands-on capacity building are the best ways out of very poor science reporting in Africa."

since incorporated Anglophone West Africa countries of Ghana, Nigeria, the Gambia and Sierra Leone. It has also served as a point of contact for organizations who wish to involve and communicate with journalists and the public on the broad field of modern biotechnology. Member journalists have developed competencies in reporting agricultural biotechnology related issues and built a body of credible and balanced reporters on the subject. They have also cultivated relationships with representatives from the government, research institutes, universities and NGOs as reported in their various reports and Newsletters. Burkina Faso chapter for instance is already legally registered by the government and publishes a regular newsletter in French (The RECOAB News, 2008).

"Exposure study tours and hands-on capacity building are the best ways out of the very poor science reporting in Africa." And it worked for Linda who after attending a series of training workshops and study tours became an expert in biotechnology reporting for the Ghana News Agency. "I became so conversant with biotech technical jargons that whenever there was a story from the regions to be submitted to our headquarters, I would be called upon to edit and make sure everything was alright," she explains.

As fate would have it, many other opportunities followed in quick succession for Linda. For instance, she accompanied several African members of Parliament and senior policy makers to a study tour of South Africa's biotech crop fields, where she had a chance to eat a meal

"I became so engrossed in biotechnology reporting that I influenced the establishment of a desk and several files for biotechnology stories in the Ghana News Agency."

prepared from Bt maize. The event, which was co-sponsored by AfricaBio in South Africa and ISAAA *Afri*Center helped to cement her then growing passion for biotechnology reporting.

Trainer of Journalists on Agri-biotech

Thanks to all these rich experiences and international exposure, Linda would later take charge of publicity during the 3rd ECOWAS Ministerial Conference on Biotechnology, held in Ghana, in March 2007. Her skills and confidence in handling biotechnology matters grew to the extent that she became a trainer of other journalists. She has competently managed several media trainings where she competently handles the topic on "Effective Reporting on Agricultural Biotechnology" at local and regional workshops.

"I became so engrossed in biotechnology reporting that I influenced the establishment of a desk and several files for biotechnology stories in the Ghana News Agency. My mission is to help my colleagues to improve their grasp of and reporting on biotechnology," she says with the full confidence of a trainer of trainers (TOT).

Linda did not stop there. She is currently part of the technical team working on the country's biosafety framework. Her passion is to see Ghana becoming a biotech country in the very near future.

The RECOAB Country Coordinator says covering biotechnology in Ghana has been a major challenge for three reasons. First, most scientists are unwilling to give information to journalists when they need it. Second, the country neither has a biosafety law nor serious on-going modern biotech research programs. And thirdly, most reporters and editors are unfamiliar with the technology. "Even so, thanks to the formation of RECOAB, a lot has been done to solve some of the challenges, Linda reassures.

For instance, RECOAB country members were very instrumental in getting Parliament to pass the Legal Instrument (LI) to facilitate modern biotechnology research and development. "We helped to do this by writing and publishing stories critical of the Government and the National Assembly for failure to enact the Biosafety law to allow scientists to do their biotech work," Linda explains.

To further strengthen biotech reporting in Ghana, she suggests more exposure tours, hands-on capacity building workshops and awards scheme for biotechnology reporters.

Although Linda is fully aware of the fact that biotech crops are no silver bullets to the food insecurity in Africa and the rest of the developing world, she believes that the continent stands a better chance of becoming food secure by integrating such tools with conventional technologies.

She urges other African journalists to be wary of people with foreign agendas and whose opposition to modern biotechnology is not based on scientific evidence and facts. Journalists should also actively seek to popularize biotechnology reporting to their editors and gatekeepers in order to receive the prominence the subject so deserves. ❑

Melody Aguiba

Multi-Awarded Science Writer

By Mariechel J. Navarro and Sonny Tababa

In 2002, Philippine journalists were not too interested in biotechnology (Juanillo, 2003). However, a subsequent Philippine study (Torres et al., 2006) showed a change in attitude as journalists ranked along with scientists in being more open and optimistic about biotechnology. These findings are validated by a consolidated media monitoring study (Navarro and Villena, 2004; SEARCA BIC reports) from 2002-2008. Media monitoring involves the "systematic register and review of what the media tells about the world" (Nordenstreng, 2001).

The Philippine Biotechnology Information Center, officially referred to as the Southeast Asian Regional Center for Graduate Study and Research in Agriculture Biotechnology Information Center (SEARCA BIC), regularly scans national daily papers to analyze articles on crop biotechnology based on number of articles, topic of article, and tone (positive, negative, neutral). Data are analyzed to answer the following questions: What agri-biotech news stories come out in national newspapers during a given period of time? What is the content and tone of news? The consolidated study shows that there has been a significant increase in media coverage of agri-biotech articles, starting with only 279 in 2002, peaking to an all time high of 1,010 in 2006 or a total of 3,652 for the period, 2002-2008 (Table 1). On the average for the seven-year period, about 522 articles were written per year or 43 articles per month. In 2006, around 84 articles per month were written or almost double the average monthly output for the seven year period.

Of the total articles published between 2002-2008, about 80 per cent were positive in tone, 11 percent were neutral, and only 9 percent were negative (Figure 1). A cursory analysis of the articles showed that majority of the articles was supportive of government and private sector initiatives. Hence, there exists a favorable media environment for agri-biotech in the Philippines. It is interesting to note that among the stakeholders interviewed in 2006, policy makers relied on the mass media for information about agri-biotech. Other stakeholders used a combination of interpersonal and mass media as information sources.

SEARCA BIC has organized various activities for the Philippine media since its inception in 2000. Several media workshops have been organized enabling the BIC to identify a core group of science communicators who can be tapped to write articles about agri-biotechnology in major dailies. The media are invited to a 1-2 day workshop to familiarize them with crop biotechnology concepts and initiatives, as well as updates on the local research and development front. Learning strategies include lectures by local experts, laboratory exercises where participants get to be scientists for a day, video presentations, board/interactive games, and a tour of laboratory and greenhouse experiments as well as farmers' fields. The simple laboratory exercises that include the extraction of DNA from the participants' cheeks, enable the non-technical audience to appreciate key scientific concepts necessary to understand biotechnology.

Table 1. Media tracking of biotechnology articles and tone, 2002-2008.

Year	Positive Articles		Negative Articles		Neutral Articles		Total
	Number	%	Number	%	Number	%	
2002	168	60.22	49	17.56	62	22.22	279
2003	141	48.62	51	17.59	98	33.79	290
2004	196	74.24	29	10.98	39	14.78	264
2005	665	84.07	80	10.11	46	5.82	791
2006	915	90.59	53	5.25	42	4.16	1,010
2007	623	87.26	43	6.02	48	6.72	714
2008	227	74.67	26	8.55	51	16.78	304
Total	**2,935**	**80.34**	**331**	**9.06**	**386**	**10.60**	**3,652**

Sources: Navarro and Villena (2004); SEARCA BIC Monitoring Reports, 2002-2008

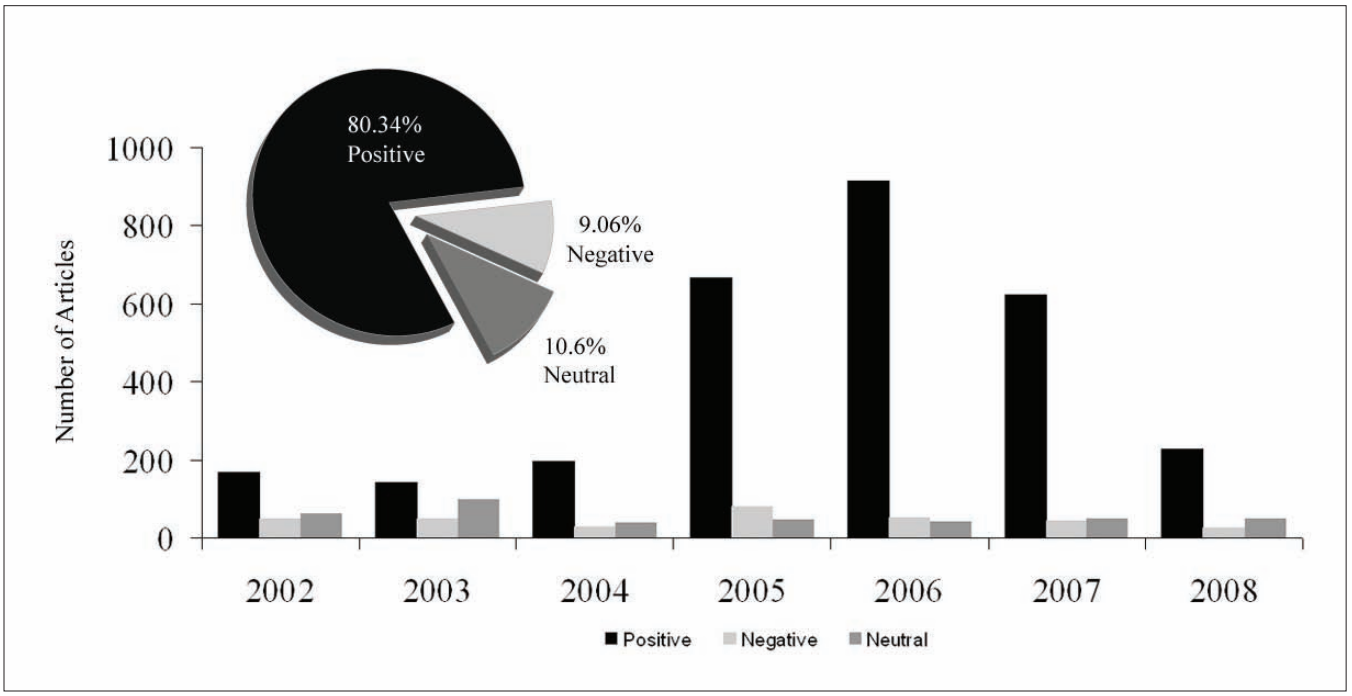


Figure 1. Tone of agri-biotech articles, 2002-2008.

Among those who participated in these media workshops was Melody M. Aguiba, a reporter of the *Manila Bulletin*, a national daily newspaper reputed to have the highest circulation figure in the Philippines. *Manila Bulletin* ranks as one of the top three national newspapers, along with the *Philippine Daily Inquirer* and the *Philippine Star*. A former freelance writer and a university teacher of journalism, Melody finished her Bachelor of Arts in Mass Communication from the Pamantasan Lunsod ng Maynila and completed the academic requirements for a Master in Business Administration from the same University.

Melody with her Gawad Galing award.

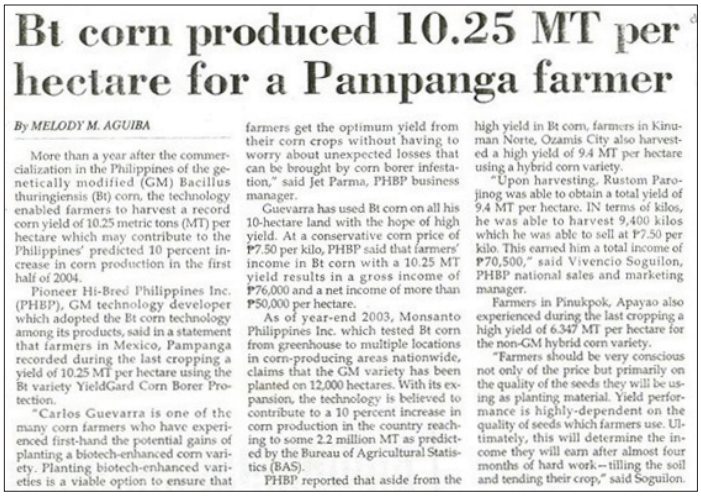
Power of Media to Educate

"As far as I can remember, writing has always been a passion. In high school, I took a journalism elective and eventually rose from being a staff writer to editor of the newsletters *Campus Light* and *Baptist Messenger*. Science also fascinated me." In college, Melody took interest in the Strategic Defense Initiative that was proposed by the United States government to use ground and space-based systems to protect it from attack by strategic nuclear ballistic missiles. She read about this in magazines such as *Discover* and *Popular Science*. "It is amazing how powerful a medium the magazines are to educate non-scientists like me," she says to illustrate the importance of popularizing science to the laymen. Eventually, her college thesis would be on a proposal for a television program on science and technology.

Melody is a prolific writer and has won several awards. She got the Best Article Award given by the United Nations Environment Programme in 2007, Reporter of the Year awarded by the Economics Journalists Association of the Philippines in 2002, 2003 and 2006, as well as the First Prize for Agri-business Journalism, Binhi Awards in 2002, 2006, and 2007. She won the First Prize in the Gawad Galing (Excellence Award) Jose Burgos Jr. Biotech Journalism Award in 2005, 2006, and 2007. The latter award is a project which the private sector-led Biotechnology for Life Media and Advocacy Resource Center and the BIC helped to institutionalize to "recognize journalists who excel in their quest for truth and help push the frontiers of scientific inquiry, with particular focus on biotechnology." Jose G. Burgos Jr. is a former press freedom fighter in the Philippines, and an award winning journalist (Jose G. Burgos Jr. Awards Program, 2006).

"Science in general, and crop biotech are concerns no country can ignore if it aspires for a leap in the economy. The Philippines is poor precisely because it has neglected science even if it is rich in natural resources on which it can have an absolute niche. Crop biotechnology is essential in food security especially during these times of food crisis. It also contributes to poverty reduction among poor farmers if only an intervention is made to help them migrate to this technology," says Melody. She adds that "A media person can contribute to poverty reduction and economic development if he thinks of these as a mission in life, if he deems writing to be both a profession and a vocation."

Based on the media tracking study of the BIC, Melody wrote 107 articles on biotech and related articles from 2006 to 2008. Melody avers that "there is a lot to write about biotechnology." Her biotech stories are slanted toward the business/ economic angle or how the technology could contribute to improving livelihood and the economic development of the country. Topics include Bt corn, hybrid rice, hybrid papaya, Bt cotton, the Philippines vast resources in biotechnology, the government biotech program, genetically modified crop value, biofuels, biotech research, and patenting issues and concerns. Since Melody writes for a business newspaper, the story has to connect to an economic issue for unless a story is used or approved for publication by the editor, there is no motivation to write these stories, she explains. *Manila Bulletin* does not have a committed space for science and technology *per se* except for the business angle on agriculture. It has a business features page, "Business Agenda" for such articles.



Bt corn produced 10.25 MT per hectare for a Pampanga farmer

By MELODY M. AGUIBA

More than a year after the commercialization in the Philippines of the genetically modified (GM) Bacillus thuringiensis (Bt) corn, the technology enabled farmers to harvest a record corn yield of 10.25 metric tons (MT) per hectare which may contribute to the Philippines' predicted 10 percent increase in corn production in the first half of 2004.

Pioneer Hi-Bred Philippines Inc. (PHBP), GM technology developer which adopted the Bt corn technology among its products, said in a statement that farmers in Mexico, Pampanga recorded during the last cropping a yield of 10.25 MT per hectare using the Bt variety YieldGard Corn Borer Protection.

"Carlos Guevarra is one of the many corn farmers who have experienced first-hand the potential gains of planting a biotech-enhanced corn variety. Planting biotech-enhanced varieties is a viable option to ensure that farmers get the optimum yield from their corn crops without having to worry about unexpected losses that can be brought by corn borer infestation," said Jet Parma, PHBP business manager.

Guevarra has used Bt corn on all his 10-hectare land with the hope of high yield. At a conservative corn price of ₱7.50 per kilo, PHBP said that farmers' income in Bt corn with a 10.25 MT yield results in a gross income of ₱76,000 and a net income of more than ₱50,000 per hectare.

As of year-end 2003, Monsanto Philippines Inc. which tested Bt corn from greenhouse to multiple locations in corn-producing areas nationwide, claims that the GM variety has been planted on 12,000 hectares. With its expansion, the technology is believed to contribute to a 10 percent increase in corn production in the country reaching to some 2.2 million MT as predicted by the Bureau of Agricultural Statistics (BAS).

PHBP reported that aside from the high yield in Bt corn, farmers in Kinuman Norte, Ozamis City also harvested a high yield of 9.4 MT per hectare using a hybrid corn variety.

"Upon harvesting, Rustom Parojinog was able to obtain a total yield of 9.4 MT per hectare. IN terms of kilos, he was able to harvest 9,400 kilos which he was able to sell at ₱7.50 per kilo. This earned him a total income of ₱70,500," said Vivencio Soguilon, PHBP national sales and marketing manager.

Farmers in Pinukpok, Apayao also experienced during the last cropping a high yield of 6.347 MT per hectare for the non-GM hybrid corn variety.

"Farmers should be very conscious not only of the price but primarily on the quality of the seeds they will be using as planting material. Yield performance is highly-dependent on the quality of seeds which farmers use. Ultimately, this will determine the income they will earn after almost four months of hard work – tilling the soil and tending their crop," said Soguilon.

A clipping of Melody's article about farmers and Bt corn.

Writing the Bt Corn Story

Melody has followed through many technologies from research to commercialization. She wrote about Bt corn being field tested by Monsanto in 2002, how it reached farmers fields in 2003, and why it continues to be a farmers' crop choice. She writes about other biotech developments such as use of sweet sorghum/ sugarcane for ethanol production, as well as natural ingredients for pharmaceutical/nutraceutical uses.

As a writer, Melody faces a few hurdles in writing about science and technology. One is the difficulty in understanding technical terms. She exerts effort to look up the meaning of words that scientists might find very basic or too simple for technical people. Another barrier is inaccessibility of certain scientists. Melody opines that "Some scientists are unwilling to communicate and divulge information. They are unable to connect science research with reality, with the big picture of helping people and the economy as a whole." She is frustrated that in the country, science is not part of a working plan or if existing, does not seem to work. "Leaders have so far been unsuccessful in making it a truly powerful tool for economic development."

Nevertheless, the *Manila Bulletin* writer offers some suggestions: organize seminars on science for journalists, and make available science books that are simply written, yet comprehensive and enlightening. She also recommends that different agencies (science, government, and media) collaborate on a more massive scale to push science information dissemination.

BIC-organized media workshops that Melody has attended were useful, she says, as resource persons introduced biotechnology concepts particularly on genetically modified organisms. She recommends tackling a broader view of biotechnology with additional topics on pharming where the country has potential to explore, or on biotech tools such as bioinformatics. Pharming or molecular farming is an emerging new paradigm in the biotechnology arena which aims to produce pharmaceuticals,

therapeutic proteins and vaccines. "It is important to have good resource persons who are patient, confident and open to the media." She cites the case of an expert from the private sector who motivated her to write a series of articles on Bt corn. The expert was able to popularize concepts and make biotechnology relevant for a media person to comprehend. The series of articles that Melody wrote traced the process that Bt corn went through from field trial to eventual commercialization.

Learning About New Technology

The lady writer represented media practitioners in a workshop *Farmer-to-Farmer: Sharing Experiences Related to Agricultural Biotechnology* in December 2003 where she had the opportunity to interact with farmers and media practitioners from several Asian countries. The BIC also facilitated her attendance as part of the Asian delegation of 15 journalists from Bangladesh, India, and the Philippines to Coimbatore, India to be oriented on the fruit and shoot borer-resistant (FSBR) eggplant technology in November 2005. The Philippine group was composed of writers from the Business Mirror, Philippine Daily Inquirer and Manila Bulletin. The writers were briefed on the issues and concerns of Bt technology, specifically in the development of FSBR eggplant. A field visit was conducted at the Review Committee for Genetic Modification trial of MAHYCO Bt eggplant Hyb 11 in Nathae Goundan Pudthur Village to see the performance of the MAHYCO Bt hybrid eggplant over regular non-Bt variety. Articles of that visit were published in national dailies and contributed to an awareness of the next potential biotech food crop due for commercialization in farmers' fields (ABSP II Newsletter, 2006).

"Feedback about articles I write is important but there is no way to directly gauge their impact. However, I observe developments or take-up of the technology in the field, whether it is advancing toward commercialization or whether farmers are picking it up." She opines that positive acceptance of a technology or its commercialization is an indirect, intrinsic reward for media practitioners like her to write about a specific topic.

Melody, together with Joel Paredes, represented the Philippines as part of the Asian delegation to Coimbatore, India.

Melody sees the potential of science and technology in national development. She finds fulfillment and value in getting enlightened about how science contributes to solving problems. With partners, she has started editing a magazine *Growth Revolution* which focuses on poverty reduction with technology as one of the central factors. She wants to focus on S & T, recognizing its impact on how countries like India and China have started emerging from poverty and how the Philippines can attain it too. She typifies journalist-respondents in the Juanillo study (2003) that showed that journalists in the Philippines, particularly those whose primary beat is science and technology, were moderately to highly interested in biotechnology and have a high regard for the role of science and technology in the development of agriculture in the country. ❑

Yingjie Huang

Bringing Biotech News to Chinese Readers

By Tian Zhang

The Aweb, an online Chinese agricultural website (http://www.aweb.com.cn/) of the Nongbo Digital Technology, Co. Ltd., is committed to timely coverage of the latest news and policies about agriculture, the countryside and farmers, as well as services for agricultural specialists and producers. Aweb visitors include officials, agriculture enterprises, dealers, farmers, students and researchers.

Yingjie Huang is the editor-in-chief of the news section of Aweb. She has been covering the agriculture scene for the last five years after completing her undergraduate degree in plant genetics and breeding from the South China Agricultural University. Her foray into website writing started with her interest in information searching and the "realization that electronic-based information is a fast and far reaching medium to disseminate scientific information."

Aweb mainly covers issues on conventional agriculture. Yingjie says that agricultural biotechnology and genetically modified (GM) crops especially in the international scene are seldom written about. This is primarily due to unavailable sources of agricultural biotechnology information and the language problem. "Most Chinese websites have difficulty in collecting, reading and comprehending English information. We are in dire need of information about agricultural biotechnology and GM crops, especially from abroad. Many of Aweb's readers who have science or agriculture backgrounds have expressed interest for such information." The lady editor is positive about crop biotechnology and says that GM crops can help accelerate varietal breeding and boost crop improvement. However, she thinks that the current release and production of GM crops must be preconditioned by genetic stability.

Yingjie states that Aweb should gradually shift its coverage focus from conventional agricultural information to include modern agricultural biotechnology. "We should attach greater importance to comprehensive global information to meet the readers' needs. These include scientific research results published by international institutions, agricultural policies, laws and regulations of various countries, research reports of various public and private agencies, field trials and commercialization of GM products, and institutional cooperation." Yingjie says that such information is available from the International Service for the Acquisition of Agri-biotech Applications' (ISAAA) e-newsletter Crop Biotech Update (CBU) that the China Biotechnology Information Center (ChinaBIC) translates into Chinese. "Thanks to the Chinese CBU, we have been enlightened about the approach and content of information about crop biotechnology."

As editor-in-chief, Yingjie frequently scans the Internet for news sources. She visited the website of the Chinese Society of Biotechnology (CSBT) to check on their events. It was there that she saw the Chinese translation of the CBU. CSBT, an information exchange center on biotechnology and

Screenshot of the home page of Aweb.

which publishes the journal *China Biotechnology*, hosts the ChinaBIC. Since then she regularly includes the CBU in her news section and selects pertinent information which she then forwards to the editors of the science and technology section.

"With the continuous development of biotechnology and its constant application in daily life, biological agriculture will witness an information explosion and increasing public interest in the field," Yingjie notes. "Thus, there is a need to popularize biotechnology information. In addition, we need workshops and seminars as well as training courses on popularizing biotechnology information. We need to promote science communication to better appreciate fair evaluation of research in biotechnology, and understand the transformation of biotechnological results into practical applications." ❑

Mohamed Elsaied Darwish Mostafa

Of Bt Cotton and Writing

By Ismail Abdel Hamid

"Writing is a life commitment. It gives me the opportunity to deliver my ideas to several thousands of readers in a very short time." Mohamed Elsaied Darwish Mostafa believes a science writer has a very important role in society – "My simple philosophy is that society can't survive without scientific advancement and updates. Science in general is the key for human beings to survive. It helps simplify and enhance our lives." He knows that translating scientific concepts and issues is a way to get people to understand what science has to offer mankind.

Mohamed writes a weekly page *Borset Alcotn* (Cotton Stock Market) for the daily newspaper *Al-Alam Al-Youm* (The World Today) and the cotton trade magazine *Borset Al Cotton* which target Arabic readers in Egypt and other Arabic speaking countries. He also writes for the international *Cotton Outlook* magazine. "My newspaper encourages articles on the applications of science

and technology, especially those related to societal development. There are weekly annexes related to health, agriculture and education. My specific field of interest is cotton as a crop and as an industry and I am interested in these news around the globe. I cover the benefits and risks of any new variety or technology related to cotton."

Workshops, conferences, and seminars are a major source for topics that Mohamed writes about. In these gatherings he is able to interview eminent scientists and experts on various topics of interest. In particular, he remembers attending the BioVision 2006 conference at the Library of Alexandria (Bibliotheca Alexandrina) in Egypt. BioVision is an annual gathering of opinion leaders and prominent scientists where they engage in an active exchange regarding the life sciences. The Egypt Biotechnology Information Center (EBIC) director arranged a meeting for Mohamed with Dr. Clive James, International Service for the Acquisition of Agri-biotech Applications (ISAAA) founder and chair. Dr. James was a speaker on the global status and future prospects of biotech crops during a plenary session on agri-food and environment. "I had a long discussion with him about Bt cotton. As I am interested in cotton in general, it was a great interview. I realized how impressive the India experience is with regards Bt cotton. It gave me a new and wider perspective on how a cotton variety can help change the life of small scale cotton farmers, whom I know are suffering from problems such as low yields and insect infestation. This interview made me focus more on biotechnology and science communication."

Mohamed (left) listens to Dr. Clive James expound on Bt cotton.

> *"I feel responsible to my readers. I have to carefully and honestly prepare my articles. I have to check the source of information and choose only the most credible sources."*

Writing About Bt Cotton

Mohamed has since then written a series of articles to cover the global and national activities regarding agricultural biotechnology applications most of them with the assistance of EBIC. He said he relies on ISAAA's annual global status report of the commercialization of GM/biotech crops which serves as a macro view to enable him to discuss the possibilities for cotton, being Egypt's major commodity. "In addition, I follow up developments regarding the field trials of Bt cotton in Egypt. Through media visits that EBIC facilitates, it is easy to distinguish between the conventional varieties of cotton, which is infested by bollworms, and the Bt cotton varieties that are bollworm free. I write about my ocular visits and mention how the planting of Bt cotton can save on the use of chemical pesticides and how this will redound to more income to farmers and a safer environment." Mohamed believes that crop biotechnology is one of the most important technologies in recent years. "It has caught the attention of both rich and poor, scientists and farmers, policy makers and academics. It interests students and housewives as well. It provides benefits to farmers, and is safe to human health and the environment."

The writer took up a sociology degree from the University of Alexandria in Egypt and was able to


90٪ من مساحة القطن بالولايات المتحدة منتج بالتكنولوجيا الحيوية و81٪ في أستراليا

صرزرعت محصولا منتجا بالتكنولوجيا الحيوية لأول مرة

دعوة لسرعة تبنى إطار تشريعى يحفز التوسع

A newspaper clipping of Mohamed's article on crop biotech.

benefit from a journalism observation study tour in Washington, DC and New York, and a customer service and relationship building training course at the Pennsylvania State University. As a writer, "I feel responsible to my readers. I have to carefully and honestly prepare my articles. I have to check the source of information and choose only the most credible sources. All these help make an excellent report or article."

Journalists and media specialists need credible, unbiased, and transparent information sources says Mohamed. "EBIC plays an excellent role in this area. Through its publications and continuous contacts with media through workshops, it provides communication practitioners like me with the most recent information and news in the field of biotechnology, particularly in its role in agricultural productivity. This is an important requirement of our work." Mohamed also mentions that he relies on other information sources like the video on the Bt cotton story in India, the Arabic version of the weekly Crop Biotech Update, and Roayaa, EBIC's Arabic newsletter.

Attendance in Workshops

Aside from EBIC media workshops, he attended an international conference on *Innovative Aspects of Biotechnology and its Better Awareness and Dissemination* sponsored by ISAAA and other partners. "During this meeting in Islamabad, Pakistan, I met with different scientists from different Islamic countries. It was a great opportunity for me to meet with experts from Malaysia, Bangladesh, Pakistan, Syria and the Philippines. I covered this workshop in my reports. I was also able to discuss with other journalists from other Islamic countries the challenges we face and how to properly handle them."

In Egypt, Mohamed notices a greater coverage on crop biotechnology "but much more needs to be done. We need to focus on its application in developing countries and tell readers how important this technology is for poor people. We need to provide information to policy makers so they can make faster decisions based on the right information. The public must be given a continuous flow of authoritative information." He suggests more opportunities for media persons like him to participate in international communication workshops and field visits where they can talk with farmers and write about their success stories.

Receiving Feedback

But writing about science in general and biotechnology in particular is not as easy as it sounds. Mohamed gets the most feedback about his articles from people who do not believe in the technologies he writes about. "I do not know how they can refuse science and the benefits they bring. I think we have to educate them about the importance of new technology particularly to poor people. I feel like blaming myself if the information does not get across."

Nevertheless, Mohamed is optimistic about the future coverage of crop biotech issues in the media. "I can see myself as one of the key journalists explaining key issues. I believe in the technology and how it will help the poor." ❑

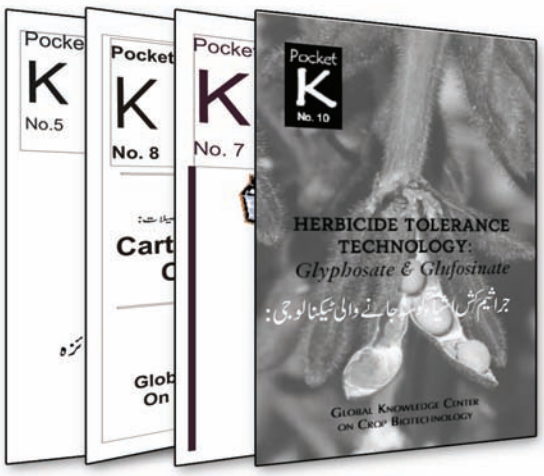
Hafsa Siddiqui

Learning Biotech Advances by Translating Biotech Publications

By M. Iqbal Choudhary

Hafsa Siddiqui is a researcher and translator at the Department of Mass Communication, Karachi University, Pakistan and concurrently a doctoral student in communication. Her primary job is to translate scientific articles from English to Urdu, Pakistan's major language. The translation of important scientific publications enables more people to know about certain developments which otherwise would not be possible for those who cannot understand English or do not have access to these materials.

"About a billion of the world's population are dying from hunger and starvation. People living in third world countries don't have enough food. In Pakistan, newspapers are full of stories of breadwinners committing suicide because they don't have enough money to feed their families, and mothers selling their children to save them from hunger and poverty. This is really an alarming situation in a country where agriculture is the backbone of the economy. Pakistan needs to take necessary steps to reform its agricultural system. This can only be done by educating farmers on the latest methods of cultivation, and new developments in agricultural inputs and research," says the Pakistani translator.



Pocket Ks translated to Urdu.

"In the future we will have a more difficult time in feeding our growing population. We need to use advanced technologies such as biotechnology and genetic engineering, which help in producing food with better quality, better appearance, enhanced nutritional traits, longer shelf life, and crops with resistance to certain pests and diseases. Many countries such as India, China and Brazil have adopted modern technology and have reaped significant socio- economic and welfare benefits," adds Hafsa.

Hafsa's encounter with crop biotechnology as a topic of interest began two years ago. The Pakistan Biotechnology Information Center (PaBIC) commissioned her to translate the Pocket K crop biotechnology series and Briefs published by the International Service for the Acquisition of Agri-biotech Applications (ISAAA).

"At that time," Hafsa recalls, "I was not aware of the achievements of biotechnology especially genetically modified (GM) foods and Bt crops. I thought that genetic modification was harmful to human health and the environment and that it would destroy our crops. I was a lover of organic

and naturally cultivated food, but at the same time I was worried about the food crisis."

Going through the ISAAA publications, Hafsa was inspired by this technology. "My perceptions about biotechnology were clarified and I realized that this technology was developed to meet the food challenges of the 21st century. Biotechnology is technology for the poor population of the world, those who face hunger. I got interested in this technology so I searched for materials, gathered information and wrote articles for newspapers to promote awareness among the general public and policy makers. I wish Pakistan will become part of the stories of Pocket Ks and Briefs. The success stories of Pakistani farmers will inspire others, and they will see Pakistan as an example of how biotechnology can help them. After all, the end users of this technology are the farmers. Awareness among the general public is also needed and PaBIC is doing well along this line. I have attended a media workshop, visited its website, and worked for its newsletter."

"I realized that this technology was developed to meet the food challenges of the 21st century."

Hafsa reiterates that promoting biotechnology is of utmost importance. "Creating awareness among farmers, mass communicators, scientists, and policy makers is very essential, and ISAAA and PABIC are fully committed to this cause. ISAAA is providing a platform to perform this job through knowledge sharing. Scientists are doing their job, but without turning media's attention toward what they are doing, objectives cannot be achieved. PABIC is putting its emphasis on media, which is on the right track." ❑

Edita Burgos

Revolutionizing Media's Role in Biotech Advocacy

By Jenny Panopio and Rochella Lapitan

An epitome of a noble wife who stood by her husband from the time he was a press freedom fighter and later as an agri-biotechnology advocate, is Dr. Edita Burgos (fondly called Dr. Edith), wife of the late Jose "Joe" G. Burgos, Jr., a revered icon in championing Philippine independent journalism. As a vanguard of the "Alternative Press", her husband established the Jose Burgos Media Services that published the WE Forum, *Malaya* (Free), Midday, and *Masa* (Mass Base). For many years, these were the only effective opposition papers of unrelenting pursuit for truth, justice and objectivity during the height of martial law (Philippine Communication Centrum Foundation website). Thus, he was recognized as one of the world's "50 Press Freedom Heroes of the

Century" by the International Press Institute in 2000 (Vanzi, 2003).

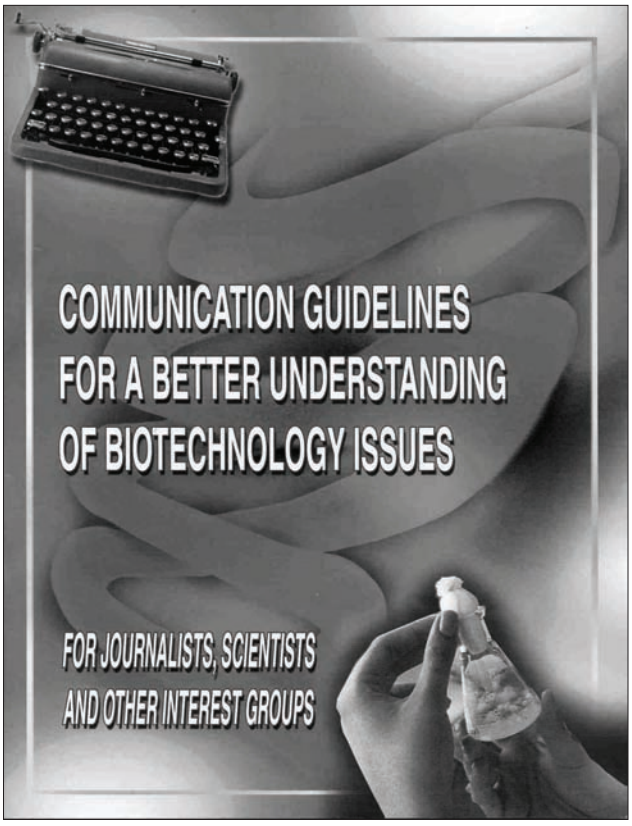
"Right after Martial Law was dismantled and democratic processes were restored in the country, we decided to serve another sector that is least served, and that is the farmer sector," recollects Dr. Edith. In 1988, the couple decided to live a modest life and engage in farming in their 12-hectare farm in San Miguel, Bulacan. "We decided to live a simple life by being farmers and later be able to write for and about farmers," she says. Dr. Edith opted for an early retirement from teaching Home Economics at the University of the Philippines (UP), joining Joe in their farm.

To better understand farming, her husband attended conferences, workshops and agri-trade fairs that would further enhance his understanding on agricultural technologies and practices. "Joe saw that science could help farmers. He saw that farmers need not have a difficult time if only certain technologies were available to them. Joe realized that their exposure to the media can be utilized to bring agricultural information to the targeted users," Dr. Edith says.

As an active farmer and a developmental journalist, Joe then anchored a weekly radio program over DZMM-ABS, *Sa Kabukiran* (In the Farm Fields) which was adjudged as ''The Most Outstanding Agricultural Radio Program'' in 1996. An educator by nature, Dr. Edith joined him in anchoring another agriculture-based radio program in Radyo Veritas where she discussed women empowerment on peasantry-related issues.

Using the mass media, Joe became a partner of research and agricultural development experts through his writings and radio talks which ranged from practical farming methods to the adoption of relevant, affordable and environment-friendly technologies.

"We believed that we would advocate for technologies that could help improve the lives of the farmers and one of these technologies is biotechnology," Dr. Edith mentions. As they started biotechnology communication to the public, they were challenged with the query: "Why would the Burgoses advocate for a technology that is not yet even proven to be safe?" Dr. Edith judiciously says, "We have never heard of anyone who died from eating products of biotechnology. Yet, we have heard a lot about those who died because of starvation. So between the two choices, we decided to serve farmers by making them understand biotechnology before it was too late."



Communication guidelines developed jointly by the Jose G. Burgos Media Services, Inc. and ISAAA.

Bridging the Scientists and Communicators

Dr. Edith and Joe believed that a link "may bridge the science-based information on biotechnology, from the scientists to the communicators, and from the communicators to the farmers." Being long time media practitioners, the couple saw the important role of the media in educating the public on the science and facts of biotechnology. "The media were not well-informed, hence, so were the farmers," Dr. Edith stresses.

To start-up the synergy between the scientists and communicators in bringing credible and factual biotechnology information to the public, specifically to the farmers, the International Service for the Acquisition of Agri-biotech Applications (ISAAA), in collaboration with the Jose G. Burgos Media Services, Inc., developed a handbook on *Communicating Guidelines for a Better Understanding of Biotechnology Issues: For Journalists, Scientists and Other Interest Groups*.

This handbook is a good example of what scientists and journalists can do to help sweep away the biotech information highway of roadblocks and other obstacles. The Guidelines was crafted from the guiding concept of the International Food Information Council Foundation (IFIC) on communicating emerging science on nutrition, food safety and health. In addition, Filipino journalists, through the Philippine Press Institute, provided inputs in the published guidelines relevant to the Philippines (Communicating Guidelines for a Better Understanding of Biotechnology Issues, 2001). Dr. Edith served as the Assistant Project Director of the Jose G. Burgos Media Service's working group when the handbook was published in 2001.

The Biotechnology for Life Media and Advocacy Resource Center

In the early 2000, public understanding and appreciation of biotechnology in the Philippines was generally low. This was further worsened by strong anti-biotech advocacy that waged through the media and at the local level. There were several efforts to support the public information campaign on biotechnology undertaken by various government and non-government agencies, but these were not yet sufficient to create a strong impact on the public.

The Philippines' Department of Agriculture (DA) Biotechnology Implementation Unit solicited for a communication proposal that would set up a "national movement in biotechnology," to strengthen and integrate the existing public information campaign into a pro-active, integrative and aggressive campaign. The J. Burgos Media Services, Inc., together with other players in biotech communication, was actively involved in the conceptualization of the biotech communication program.

However, Joe had an untimely death, and two years after, on January 10, 2005, the Biotechnology for Life Media Advocacy and Resource Center (BMARC), a national multi-stakeholder umbrella of biotechnology agencies that conduct information, education, communication campaign in biotechnology, was born.

"To keep his memory alive – and the kids were begging me to do that, – I decided to continue BMARC," Dr. Edith said. Currently, she manages BMARC as its Executive Director.

The BMARC binds together the government and the private sector through the DA, the Department of Science and Technology's Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (DOST-PCARRD), the Southeast Asian Regional Center for Graduate Study and Research in Agriculture through the Biotechnology Information Center (SEARCA-BIC), the Biotechnology Coalition of the Philippines (BCP), and the J. Burgos Media Services, Inc.

BioLife Magazine features biotech stories for a general audience.

Through collaboration, complementation and coordination, BMARC deploys a multi-media and multi-sectoral approach to public information campaign on biotechnology.

BMARC reaches out to different stakeholders through its BioLife Magazine that features news and stories on biotechnology for a general audience. To date, BMARC has already published 17 issues of this magazine since its launch in January 2005. The SEARCA BIC has been a critical partner as a distribution channel for the magazines to different stakeholders in the countryside through its biotech outreach activities and through its website.

The Jose G. Burgos, Jr. Awards for Biotech Journalism

Biotechnology is a highly technical and abstract science for the media. Thus, communicating biotechnology to the general public is not a simple task for a science journalist. With this in mind, BMARC saw the importance of recognizing science journalists who write accurate and well-researched biotechnology news and features.

Gawad Galing (Excellence Award) is designed to recognize the efforts of journalists in writing stories on biotechnology in national newspapers. Specifically, the Award aims to recognize outstanding efforts of national media practitioners in disseminating information on biotechnology to help motivate and sustain the interest of national media and to help develop public awareness and understanding on biotech," Dr. Edith mentions.

The *Gawad Galing* for Biotech Journalism was launched in 2005 to honor Filipino journalists and establishments popularizing biotechnology through their news reports. Later on, the Award was named after the late Joe Burgos, Jr. The Jose G. Burgos, Jr. Awards for Biotech Journalism is a collaborating endeavor of the BMARC consortium. SEARCA BIC, as member of the consortium, plays a vital role in providing the year-round news clippings on biotechnology from several national dailies. SEARCA BIC monitors media coverage on biotechnology to obtain a general idea of the nature of media coverage that biotechnology gets. These collected news, articles and news features are forwarded to the judges for the Biotech Journalism Award. The SEARCA BIC also sits as a member of the steering committee of the Awards.

"We at the J. Burgos Media Services, Inc. cannot do it alone, we have our partners from the BMARC assisting us for the success of the Biotech Journalism Award. One senior staff from ISAAA was also tapped as one of the judges for the Biotech Journalism Award. She also sits as a technical advisor to the Communication Program of the Department of Agriculture," adds Dr. Edith.

"We must empower the media and provide them trainings to encourage them to write."

During the 2008 J. Burgos Biotech Journalism Awards, ISAAA and SEARCA BIC were conferred with special citations for their exemplary contributions in biotechnology initiatives in the Philippines - ISAAA for brokering the transfer of biotechnology applications in the country and for supporting the National Programs through R&D and capacity building initiatives, and for SEARCA BIC's efforts in promoting public understanding and acceptance of biotechnology in the country.

"It is really a collaborative effort of agencies with a common interest of sustaining and augmenting the positive perception of the public in biotechnology through the recognition of media's contribution. And today, our vision of encouraging the media has tremendously been realized as we see more and more of them writing about biotechnology each year," Dr. Edith says proudly.

The Jose G. Burgos, Jr. Awards for Biotechnology Journalism remains to be the foremost Award that recognizes biotech journalists in the country. Dr. Edith hopes to bring in the community papers and to broaden the range of the Award from print to broadcast media in the years to come. "If we can find partner agencies that may sponsor cash prizes for the entries from community newspapers, many local reporters in the community will be convinced to write about biotechnology," she says. "We should also acknowledge the role of broadcast media in effectively influencing the perception of the public on biotechnology. If they will also be informed and conferred, many of them will be encouraged to spread the word of biotechnology," adds Dr. Edith.

Heading Towards Sustainable Biotech Advocacy

To maintain the positive environment of biotechnology in the country, Dr. Edith also cites that "we must empower the media and provide them trainings to encourage them to write. If we educate them with the contribution of biotechnology and bring them to those with first-hand experiences in biotechnology adoption, then, they will surely write more success stories." She mentions that "we should also extend our relationship with the gatekeepers of media establishments. We may invite the editors and columnists to our outreach activities. BMARC has positioned itself with compelling linkage to the media. Thus, it can be a delivery channel of ISAAA in reaching out to these media people," opines Dr. Edith.

ISAAA has identified the media as a key partner in communicating the benefits of biotechnology. Yearly, ISAAA conducts country media briefings on the highlights of its Annual Review on the global status of commercialized GM/biotech crops. This annual event produces thousands of publications and media and news releases. In 2009, the Philippine media briefing was held in partnership with BMARC, National Academy of Science and Technology (NAST) and SEARCA BIC. The event was attended by several media practitioners from the national dailies resulting in media and photo releases around the country.

Looking forward to sustainable advocacy, Dr. Edith underscores the need for continued partnership among the frontliners of biotechnology advocacy and adoption in the country. "ISAAA should continue to become a persistent broker of biotechnologies, linking various stakeholders from government and private sectors to provide funding for technology generation for the benefit of the farmers. The BIC has established itself as a catalyst of information initiating the networks in the biotech

community. Through its facilitation, the BMARC consortium may work hand in hand in responding to other communication needs. Collaboration, cooperation and networking are needed to address communication issues in the Philippines. Our relationship must be sustained to achieve our common goals," she suggests.

To sustain long-term advocacy, Dr. Edith envisions their group to become a Foundation with established finances reaching out to more and more stakeholders. Truly, Dr. Edith has the heart of her husband in advancing biotechnology revolution in the country. ❑

Wandera Ojanji

Empowering Journalists to Effectively Report on Biotechnology

By Margaret Karembu and Daniel Otunge

He is considered one among the most authoritative journalists on biotechnology in the East African region and for valid reasons. Wandera Ojanji has extensively published solid, well researched and analytical articles on biotechnology since joining journalism 10 years ago, and particularly so over the last three years. And although he found himself in the newsroom by accident, he is not a science writer by accident.

"I was working for a consultancy firm where my work involved a lot of technical report writing and editing. While there, I made a resolve to enroll for a Post Graduate Diploma in Journalism at the School of Journalism and Mass Communications at the University of Nairobi to improve my report writing and editing skills," explains Wandera. "During my internship at the Kenya Forestry Research Institute, I came across very interesting information on forestry and related socio-economic issues requiring public discourse, which inspired me to also start writing for newspapers. The articles appeared to have an impact on the science editor at the Nation Media Group, one of Kenya's largest circulating dailies, who then took me on board as the paper's Science Correspondent."

One of the few journalists in the region who have specialized in science reporting, Wandera's passion for sciences can be traced back to his school days at the prestigious Alliance High School where he deliberately pursued the sciences ending up with a Bachelor's degree in Forestry from Moi University in Kenya.

"Indeed, it is out of this obsession for 'life forms' that motivated my drive for science reporting, especially considering that the Kenyan media hardly recognizes and rewards science journalism," Wandera confesses.

Wandera Ojanji at his office in Nairobi.

Wandera cites the case of *The Standard* and *The Nation* newspapers – the two daily newspapers that boast of having the highest circulation figures both in Kenya and the East and Central Africa region (350,000 and 500,000 respectively), and, which he has previously worked for. "These are the only two newspapers with special sections reserved for science and technology issues. However, these sections do not carry as much weight as other sections such as business, entertainment or politics," he says.

Inadequate Media Coverage on S & T

"It is possible that this low regard for science reporting is partly to blame for the rather poor or inadequate media coverage of science and technology compared to other areas such as politics, sports and business. The coverage is even worse for biotechnology reporting and science in general which is mainly restricted to small science sections in the various newspapers such as *Horizon* in the *Daily Nation* and *Panorama* in the *Standard*."

Wandera believes the low treatment and appreciation of science and technology by many editors and other gatekeepers is partly due to the fact that many of them do not have a science background and therefore lack basic understanding of science and technology issues and crop biotech in particular. Reporting on biotechnology is further complicated by the fact that many would- be-writers find it highly technical and very complex. Worse still, many of the gatekeepers do not appreciate the challenges in science writing.

"Unless the story carries controversy, then it is not a story. Issues are not important. It is the prominence of the people, particularly politicians and not scientists, that makes the news," states Wandera. "Many of the innovations in biotechnology hardly arouse the interest of editors."

Indeed, lack of adequate capacity to comprehend agricultural biotech issues by both writers and editors have been a major contributory factor to the low and oftentimes poor coverage of biotechnology in Kenya and the region.

Things have however been different for Wandera who has combined his professional training as a journalist with his science background to independently and authoritatively report on modern biotechnology, leaving little room for unsubstantiated opinions.

According to Wandera, agricultural biotechnology is just another technological advancement in plant breeding, with certain aspects of the technology, particularly genetic engineering, eliciting high levels of emotions among the general public including even scientists. "But as a writer, I have tried to be as impartial as the profession demands, being fair and objective in my reporting. In my opinion, science is the engine behind plant breeding and development."

Capacity Building Activities

Wandera attributes his better understanding and increased reporting on biotechnology to the various capacity building activities he has benefited

Wandera exchanges contacts with participants during one of the OFAB meetings in Nairobi.

from, conducted by the International Service for the Acquisition of Agri-biotech Applications (ISAAA) *Afri*Center. These have come in different forms – from hands-on trainings to exposure visits in Kenya and abroad.

"I was one of the journalists from the Eastern Africa region who benefited from an intensive media workshop that tested a UNESCO Multi-media training kit (MMTK) in Addis Ababa, Ethiopia in 2006," says Wandera. The workshop, which adopted a participatory approach to learning, brought together biotechnology and media experts to test and localize the Multi-Media Training Kit to improve reporting of the subject using relevant Africa examples. This was made possible through presentations by scientists and the media experts, role play, teaching aids and field visits. In addition, the media trainers evaluated the trainee journalists through individual assignments to gauge their understanding of the issues discussed.

"I had read and written about biotechnology for several years. But, I had never come face to face with genetically engineered crops. This completely changed with my visit to South Africa."

On their part, the journalists wrote articles and/or produced radio and TV news' clips based on presentations and direct interviews with the experts.

And, according to Wandera, adequate learning did take place. "One aspect that I really found valuable in improving story writing skills and style was the thematic area on *Developing New Story Angles* where real biotech-related examples were used to guide the "unpacking" and "packing" process. "Using various press releases and past articles for example, we were able to identify various biotech story angles such as economic, environmental and social benefits; factors motivating expansion of biotech crops' farming; the political and policy implications of biotechnology adoption/non-adoption; biosafety issues; ethical and religious issues; status of biotechnology-globally, regionally and locally; conflicts in biotechnology; public perceptions, among many other story angles, all of which would be very attractive to an editor. This was in sharp contrast with what many of us had cited as obstacles to writing on the subject – highly technical and complex. This particular media training in Addis Ababa greatly changed the way I write on biotechnology – both in style and content," states Wandera. "ISAAA should conduct more of these trainings for journalists as a way of building their capacity and consequently improving the quality and quantity of coverage of the subject."

Wandera was also in the company of Kenyan policy makers and legislators who participated in a biotechnology fact finding mission to South Africa in 2006. "These capacity building activities have made all the difference in my professional career. "I had read and written about biotechnology for several years. But, I had never come face to face with genetically engineered crops. This completely changed with my visit to South Africa. Listening to South African authorities explaining how they have commercialized biotech crops, and the benefits

Printed materials and videos on biotechnology.

they were reaping from the technology, was indeed very reassuring. And, listening to farmers talking about the benefits and how the technology had changed their lives reinforced my resolve to increase writing on the subject and especially on the need for a facilitative legislative process. True to his word, Wandera wrote many articles on the Biosafety Bill process in Kenya that could be attributed to its eventual enactment in February 2009.

"Besides capacity building, ISAAA *Afri*Center has been a very good source of materials and information on issues of crop biotech, particularly the videos on specific crops such as tissue culture banana and cotton, the report on the annual status of commercialized biotech crops, and the website. These have been very useful sources of background information for my articles. I have used these materials to gain deeper knowledge of biotechnology. These have helped me to write my stories using most up-to-date information and to challenge some misconceptions about the technology. I am also a regular attendant to the monthly Open Forum on Agricultural Biotechnology (OFAB) meetings in Nairobi, which have been good sources for my stories."

Indeed, Wandera has never looked back since these trainings and exposure visits. He has been very consistent in his coverage of biotechnology issues. "Besides general coverage, I convinced the *Standard* management to create a special page on biotechnology which turned out to be my column. Known as *BioWatch*, the column ran every Sunday in the *Bizbytes*, a special pullout in the *Sunday Standard*. I also managed to convince the management of the *Standard* on the need for a special pullout on science and technology, which came to be known as *Panorama* that runs every Thursday."

Feedback on Biotech Articles

Wandera's works have not gone unnoticed. "I get a lot of feedback from my stories/writings. There are those who confessed to having developed an addiction and used to buy the Sunday paper only because of the biotechnology column *BioWatch.* Many of my readers would call and write to either complement or differ on some of the analytical pieces."

"I have also been invited to speak on my experiences on reporting agricultural biotechnology at various conferences in recognition of my work - the most recent being at the just concluded *Insect Resistance Maize for Africa, End of Phase II Project* Workshop organized by the International Centre for Maize and Wheat Research (CIMMYT) and the Kenya Agricultural Research Institute (KARI) in Nairobi.

But possibly the greatest feedback (and reward) for Wandera's work was the continental prize on agricultural reporting under the *Outstanding*

BIOTECHNOLOGYWATCH

BIZBYTES

Long road to bill on biosafety

Wandera's Bizbytes article in the Sunday Standard.

Journalism in Agricultural Reporting in Africa category for a biotechnology story he published in the *Standard*.

Wandera received the outstanding print award for his article, "Endangered Species", published on September 2, 2007 in the *BioWatch* column of the Standard newspaper. In this story, Wandera effectively highlighted the plight of diminishing indigenous livestock breeds in Kenya and neighboring countries, and advocated strongly for the conservation of their genetic diversity through research, local breeding programs and policy interventions. 'Endangered Species' is a good agriculture research story and the journalist has done proper justice to a difficult theme," said the judges.

"I get a lot of feedback from my stories/writings. There are those who confessed to having developed addiction and used to buy the Standard paper only because of the biotechnology column BioWatch."

The CGIAR-FARA 2008 Award for Excellence in Agricultural Science Journalism in Africa attracted 49 print and broadcast entries on issues affecting Africa's key crops (banana, cassava, maize, rice) and livestock, namely, biofuels, climate change, the role of biotechnology, food safety, access to fertilizers, pest management and efforts to control noxious weeds such as striga.

Commenting on the award-winning pieces, Francois Stepman, Communications Specialist for the Accra-based Forum for Agricultural Research in Africa (FARA) had this to say *"In this day of information overload, journalists have to be concise, accurate and relevant. They additionally have to present agricultural information attractively and innovatively. Their choice of words and images sometimes has more impact than loads of scientific evidence. "We truly laud the efforts of journalists to inform and educate the public about the importance of issues affecting agriculture in Africa, and solutions offered by research."*

Despite the apparent low coverage of agricultural biotechnology currently being experienced due to heightened political intrigues, Wandera believes this is bound to change for the better especially with the now enacted Biosafety Law and as the technology eventually moves from the laboratory to the farms and to the Kenyan markets. ❑

Hoang Minh Nhat

Using Radio to Disseminate Agri-biotech Information

By Hien Le

Radio the Voice of Vietnam (VOV) is the national broadcasting media station of the Vietnamese Party. More Vietnamese listen to the radio than watch television or read newspapers. Hence, radio is an important communication channel in a country where 70 percent of the population still resides in the countryside. VOV is estimated to reach more than 90 percent of all households.

VOV is keen on broadcasting news about science and technology (S&T) knowing that S&T is a driving force for economic development and a means to help Vietnam develop and integrate with the global economy. The broadcasting time and duration for S & T is equal to that of other programs devoted to political, economical and social concerns.

Mrs. Hoang Minh Nhat is a 54-year old reporter and editor of the Science and Technology Department, VOV1, Radio the Voice of Vietnam, where she has been working for the last 25 years. Prior to her current stint, Nhat was a biology teacher in secondary school for seven years. She graduated from the Agriculture Technology and Biology Department, Hanoi Teaching University in 1976.

Nhat finds translated publications such as Pocket Ks helpful in her job.

Nhat takes the lead in broadcasting 3-4 programs of S&T (25 minutes each) and 2 programs on innovation in S & T. Her programs cover new technology in construction, health, new materials, agriculture, and biotechnology.

Nhat believes that "S & T is a priority in economic development in Vietnam, especially for a knowledge-based economy." She says that "genetically modified (GM) crops are a result of advanced and modern technology. They are high yielding, resistant to certain pests and diseases, and are suitable for use in Vietnam's agricultural environment. However, it's a new technology, hence we broadcast not only to promote its adoption but to tackle issues related to management and regulation."

Covering agricultural biotechnology in Vietnam is not common and is often discussed mostly in academic journals. Inadequate knowledge in this field as well as its difficulty in accessing information are aggravated by the fact that GM crops are not yet commercialized in Vietnam.

Nhat shares her thoughts in broadcasting about biotechnology. It entails transforming science news into an easy to understand format for readers. This is often a difficult task as it involves translating a lot of terminology and making an attractive story. The writer is constrained by his knowledge and understanding of issues, and cannot depend much on the given copy.

Aside from the language, listeners also pay attention to arguments and opinions about S & T so they can make informed decisions. Her stories on S&T are highly appreciated by the science community as being from a trustworthy and reliable source.

Updates Through Workshops

Nhat participated in some activities organized by the International Service for the Acquisition of Agri-biotech Applications (ISAAA) in Vietnam such as media briefings on the status of global biotech/GM crops in 2007 and 2008, and a workshop on the safety assessment of GM crops. She says that these opportunities help her to better understand GM crops, the global status of biotech crops, benefits that the technology can bring, and issues when adopting GM crops.

She has covered stories on such topics as GM food safety, global status of GM crops and its development in Vietnam, and delayed ripening technology. "The role of Agbiotech Vietnam is important in providing news to VOV readers, especially to farmers, scientists, policy makers, students, and the public in general. It is contributing to raising GM crops awareness and development in the country by giving us the latest updates on the technology through the translation of key publications into Vietnamese."

"For a Vietnamese reporter to write an accurate science story, translation of news from English into Vietnamese is a service that must be readily available. Agricultural biotech is a new technology and the information in the Crop Biotech Update targets a specific reader group with enough information to understand. Other translated publications, such as Pocket Ks, the book on *Agbiotech in Vietnam*, and the report on the global status of GM crops are proving to be very useful. Workshops or field visits are also ways to help raise awareness on crop biotechnology. The best and attractive story is one where a reporter actually experiences witnessing facts become reality," says Nhat. ❑

Ashok B. Sharma

Multi-Awarded Journalist Writes About Biotech

By Bhagirath Choudhary and Kadambini Gaur

Mr. Ashok B. Sharma is a veteran and acclaimed agricultural journalist from India. He has been in the writing profession since 1974 and has worked for many years in the newspaper *Financial Express* based at New Delhi. Mr. Sharma worked for 22 newspapers in and outside Delhi and has extensive field reporting experience from Nagpur Ahmedabad, Bhopal and Guwahati.

As an agricultural editor at *Financial Express*, he wrote a weekly column on farm economy known as *Farm Front*. During his career, he won various national and international awards in journalism including the Food and Agriculture Organization (FAO) award for excellence in agricultural journalism, Prem Bhatia Memorial Award for excellence in environmental journalism, and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) award for excellence in science and agriculture journalism. He has extensively travelled to several countries in five continents: Asia, Europe, North America, Latin America and Africa.

Ashok B. Sharma (right) receives ICRISAT award for excellence in science and agriculture journalism.

Mr. Sharma's interest in development issues and concerns for the upliftment of the poor drove him to the profession of journalism. "Science communication should be based on complete unbiased writing weighing the benefits and adverse impact of any technology," he says. Topics for his writing range from various disciplines of agricultural sciences to issues related to commodity market, Intellectual Property Rights (IPRs), World Trade Organization's (WTO) agreement of agriculture, technical barrier to trade and sanitary and phyto-sanitary agreements. Mr. Sharma was instrumental in defending the concerns of developing countries during WTO's Doha Round, saying "I am open to all views as far as policy and support for science and technology articles are concerned."

"Genetically modified crops as part of agricultural biotech is still under debate globally. Pros and cons on the issues related to health and environmental concerns are being raised by critics. In view of these issues, the media should be vigilant in all aspects," he avers. Mr. Sharma has extensively reported these issues in popular media and has never encountered any problems in getting these issues published.

The veteran writer has had extensive interaction with the International Service for the Acquisition of Agri-biotech Applications (ISAAA) over the last nine years particularly with Dr. Clive James on biotech issues and the global status of commercialized biotech/GM crops report. He has been the first to report every year on ISAAA's annual brief on the global status of commercialized biotech/GM crops. "ISAAA has put in its best effort in promoting genetically modified crops in agriculture. But the organization should do an in-depth analysis of

Bt brinjal can resist attack of FSB larvae, safe for consumption: study

Ashok B Sharma
New Delhi, Mar 1

A study conducted by the global pro-GMO lobby, ISAAA, has claimed that Bt brinjal can resist the attacks of the common enemy fruit shoot borer (FSB) larvae and also be safe for human consumption.

The study, co-authored by Bhagirath Choudhary and Kadambini Gaur, said that Bt brinjal hybrids containing cry 1 Ac gene express Bt protein in all parts of the plant throughout its life cycle. To get activated and exhibit insecticidal property, Bt protein must be ingested by FSB.

When FSB larvae feed on Bt brinjal plants, they ingest Bt protein along with plant tissue. In insect gut, it is solubilised and activated by gut proteases generating a toxic fragment. The activated insecticidal protein then binds to two different receptors in a sequential manner.

Quoting extracts from a paper in the American Academy of Microbiology, the study said that the first contact of the insecticidal protein is with the cadherin receptor, triggering the formation of oligomer structure. The oligomer then has increased affinity to a second receptor, amino-peptidase-N (APN).

The APN facilitates insertion of the oligomer into membrane causing ion pores. These events disrupt digestive processes such as loss of transmembrane potential, cell lysis, leakage of the mid-gut contents and paralysis that in turn cause the death of FSB.

The 102-page study entitled - The Development and Regulation of Bt brinjal in India - however, said that Bt brinjal does not harm or pose any threat to higher order organisms and non-target organisms, as they lack specific receptors and conditions for activation of Bt protein in their gut and hence is safe for human consumption.

Apart from Cry 1 Ac gene, Bt brinjal contains a selectable marker, nptII gene, which encodes enzyme neomycin phosphotransferase, Cauliflower Mosaic Virus 35S promoter and aad gene, which encodes for bacterial selectable marker enzyme 3n(9)-0- aminoglycoside adenyl transferase.

Addressing the concern of a possible genetic contamination of non-Bt brinjal, the study said that the maximum distance travelled by pollen could be between 15 to 20 metres and outcrossing could vary from 1.46% to 2.7%.

The study attempted to resolve the issue of the centre of origin of the crop by saying that reports suggested Central and South America as the centre of origin of the species of genus Solanum to which potato and brinjal belong.

It further said that brinjal probably originated from African wild species S incanum, S melongena and was first domesticated in South-East China and taken to the Mediterranean region during Arab conquest in the 7th century. There are studies, which also report that brinjal originated in the Indo-Burma region.

The ISAAA study however noted that as brinjal appears in ancient Indian literature, India may be a secondary centre of diversity, while Africa may be the primary centre. Noted scientist Vavilov, however, regarded India as the original home of brinjal.

The ISAAA study lauded the regulatory system in India and hoped that India would be able to give to the world the first Bt brinjal.

Resistant genetics

- Bt brinjal doesn't harm any higher order and non-target organisms, as they lack specific receptors and conditions for activation of Bt protein in their gut and hence is safe for human consumption
- The study notes that India may be a secondary centre of diversity, while Africa may be the primary centre

Mr. Sharma's Bt brinjal article published in the Financial Express.

concerns on health and environmental issues being raised by the critics of the technology."

Mr. Sharma feels that ISAAA has developed unique communication channels with the media for which it is getting its extensive coverage. Since 2004, he has been involved in various activities of ISAAA including the *International Conference on Agricultural Biotechnology: Ushering in the Second Green Revolution* organized jointly with the Federation of Indian Chambers of Commerce and Industry and M.S. Swaminathan Research Foundation in August 2004 where Mr. Sharma delivered a speech on *Public Acceptance and Consumer Perspective of Genetically Modified Crops*. Later he actively participated in media workshops for training media persons in their reportage on modern biotechnology organized by ICRISAT in collaboration with the Asian Media Information and Communication Center-India, ISAAA and the United Nations Educational, Scientific and Cultural Organization.

The first media workshop where Mr. Sharma was a participant was held in October 2004 in Patancheru, India. It was attended by senior journalists from India, Sri Lanka, Bangladesh and Nepal. Resource persons were biotechnology experts from ICRISAT and communication practitioners from the Philippines and India. Participants wrote articles based on the inputs of resource persons and these were published in their respective newspapers. This workshop was the start of a series of media workshops that targeted writers from India, Bangladesh, and eventually to Niger, Africa where journalists from Burkina Faso, Ivory Coast, Mali and Senegal participated. Knowledge and wisdom gained from the workshops inspired the sourcebook for journalists entitled *Genes are Gems: Reporting Agri-biotechnology*. ❑

REFERENCES

ABSP II Southeast Asia Newsletter, 2006. Vol. 1, No. 12. Journalists Oriented on FSBR Eggplant Technology. Los Baños, Laguna, Philippines.

Bonfadelli, Heinz., Urs Dahinden, and Martina Leonarz, 2007. Mass Media and Public Perceptions of Red and Green Biotechnology: a Case Study from Switzerland. *In* The Public, the Media and Agricultural Biotechnology. Edited by D. Brossard, J. Shanahan and T.C. Nesbitt. CAB International, United Kingdom. Pp. 97-125.

Communication Guidelines for a Better Understanding of Biotechnology Issues. 2001. International Service for the Acquisition of Agri-biotech Applications (ISAAA). 30 pp.

Jose G. Burgos Jr. Awards for Biotech Journalism Program. 2006. Quezon City, Philippines.

Juanillo, Napoleon. 2003. The Social and Cultural Dimension of Agricultural Biotechnology in Southeast Asia: Public Understanding, Perceptions, and Attitudes Towards Biotechnology. University of Illinois at Urbana-Champaign and the International Service for the Acquisition of Agri-biotech Applications (ISAAA).

Navarro, Mariechel and Monina Villena. 2005. Understanding the Agri-Biotechnology Debate in Asia through Reportage in the Print Media. International Service for the Acquisition of Agri-biotech Applications Southeast Asia Center. 36 pp.

Navarro, Mariechel and Monina Villena. 2004. Media Monitoring of Agri-Biotechnology in the Philippines: Understanding the Media Debate. The Philippine Agricultural Scientist. Vol. 87, No. 4. University of the Philippines Los Baños, College, Laguna, Philippines. Pp. 327-337.

Nordenstreng, K. 2001. Something to be Done: Transnational Media Monitoring. Paper presented during the conference on the Ethics of Journalism: Comparison and Transformations in the Islamic-Western Context in Berlin. http://www.tbsjournal.com/Archives/Spring01/nordenstreng.html. (Accessed November 16, 2008).

Philippine Communication Centrum Foundation. Jose G. Burgos. http://www.aijc.com.ph/PCCF/mediamuseum/who%27who/whos%27who-comm-print-burgos.htm (Accessed March 16, 2009).

RECOAB News. 2008. Burkina Faso.

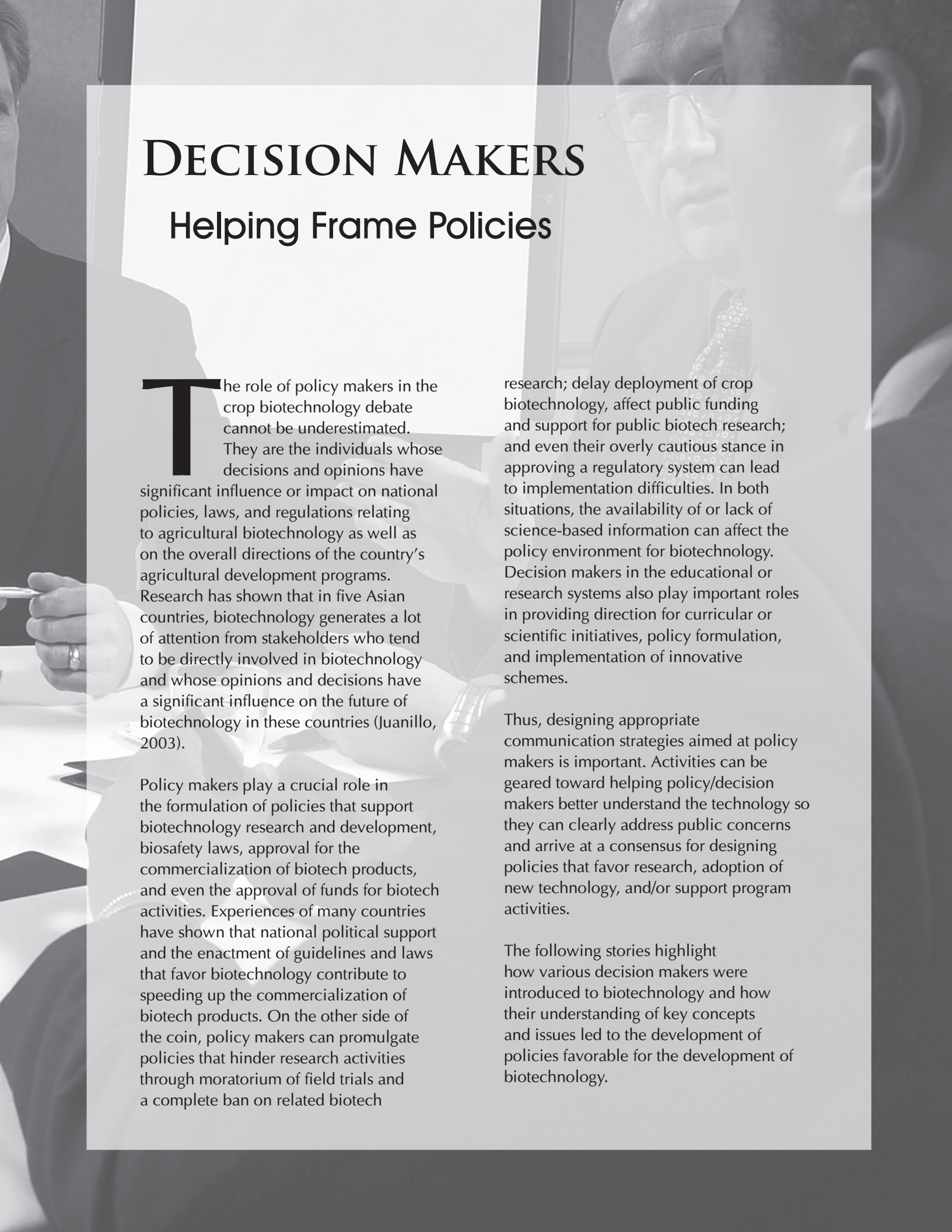
SEARCA Biotechnology Information Center Reports, 2002-2008. Los Baños, Laguna, Philippines.

Scheufele, Dietram. 2007. Opinion Climates, Spirals of Silence and Biotechnology: Public Opinion as a Heuristic for Scientific Decision-making. *In* The Media, the Public and Agricultural Biotechnology. Edited by D. Brossard, J. Shanahan and T.C. Nesbitt. CAB International, United Kingdom. pp. 231-244.

Science and Engineering Indicators 2008. http://www.nsf.gov/statistics/seind08/c7/c7sl.htm (Accessed November 16, 2008).

Torres, Cleofe, Ma. Theresa Velasco, Maria Celeste Cadiz, and Rhodora Ramonette de Villa. 2006. Public Understanding and Perception of and Attitude Towards Agricultural Biotechnology in the Philippines. International Service for the Acquisition of Agri-biotech Applications, Southeast Asian Regional Center for Graduate Study and Research in Agriculture, and College of Development Communication, University of the Philippines Los Baños, College, Laguna, Philippines. 100 pp.

Vanzi, Sol Jose, 2003. Jose Burgos Jr, Press Freedom Icon Dead at 62. The Philippine Star. November 17, 2003.



Decision Makers

Helping Frame Policies

The role of policy makers in the crop biotechnology debate cannot be underestimated. They are the individuals whose decisions and opinions have significant influence or impact on national policies, laws, and regulations relating to agricultural biotechnology as well as on the overall directions of the country's agricultural development programs. Research has shown that in five Asian countries, biotechnology generates a lot of attention from stakeholders who tend to be directly involved in biotechnology and whose opinions and decisions have a significant influence on the future of biotechnology in these countries (Juanillo, 2003).

Policy makers play a crucial role in the formulation of policies that support biotechnology research and development, biosafety laws, approval for the commercialization of biotech products, and even the approval of funds for biotech activities. Experiences of many countries have shown that national political support and the enactment of guidelines and laws that favor biotechnology contribute to speeding up the commercialization of biotech products. On the other side of the coin, policy makers can promulgate policies that hinder research activities through moratorium of field trials and a complete ban on related biotech research; delay deployment of crop biotechnology, affect public funding and support for public biotech research; and even their overly cautious stance in approving a regulatory system can lead to implementation difficulties. In both situations, the availability of or lack of science-based information can affect the policy environment for biotechnology. Decision makers in the educational or research systems also play important roles in providing direction for curricular or scientific initiatives, policy formulation, and implementation of innovative schemes.

Thus, designing appropriate communication strategies aimed at policy makers is important. Activities can be geared toward helping policy/decision makers better understand the technology so they can clearly address public concerns and arrive at a consensus for designing policies that favor research, adoption of new technology, and/or support program activities.

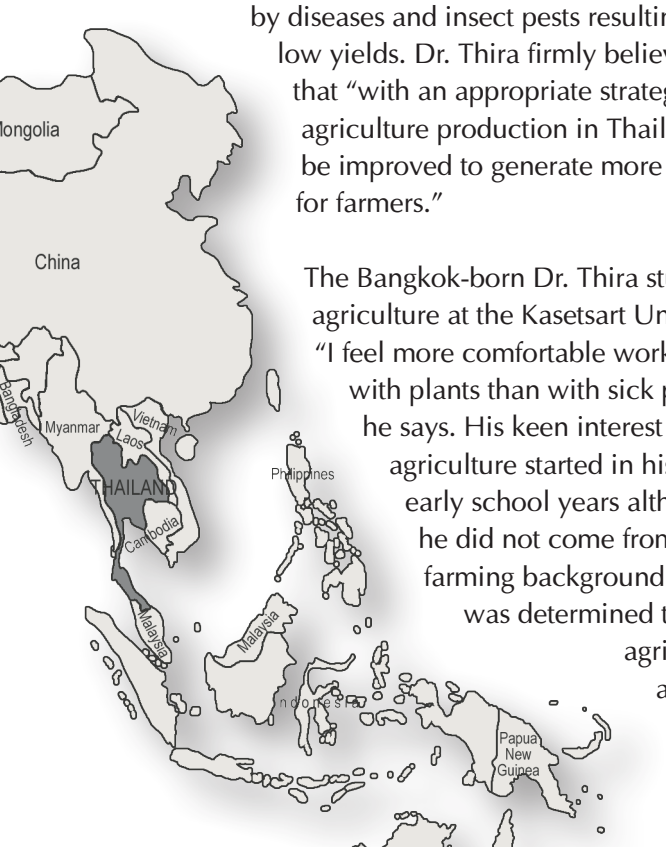
The following stories highlight how various decision makers were introduced to biotechnology and how their understanding of key concepts and issues led to the development of policies favorable for the development of biotechnology.

Thira Sutabutra

Agriculture Minister Supports Biotechnology

By Supat Attathom

It is not often that a country's Agriculture Minister is a scientist by training and has actually done research with plants enough to understand the importance of biotechnology in improving a country's agricultural productivity. But that is exactly what Dr. Thira Sutabutra was when he became Thailand's Minister of Agriculture and Cooperatives from October 2006 to February 2008. He provided national leadership to a country that is a major exporter in the world rice market and which produces significant amounts of tapioca, rubber, grain, and sugar. Geographically, Thailand is situated in an area suitable for crop production and is hardly affected by natural catastrophes such as drought, tropical monsoons and flooding. However, crop production in the country is still affected by diseases and insect pests resulting in low yields. Dr. Thira firmly believes that "with an appropriate strategy, agriculture production in Thailand can be improved to generate more income for farmers."



The Bangkok-born Dr. Thira studied agriculture at the Kasetsart University. "I feel more comfortable working with plants than with sick people," he says. His keen interest in agriculture started in his early school years although he did not come from a farming background. He was determined to study agriculture as he realized that "agriculture is very important in a country's development and a significant number of Thais are farmers." Through a government scholarship which was awarded to him in his junior year in college, he was able to study at the University of California, Davis where he finished his B.S. (Hons), M.S. (Plant Pathology) and Ph.D (Plant Pathology) in 1964, 1965 and 1968, respectively.

After graduation, he joined the Department of Plant Pathology at the Kasetsart University where he worked until his retirement in 2002. He spent most of his time working on plant diseases, particularly virus and phytoplasma diseases of crop plants such as ornamental plants (orchids), food crops (rice, corn, sugarcane, tomato, and yard long bean), and fruit crops (longan and citrus). He received several awards for his research accomplishments, particularly on Mycoplasma, the causal agent of Witches' broom disease of longan, and his characterization of the cowpea aphid-borne mosaic virus, from various academic institutes including Kasetsart University, University of California Davis, and the National Research Council. The researcher became the President of Kasetsart University from 1996 to 2002.

A Minister's Support for Biotechnology

Dr. Thira's assent to become the Minister of Agriculture and Cooperatives in 2006 under the Cabinet of Prime Minister Surayud Chulanont was in recognition of his managerial prowess as rector of a premier university and his agricultural background. He was expected to continue implementing Thailand's National Biotechnology

Policy Framework 2004 - 2011 of which one of six goals was to promote the country as "kitchen of the world" by maintaining and enhancing its competitiveness in agriculture and food industries. The biotech framework stipulates that "by the year 2011, biotechnology will be playing a vital role in the country's development in line with government policy and the national agenda, which encompasses sustainable competitiveness, healthcare for all, equitable income distribution and a self-sufficient economy. The emphasis will be placed on applying core technologies, e.g. genomics, bioinformatics, plant and animal breeding by means of molecular markers to accelerate development in the following areas: agriculture/food, medical and care, environment protection, new knowledge creation for the development of higher value-added products, as well as for knowledge-based policy and strategic planning" (The Nation, 2006; Business in Asia).

Biotech as Tool to Create Crop Diversity

Dr. Thira is a strong supporter of science and technology in agriculture. As Chairman of the Board of the National Research Council for Agriculture, agricultural biotechnology was emphasized, particularly on biocontrol of insects and diseases, and value added for rice and other raw materials. "I strongly emphasized that agriculture needs technology such as biotechnology as a tool to create diversity for an efficient crop improvement technique. We need varieties that are resistant to diseases and insects. We also need varieties which have better nutritional values for daily diets," he explains.

"As a plant pathologist, especially as a virologist, the best thing we can do is to tell the farmers to remove virus infected plants from the field. How can you help them if the whole tomato or chili pepper fields are infected?" asks Dr. Thira. "Thailand is the paradise of plant virus diseases because crop plants can be grown all year round and at the same time, pathogens and their vectors

"I strongly emphasized that agriculture needs technology such as biotechnology, as a tool to create diversity for an efficient crop improvement technique."

are always there. There is no winter break for diseases and insect vectors. Papaya is a good example. We attempted for more than 20 years to develop a variety resistant to papaya ringspot virus (PRSV) but without much success. This is the reason why we are interested in biotech crops. Any crop that can resist insects and diseases will be the key solution for tropical agriculture."

To this day, Thailand still faces opposition to the introduction of biotech crops for agriculture production particularly from cause-oriented groups. The country placed a moratorium on field testing of biotech crops as a result of the cabinet decision in April 2001. "The cabinet decision is basically equivalent to a law and thus, nearly impossible to overturn," Dr. Thira explains. "As the Minister of Agriculture and Cooperatives at that time, I wanted very much to remove this barrier that had a negative impact on the development of agricultural biotechnology." To be able to do so, he formed an alliance within the cabinet members including Ministers from Science and Technology, and Natural Resources and Environment and re-submitted the case for cabinet consideration. In addition, groups of farmers that had undergone biotech workshops with the Thailand Biotechnology and Biosafety Information Center (BBIC) submitted a petition to the Prime Minister and cabinet members including Dr. Thira to allow field testing and planting of biotech papayas to control PRSV. Representatives from the BBIC, Biotechnology Association Alliance, and other groups testified in front of the Congressional Sub-committee on Agriculture of the Department of Agriculture on the benefits of biotech crops and received positive endorsement. With

all these efforts, the cabinet decided in November 2007 to allow field testing of transgenic plants with restricted measures. Thailand eventually revoked the ban on biotech field trials in December 2007 but the government and private stakeholders still consider the new requirements too restrictive. At present, the Ministry is working on the proposal to allow the field testing of papaya. The draft National Biosafety Framework is currently at the Office of the Council of State for legal review which is expected to be concluded in 2009 (USDA Gain Report, 2008).

Live Classroom Approach

The workshops organized by BBIC to orient papaya farmers on the need to find alternative ways to combat the PRSV disease problem are done at Kasetsart University using the "live classroom" approach. Here farmers are briefed on the process of developing a biotech crop from the laboratory to contained field level stage not only to demonstrate the science-based process of product development, but to show the benefits of planting such a crop when compared with the traditional varieties that are prone to certain diseases. Participants of these workshops are empowered with sufficient information to make decisions as exemplified by the farmers who submitted a petition to the government to allow field testing.

"The International Service for the Acquisition of Agri-biotech Applications' (ISAAA) report on the global status of commercialized biotech/ GM crops has proven to be very useful," says Dr. Thira. He also receives regular copies of BBIC publications such as its quarterly newsletter that highlights activities and developments in crop biotechnology. Dr. Thira serves as advisor of the BBIC newsletter.

Dr. Thira's ties with ISAAA had actually started as early as when he was still the President of Kasetsart University. He hosted the First Papaya Biotechnology Network for Southeast Asia in March 1998. This workshop was co-organized by ISAAA and attended by researchers from Thailand and neighboring

Farmers discuss issues regarding genetically modified organisms in a BBIC-sponsored workshop.

countries such as Malaysia, Indonesia, Vietnam and the Philippines. It was intended to utilize modern biotechnology to solve the PRSV problem in the region. As a follow up to that activity, BBIC was established in 2000 to facilitate information dissemination within and outside the country. Dr. Thira fully supported its establishment and subsequent activities such as a series of seminars and workshops for various stakeholders to enable them to better understand the benefits and concerns regarding biotechnology.

The Future for Crop Biotechnology

Thailand has a long history of supporting biotechnology and was a leader in the region for a time. The ban on field testing and commercialization of biotech crops continues to slow down research and development initiatives in biotechnology. "Sooner or later the country may lose its competitiveness in crop production. I have no doubt about the food safety aspect of biotech papaya," said Dr. Thira. "But we want to make sure that it will retain its resistance to PRSV under field conditions. That's why we need to bring back the field trial of biotech plants. And if we don't do it now, we may have to buy GM seeds from outside within 10 years," Dr. Thira adds.

The former Agriculture Minister mentions that Thailand still lacks a critical mass in specialized areas such as biotechnology. "The country remains weak in basic research due to the lack of incentives for researchers. Current research topics are geared toward immediate problems demanded by users. It is quite difficult for the public to appreciate any product, particularly those derived from basic research such as the biotech plant, amidst the strong opposition by pressure groups. ISAAA has done a very good job in disseminating information and educating the public through various mechanisms. It can't happen in one day but sharing of efforts by concerned parties as what ISAAA is doing will be the key to success," Dr. Thira concludes. ❑

Alfred Nderitu

Reaching Out to the Legislature

By Margaret Karembu and Daniel Otunge

For a man who grew up watching his father struggle miserably with rice growing, it is not surprising that Hon. Alfred Nderitu, a former Kenyan legislator, has dedicated his energy and resources in trying to fight for the improvement of agricultural practices in the country.

"The sad childhood memories are partly what drove me into politics, to fight for the rights of rice farmers, whom I believed, were being grossly exploited from "cooperative" rice farming. My father was a rice farmer. And like many others in the Mwea Irrigation Scheme in Central Kenya, they were receiving negative returns year in, year out. It was unbelievable that one could dedicate his entire time to farming and yet end up with huge debts due to the oppressive regulations and controls, more importantly poor quality seeds," Nderitu sadly narrates.

He recalls that anyone who attained the age of 18 years was thrown out of the scheme. "The farmers were not even allowed to build permanent houses because they were simply tenants," he exclaims.

"I saw the need to change some of these draconian rules and laws," states the 51-year old Hon. Nderitu who joined Parliament in 1997. And he is proud of his 10 years that he spent as a member of the Legislative House for he believes he made the change he so passionately desired – that of improving the livelihood of many rice farmers. "Rice farming is now a more profitable venture," he says.

However, Nderitu believes farmers are not getting the best returns to their investment due to the many production constraints such as low quality seed, pests and diseases and erratic weather conditions.

According to Hon. Nderitu, biotechnology can address some of these constraints to increase productivity. He takes issue with some non-

government organizations (NGOs) and others opposed to the technology, challenging them to talk from a point of knowledge. To emphasize this point, he recalls a widespread opposition from a section of bankers in Kenya in the nineties who were opposed to the introduction of computers because they felt it would render them jobless. "A former head of state in Kenya was even opposed to mobile phone technology! These are the same unfounded fears shrouding modern biotechnology," states Hon. Nderitu. "Let them visit India which is becoming the greatest producer of biotech cotton."

Equally, farmers in Kenya, through biotechnology, would significantly increase their farm productivity. "Through fighting major crop pests like the African bollworm for example, I have learned from the experimental trial site being conducted by Kenyan researchers at the Kenya Agricultural Research Institute (KARI) center in Mwea that application of biotechnology can raise cotton yields by over 20 per cent more than the conventional one even without the adapted germplasm."

And the *mheshimiwa* (Swahili for an honorable member of parliament, past and current) believes he has gathered enough evidence from farmers commercially growing and trading with biotech crops. "I had rubbed shoulders with all kinds of farmers - small and large or so, I thought, but what I experienced in the United States of America (USA) changed my entire perception of farming and agriculture in general."

U.S. and South Africa Tour of Biotech Farms

In October 2008, Hon. Nderitu, was lucky to be facilitated by the International Service for the Acquisition of Agri-biotech Applications (ISAAA) *Afri*Center to represent Kenyan farmers at the World Food Prize awarding ceremonies in the USA. The World Food Prize is an international award recognizing the achievements of individuals who have advanced human development by improving the quality, quantity or availability of food in the

"I had rubbed shoulders with all manner of farmers - small and large or so, I thought, but what I experienced in the USA changed my entire perception of farming and agriculture in general."

world. The prize was created in 1986 by Nobel Peace Prize Laureate Norman Borlaug (who is also a patron of ISAAA), and recognizes contributions in all fields involved in the world food supply – food, and agriculture, science and technology, manufacturing, marketing, marketing, nutrition, economics, poverty alleviation, political leadership and the social sciences. As well as recognizing personal accomplishments, Borlaug saw the prize as a means of establishing role models who would inspire others.

While in the US and as part of the event, the *mheshimiwa* had a chance to visit farmers growing biotech crops. One farmer, a Mr. Gerald, had over 12,000 acres of biotech maize and over 5,000 acres of biotech soybean. His neighbor had 24,000 acres of biotech maize and over 12,000 acres of biotech soybean.

"I was amazed at how these farmers have flourished through growing of biotech crops. For one, they do not own the land, but have leased it from the Government at a rate of US$6,000 per year per acre. Each farmer has about five farm employees spending about US$2,000 monthly on wages with a mere farm laborer pocketing at least US$150 per month."

But what impressed *mheshimiwa* the most was the fact that farmers did not grow to sell to the government or private companies unless on contract. "Farming is an industry. The produce, be it maize, soybean or milk for those in the dairy sector, is processed right at the farm. It is the processed (value-added) product that is marketed,

and in most instances, under contract from consumer chain outlets."

And he quickly compares this practice with the situation in Kenya. "With the exception of a few multinationals in the tea, coffee and fresh produce sectors (e.g. Del Monte in Central Kenya with pineapples), and maybe former colonial farms like the Delamere (in the Rift Valley), the rest of Kenyans in the agricultural sector are mere spectators, " states Hon. Nderitu. "In America, commercial farming is heavily entrenched in the agricultural practice. This cannot be said of the Kenyan growers."

Further, Mr. Nderitu reckons that the American experience only managed to consolidate his resolve for the adoption of genetically modified (GM) crops in the country. He had been to South Africa in 2006, in another ISAAA *Afri*Center facilitated exposure visit for policy makers from Kenya and Malawi. The high level fact-finding study tour for decision makers, which was co-organized by AfricaBio (South Africa), the African Biotechnology Stakeholders Forum (ABSF-Kenya), BioEROC (Malawi) and ISAAA *Afri*Center took place in May 2006. It was attended by a total of 24 participants from three African Countries (Kenya, Malawi and South Africa), half of whom were members of Parliament from the respective countries. Topics covered during the workshop included: an introduction to biotechnology; status of biotechnology in Africa; overview of small scale farmers' biotech projects in South Africa and the government's perspectives on biotechnology and biosafety among several others.

As part of the intensive 5-day program, delegates visited Bt white maize demonstration sites in the Soweto and Olifantsvlei area and saw first hand the potential benefits the biotech maize could bring for small-scale farmers in areas where stalk borer damage is a limiting production factor.

Parliamentarians on a tour of a Bt cotton trial in KARI Mwea during the Biosafety Bill process.

The delegations were also provided with an additional opportunity of participating in a one-day field trip to Makhatini Flats in the Kwazulu Natal province of South Africa on the eastern coast of the country. This trip allowed them to see, touch and feel the Bt cotton grown by small scale farmers and to discuss with them, the role the technology played in cotton production on their farming enterprises. The delegates also visited the Makhatini research farm, under the KwaZulu Natal Department of Agriculture, and two other small scale cotton farms. The visit occurred during the harvest season and delegates were able to have a one-on-one discussion with the farmers and researchers.

"I listened to the South African government officials talk about their bold decision to commercialize GM crops in the country after setting up the necessary regulatory mechanisms to ensure safe and responsible use of the technology. In the biotech maize and cotton fields, I listened to farmers speak about their change of fortunes since adopting GM crops. Joseph Buthelezi's story, the chairperson of the Ubongwa Farmers' Association, which he told us represents more than 4,000 small-scale farmers in the Makhatini region was

Hon. Alfred Nderitu (holding corn) with other legislators in South Africa discussing Bt maize with a farmer.

the most fascinating. "Before I started using this Bollgard cotton seed, the bollworm was harvesting my crop, literally! Bt cotton has changed my life as a small-scale farmer and that of my fellow Union members. I used to work every day of the week, getting exposed to dangerous chemicals and at the same time realizing very little income, but not any more. My yield has more than doubled, he said. And the story was the same for another farmer - Jabulile Gumede, from the same area, said that the Bt cotton had contributed significantly to her farm's cost-effectiveness, sustainability and productivity due to the reduction of farm input costs but most importantly pesticides and the reduction in the number of sprays. "We now spray twice compared to more than ten times when we were planting conventional cotton the farmers told us."

While this workshop was intended to concentrate on general biotechnology awareness and the visual demonstration of the technology, issues pertaining to food security, policy and the regulation of the technology took center stage. A key message from the delegates was the need to converge science and politics in the African region.

And Hon. Nderitu made a resolve and an obligation that when he got back home, he would play his part, especially through the mobilization of relevant Parliamentary Committees on Agriculture, Health and that of Education, Science and Technology to ensure that Parliament enacts the necessary legislation for the commercialization of biotech crops in Kenya. True to his word, Nderitu championed the cause for the Biosafety Bill to its eventual tabling and debate in Parliament. Although Parliament adjourned just before voting for the Bill, the *mheshimiwa* is very proud to have been associated with the highly informed contributions from his fellow that characterized its extensive debate both in Parliament and outside.

He argues that while GM crops or biotechnology is not the panacea for the world food crisis, biotechnology is the future for agriculture. "It has enormous potential to greatly increase productivity and help solve major production constraints. With biotechnology, the country has the potential to be self sufficient in cotton production and even produce surplus for export considering that there is a lot of idle land suitable for cotton growing. All it requires is making the 'bold decisions' to acquire the right technologies, like India has done with Bt cotton, and the Government playing its rightful role of developing enabling policies and support," says Mr. Nderitu.

Message Maps

He believes much of the opposition to biotechnology in Kenya and indeed in the continent is based on misinformation. He says there is need for organizations like ISAAA and others in the know to fast track the passing of right information and knowledge on biotechnology to farmers.

Hon. Nderitu applauds another ISAAA initiative he believes was instrumental in guiding debate on the Biosafety Bill and its eventual approval

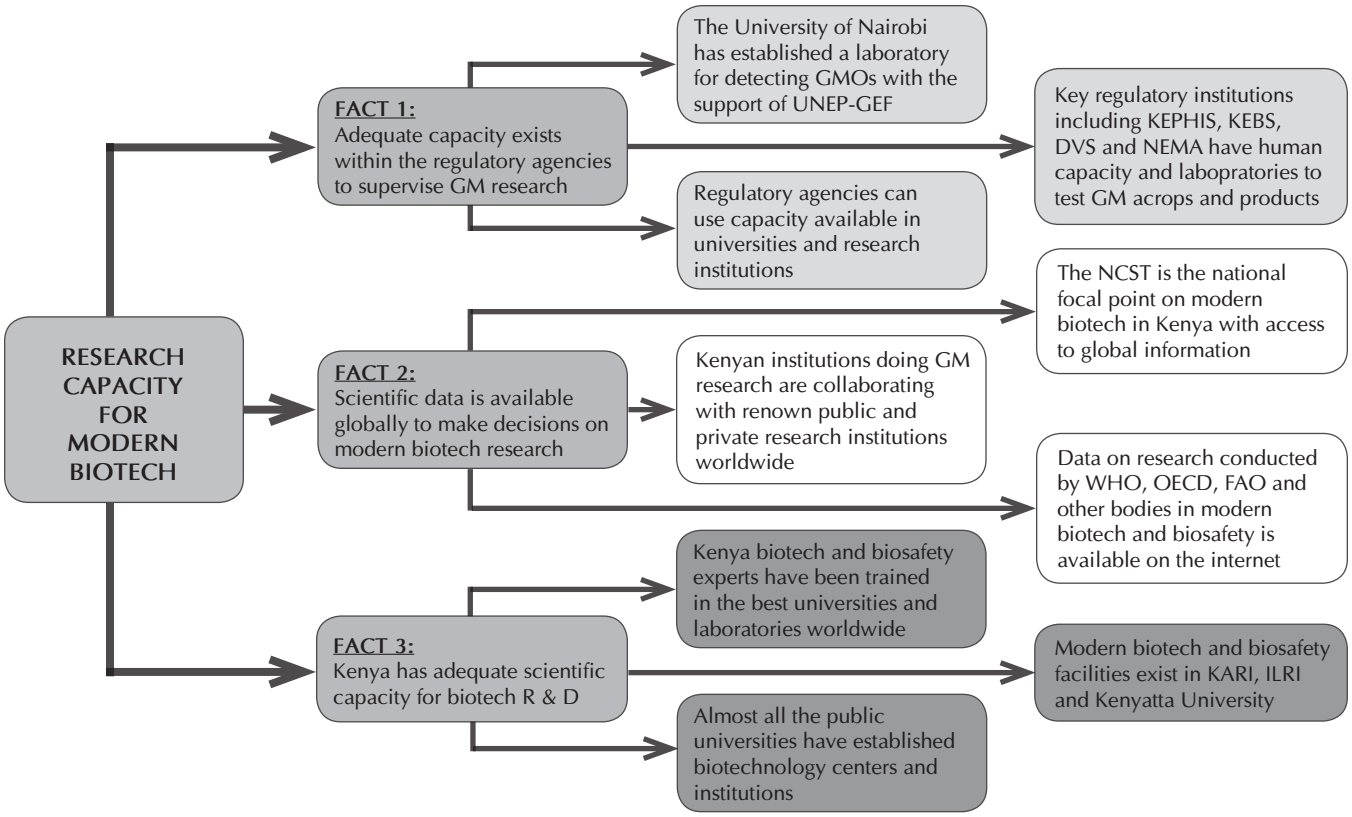


Figure 1. Message map on research capacity for modern biotech in Kenya.
Acronyms: DVS – Directorate of Veterinary Services; FAO – Food and Agriculture Organization; ILRI – International Livestock Research Institute; KARI – Kenya Agricultural Research Institute; KEBS – Kenya Bureau of Standards; KEPHIS – Kenya Plant Health Inspectorate Service; NCST – National Council for Science and Technology; NEMA - National Environment Management Authority; OECD – Organization for Economic Cooperation and Development; UNEP-GEF – United Nations Environment Programme-Global Environment Facility; WHO – World Health Organization

by Parliament in 2008 – the *Message Maps*. "We politicians do not have time to read and digest big scientific reports given the majority do not have a basic science background in the first place. Not only did those message maps aid our understanding of what my fellow parliamentarians thought was a very complex topic but exposed them to the bigger picture of the world of biotechnology with crispy facts and statistics both in-country and globally. They (message maps) responded to many of the concerns thus building confidence in the technology, good enough to diffuse the many doubts of more and more members of the National Assembly," explains Hon. Nderitu.

Message maps are tools for presenting facts and figures on a particular subject that end-users or those directly involved consider highly technical or of major public concern in a format that facilitates quick reading and comprehension. In the period leading to the tabling of the Kenya Biosafety Bill for enactment by Parliament (2006 to 2008), ISAAA *Afri*Center in collaboration with local experts developed a variety of biotech Message Maps targeting parliamentarians and high-level policy makers. The one-page messages aimed at contributing to a better understanding of the various concerns related to modern biotechnology

and biosafety in view of heightened and polarized debates on the subject that was creating a lot of fear thus impeding informed decision making on the same. The messages developed covered the following key topics with reference to Kenya:

- Governance of modern biotechnology
- Legislation on biosafety
- Field trials of modern biotech crops
- Research and scientific capacity for modern biotechnology
- Modern biotechnology and trade implications
- Global adoption and status of commercialized GM crops
- Food and feed safety of biotech products
- Benefits of Bt cotton
- Modern biotechnology and the subsistence farmer
- Modern biotechnology and the environment
- Biotech crops and Intellectual Property Rights (IPRs)

More and more countries in the region for example Burkina Faso, Mali and Egypt have since localized the message maps to suit their situation.

And the *mheshimiwa* has some advice to ISAAA: "Besides these initiatives, ISAAA needs to devise ways of ensuring that farmers can have access to their other invaluable information and knowledge resources on biotechnology such as videos with experiences from other countries (Bt Cotton in India and China) and publications such as the Global Status of Commercialized Biotech/GM Crops that I believe can build confidence in farmers and other stakeholders." He however, notes that while the information can easily be understood by policy makers, the materials particularly the printed ones and those on the ISAAA website need to be simplified to a level that is easily understood by most farmers and those without a University education.

Biotechnology Crusader

He is of the opinion that ISAAA and its collaborators need to come up with an initiative that particularly targets farmers to diffuse the fears and anxiety that have been created by gross misinformation. "There is need to establish local biotechnology information and education centers at every administrative district or even at the Constituency level. In addition, there is need for massive public campaign and awareness creation about the real attributes of biotech crops and products."

Hon. Nderitu, who has turned himself into a biotechnology crusader, is not disappointed with his awareness campaigns. "People are positive about the technology and keep asking me when the Bt cotton is going to be commercialized. All I get is positive feedback."

For the *mheshimiwa*, there is no turning back on the technology - he has taken on what is currently available in the country and already, four acres of his land is under tissue culture bananas. A civil engineer by profession, Hon. Nderitu has a lot of faith in biotechnology that he is contemplating leasing at least 1,000 acres of land from the Government that he would develop into a demonstration farm for biotech crops. And he has transformed himself into "thinking big" so he says. By Kenyan standards, "I am a commercial farmer. What I earn from farming is far much more than my pension. For instance, I have been earning close to Ksh 140,000 (USD 1,800) per week over the last six months from my five acres of mango trees, which is mainly for export."

He was excited over the President's assent to the Biosafety law in February 2009 and hopes for its quick actualization to stimulate commercialization of biotech crops in Kenya. ❑

Zaidah Binti Mohd Yusoff

Educating the Young to Appreciate Biotech

By Mahaletchumy Arujanan and K. Cheng Liew

Zaidah Binti Mohd Yusoff is one of the foremost science educators in Malaysia. After earning a Diploma Science in Education and BSc. (Hons) in Biology (Major) and Biochemistry (Minor) from Universiti Sains Malaysia, she forged her way through being a secondary school teacher between 1977 to 1997. Today, she is the Assistant Director and Chief of the Elective Science Unit, Science and Mathematics Section of the Curriculum Development Division (CDD) where she plays a central role in designing and developing the curriculum for national upper secondary schools in the four elective science subjects: biology, chemistry, physics and additional science. The CDD is vital in disseminating and implementing the curriculum, monitoring curriculum implementation, developing support materials for the curriculum, and evaluating and enhancing the quality of the curriculum to meet current requirements and future trends of the nation.

With the Malaysian government's concerted thrust in developing the biotechnology industry, the CDD has been enhancing and developing a curriculum to support the government's vision. Through the science curriculum that is designed and developed with learning areas for biotechnology, teachers will then be able to impart knowledge and skills to students. Where appropriate, emphasis will be placed on the applications of biotechnology, its impact on everyday life, current issues in biotechnology, the history of biotechnology, the nature and practice of biotechnology, ways of scientific thinking, and designs of experiments which will be more interesting and relevant to students. To further stimulate a culture with an enthusiasm and interest for biotechnology, and an appreciation for scientists, activities and programs are being planned for teachers and students. In Zaidah's words, "We are educating the young who are learning science to become future specialists in the biotech field."

Role of Science and Technology

As a secondary school educator, Zaidah is very optimistic with regards to the role of science and technology, citing it as a powerful influence on our daily lives, with almost every segment of human society, especially social, economic and medical aspects revolving around it. "One example would be the invention of the mobile phone," she comments. "Its influence is almost inseparable to most people living today."

"I also believe that research is an on-going process in designing and creating technologies that can solve problems and improve life," she says.

Zaidah (left, second row, wearing glasses) participates in biotech dialogue.

"This is why while designing and developing the science curriculum at CDD, we hope to provide students with the knowledge and skills in S&T while enabling them to solve problems and make decisions in everyday life based on scientific attitudes and values. We also make sure that the curriculum also aims at developing a concerned, dynamic and progressive society with an S&T culture that values nature and works towards preservation and conservation of the environment."

However, in this respect, she is also concerned about the directions and risks of future S&T. Being concerned about the effects of biotech products as double-edged swords, Zaidah is vocal about both positive and negative aspects of the technology. Where people are being optimistic about technology, she maintains a skeptical outlook preferring for the science to speak for itself. However, she also notes that "crop biotechnology scientists need to tackle many issues such as ethical, social and legal issues as well as production issues. There is a pressing need for greater dialogue and understanding on biotechnology."

Spreading the Word

Zaidah is innately involved in spreading the knowledge of biotechnology to the various educators under her charge. She has organized visits, talks and workshops on biotechnology for secondary school teachers and CDD officers with scientific background through extensive collaboration spearheaded by the Malaysian Biotechnology Information Center (MABIC) to ensure a greater understanding of the subject matter. To achieve such means, she has extensively collaborated with various biotech organizations including MABIC and research organizations such as the Malaysian Palm Oil Board (MPOB), Forestry Research Institute Malaysia (FRIM), and Malaysia Agricultural Research Development Institute (MARDI).

"With the knowledge gained they (the teachers) are more confident to teach and now they can do something different in their classrooms like sharing knowledge and establish more practical hands-on activities."

Among the various talks she has organized with the assistance of MABIC include biotechnology workshops for teachers at the National Science Center, seminar for teachers and CDD officers on *Teaching Biotechnology in School: The Effective Pedagogy* at the CDD, Ministry of Education, workshop for teachers on tissue culture technology at FRIM, and another biotechnology workshop for teachers on *Enhancing Effective Pedagogy* at MPOB.

She also pulls no punches in updating herself on the various advances in the field, and has no qualms in talking to regional experts to achieve such means. For example, she has listened to talks on biotech by Singaporean experts from the Nanyang Institute of Technology. Her dedication and resolve has earned her the respect of her peers as well as obtaining positive feedback from the various participants in such activities. She divulges that "Some of the teachers commented that their involvement in these activities contributed to their personal, intellectual and professional development and also to their practical capability in conducting classroom activities associated with biotech." In turn, she believes that these activities also provide motivation for them to teach biotechnology effectively. "With the knowledge gained they (the teachers) are more confident to teach and now they can do something different in their classrooms like sharing knowledge and establish more practical hands-on activities." According to Zaidah, participants hope that the Ministry of Education (MOE) and MABIC will continue their collaboration

in organizing more activities on biotech and also nanotechnology in the near future.

Keeping Abreast with Current Information

She has been actively using materials produced by ISAAA and MABIC as references and resources for the development and quality enhancement of the school science curriculum to meet current requirements and future trends. This in turn determines what other information could be included in biology, additional science and core science curricula. "From publications I've gotten from ISAAA and MABIC, it is easy to keep abreast of the myriad of current information and valuable knowledge in the field of biotechnology such as biosafety, and biotech crop utilization, which are not included in the current curriculum," she says. "Such knowledge is important and relevant."

Examples of the resource materials she has been referring to include *Biodiversity, biotechnology and biosafety: An Islamic perspective*; and the Global status of commercialized biotech/ GM crops. "Curriculum is dynamic," says Zaidah. "So much so that the content knowledge in S&T needs to be expanded and upgraded and value added when we review the curriculum."

For the near future, she sees the need to further educate and update herself on biotechnology. "I hope to actively participate in the promotion of this dynamic field to enable the younger generation to feel the progress and be prepared to see opportunities turn into business reality and success." ❑

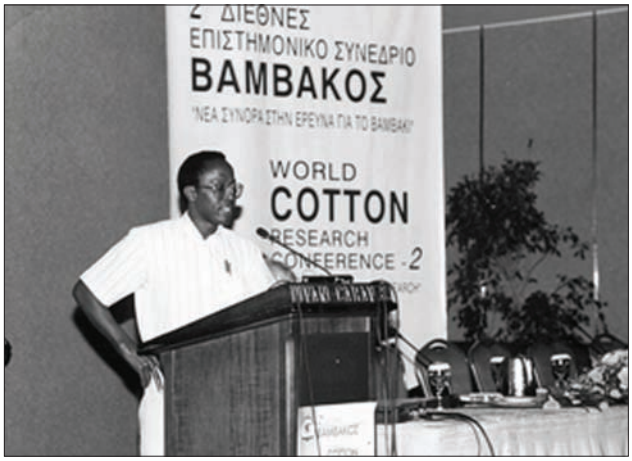
Serunjogi Lastus Katende

Making S&T Top Parliamentary Agenda

By Margaret Karembu and Daniel Otunge

They spend years in laboratories developing innovations with potential to improve livelihoods, only to be frustrated by lack of supportive policies from the legislative arm of Government. But having failed to convince parliamentarians, many of whom are non-scientists to enact the necessary policies and legislation for facilitating speedy translation of their hard-earned innovations into products, some scientists are now considering it their responsibility to be part of the political process.

One such politician who has taken it up for the sake of fellow scientists and the greater public is Dr. Serunjogi Lastus Katende, Member of Parliament for Kiboga County, East Constituency in Uganda. "I was inspired into politics by the lack of competent and hardworking representatives from



Dr. Katende speaks at a conference on cotton.

my home area in Parliament and by what I felt was laxity by policy makers to actualize excellent policies especially on agriculture for the benefit of Ugandans," states Hon. Katende.

What was even more compelling for the Ph.D holder in Plant Breeding and Seed Science from Ohio State University USA, was the fact that he had been involved in drafting some of those policy documents idling in Parliamentary shelves, which he considered critical for agricultural development in Uganda.

Indeed, besides being a member of the Institutional Biosafety Committee (IBC), he was a member of NARO's (the National Agricultural Research Organization) task forces that drafted the Plant Variety Protection Bill, Biotechnology and Biosafety Policy, and the International Plant Genetic Resources for Food and Agriculture, of which none had seen the light of day at the time he joined Parliament in 2006.

Seeing Through Relevant Biotech Legislation

Dr. Katende believes he is making a difference. "The country's Biotechnology and Biosafety Policy is already in place within the two years I have been in office and I am making all efforts to see the relevant legislation for modern biotechnology - the Biosafety Law is enacted without further delay. We have already lost a lot of time since the drafting of this piece of legislation, which was done way back in 2004 during the first Phase of the United Nations Environment Programme- Global Environment Facility (UNEP-GEF) project," he discloses.

A strong believer in science, technology and innovation as cornerstones for development in Uganda, Dr. Katende explains that this would only be achieved through propagation of technologies and innovations for production of crops and livestock, engineering prototypes and machinery for processing of agro-products, innovations in health and environmental protection, but most importantly facilitative policies and efficient legislative frameworks.

"The total contribution of science, technology and innovation will increase production, employment, household incomes and livelihoods for ordinary people and hence national economy," he emphasizes.

Dr. Katende sees modern agricultural biotechnology as an application of new tools and techniques with huge potential to boost agricultural productivity. "Uganda should embrace agricultural biotechnology now as a means of increasing productivity of quality crops and livestock while minimizing use and costs of inputs such as pesticides which are detrimental to our environment," argues Dr. Katende, but adds with caution, "Any new biotech entrant should be thoroughly tested for safety prior to commercial use."

And he is confident that it is just a matter of time before commercialization of the technology in Uganda. "The future of agricultural biotech is promising," states Dr. Katende noting that there are systems already in place to facilitate testing and adoption of the technology in the country.

"Modern biotech research laboratories and biosafety containment facilities are already in place at the NARO's National Laboratories Research Institute (NALRI), Kawanda." And he is proud of the country's capacity – "Indeed NARO, our national research institution has some of the best well trained staff on biotechnology in the region. The private sector is already collaborating with NARO for utilization of biotechnology at commercial scale for instance, in rapid multiplication of clean planting material like bananas through tissue culture."

He calls on researchers to embrace research programs that go beyond the lab to transformation of existing crop varieties as a way of combining the inherent attributes in the varieties with novel biotech traits and for enhancing nutritional traits of staple food crops.

Public Discourse on Biotech

For a man who had dedicated much of his life in science and arguably one of the most outstanding authorities in modern biotechnology in Uganda, Dr. Katende is not looking back. Having first got involved in biotech crops while working with NARO on cotton research, he has now joined politics to further exert public discourse for biotechnology.

"I see my role in biotech field now mainly as an advocate for its use and promotion in Africa. I will continue to give advice on policy formulation and even on technical issues such as opportunities and potential risks. I am trying all I can to inspire fellow policy makers by educating them on the attributes of biotechnology and counselling them against their 'fears' of the technology as a result of gross misinformation."

It is a new agenda Dr. Katende has undertaken with the same zeal and enthusiasm he exhibited during his 33 years in the lab. Within the two years he has been in Parliament (from 2006), the scientist-cum-lawmaker has maneuvered his way into being in charge of some of the key science portfolios in parliament. He is the Vice-Chairman of the Parliamentary Agricultural Sessional Committee, having previously served as the Vice-Chairman of the Parliamentary Social Services (Health & Education) Sessional Committee from May 2007 to April 2008.

"My responsibility and focus as a Member of Parliament is the legislation of laws, offer professional advice on government policies, provide oversight roles on government programs and scrutinize national budgets especially for agriculture."

But while politics is often stereotyped as a dirty game, Dr. Katende wants to play it clean and professional, focussing on issues and not the games. "My responsibility and focus as a Member of Parliament is the legislation of laws, offer professional advice on government policies, provide oversight roles on government programs and scrutinize national budgets especially for agriculture," states Dr. Katende.

Cotton as a Passion

And he is not limiting himself to Parliament. With a sentimental attachment to cotton, a crop he has researched on for the last 36 years, Dr. Katende has extended his responsibilities beyond Parliament to his constituents and the development of the cotton sector in general. He is an advisor on both conventional and modern biotech methods in cotton research and production to the Cotton Development Organization (CDO), a regulatory body under which he has previously served as a member of the Board of Directors from 2003 to 2005.

Biotechnology information corner in the Parliament library.

A cotton farmer himself, he has taken it upon himself to offer advice to his constituents on modern farming techniques and providing planting material through community-based nurseries. Besides cotton, Dr. Katende's agricultural activities extend to coffee, bananas and groundnuts, cattle, goats, pigs and poultry farming.

Dr. Katende's passion for cotton runs deep. Other than being a cotton breeder and having developed and released all cotton varieties now in production in Uganda, he is also the founding Director of the Uganda National Cotton Farmers' Federation (UNACOFFE). He served as the Director of Research at Serere Research Institute, Soroti Uganda from 2001 to 2005. He is likewise a member of the International Cotton Advisory Committee (ICAC), participating in the Technical Seminars on Biotechnology including presentations in international conferences of which his favorite topic is "Why Fear Biotechnology." He presented this topic in a technical seminar at the 63rd plenary meeting of ICAC, Mumbai, India in November 2004.

Other than preparing a Field Protocol for Biotech Cotton Confined Field Trials in Uganda, he now represents CDO at the forum preparing for confined Biotech Cotton Field Trials. He could not hold his joy with the new development that NARO will soon start testing bollworm resistant cotton (BGII) and herbicide tolerant cotton, known as Roundup Ready Flex (RRF), in two major cotton growing regions of Uganda, one in the East and another in the West. "NARO, our public research institution, is partnering with the private company Monsanto to access modern cotton biotechnologies for the benefit of Uganda farmers," he reveals.

With assistance from the Agricultural Biotechnology Support Project (ABSP II), NARO negotiated an agreement under which it has gained access to privately-developed biotech cotton lines for testing under local conditions. The tests will evaluate the technology for its performance and environmental effects. Likewise, effects on social and economic factors will also be undertaken in later periods. All necessary regulatory and safety procedures have been observed and, in February 2009, NARO received an import permit for both the BGII and RRF transgenic cotton technologies.

Dr. Katende is arguably a well-informed and highly knowledgeable authority on issues of modern biotechnology. But his new role of advocacy demands more than information and knowledge to regular exposure on global trends and experiences from those commercially growing biotech products on a regular basis, good enough for policy influence.

And to him, the International Service for the Acquisition of Agri-biotech Applications (ISAAA) has been his fountain of such exposure and source of periodic updates on most recent developments in agricultural biotechnology that has kept him abreast on new and potential innovations. "The weekly Crop Biotech Update newsletter on global developments in the field of agricultural biotechnology is a *must-read,"* confesses Dr. Katende.

"Through ISAAA, I have interacted with scientists from all over the world on issues of biotech cotton. I

learned lessons, understood better the opportunities and constraints therein from countries like India, South Africa and China, who are already producing biotech cotton on commercial scale. I am particularly amazed at the high adoption rates by Indian farmers for instance," states Dr. Katende.

In 2008, a record five million small farmers in India planted Bt cotton on 7.6 million hectares, equivalent to 82% of 9.3 million total cotton area in that year. Total area on Bt cotton increased 150-fold in seven years between 2002-2008, which was four times faster than global adoption. On average, Bt cotton saved 39% of insecticides, increased yield by 31%, which translated into increased profitability by 88% or $250/ha. In the same year, Bt cotton contributed $2.0 billion to India's national farm economy.

"Indeed, my attendance to seminars organized by ISAAA has exposed me to the most up-to-date statistics on the economics and adoption levels, global acceptance issues and trends in modern biotechnology. This has given me the confidence and ability to authoritatively discuss and share the socio-economic, policy and technical aspects of the technology in many fora. The National Assembly, Ministry of Agriculture and related agencies, do appreciate my knowledge and consult me regularly for advice on various biotech issues."

Some of the activities the scientist-cum-lawmaker has participated in include: the ISAAA/NIGBE/CFC/ICAC Regional Consultation meeting on *Risk assessment for genetically modified cotton and opportunities for small-scale cotton growers* in Faisalabad, Pakistan in March 2007; the African Caribbean Programme on cotton with European Union in Ouagadougou, Burkina Faso in September 2008, and the monthly Open Forum for Agricultural Biotechnology in Africa (OFAB) – Uganda Chapter meetings. "The proceedings of all these meetings are helping me to shape and discuss programs on biotech cotton in Uganda. I am using the proceedings as sources of information for discussions in Parliament and with other stakeholders including farmers," he says.

"Another unique initiative by ISAAA *Afri*Center that I find highly valuable is the starting up of a Biotechnology Information Corner in our Parliament's library and stacking it with scientific journals and simplified biotech educational materials. This activity is timely and has responded to a recurrent expressed need from fellow parliamentarians for a mechanism that would facilitate quick access to reference materials on the subject for informing their debates and decision-making processes."

Parliamentarians as Important Stakeholders

In fulfilling the knowledge and information-sharing mandate, ISAAA has recognized the important role played by parliamentarians in biosafety legislation and implementation of related policies. Lawmakers are therefore an important stakeholder group in all of the institution's communication activities. The *Afri*Center is responsible for sourcing, collating and stocking the Biotech Information Corner with the latest relevant information on the subject from credible sources, centers of excellence and partner institutions both nationally and internationally.

In addition to the information and knowledge-sharing service, Dr. Katende proposes that ISAAA establishes a mentorship program to support short-term courses on broader issues of modern biotechnology for upcoming young scientists in Africa and developing countries. And with the entry of two more African countries (Burkina Faso with Bt cotton) and Egypt (Bt maize) growing biotech crops commercially in 2008, there is much optimism that East Africa would follow by example. Lauding Kenya, immediate neighbor to Uganda for having already enacted a Biosafety Act, he says, "all these are good indicators that the continent is pooling up to the gene revolution." ❑

Hassan Mat Daud

Playing a Major Role in Biotech

By Mahaletchumy Arujanan and K. Cheng Liew

The International Service for the Acquisition of Agri-biotech Applications' (ISAAA) mission is to contribute to poverty alleviation by facilitating the transfer of agricultural biotechnology applications from industrial countries to developing countries. By increasing crop productivity and income generation through such means, resource-poor farmers and developing countries benefit greatly, particularly through the adoption of proprietary technology from various sectors. ISAAA was established under an initiative by scientists and policy makers from developing countries to bridge the technology gap between developed and developing countries. Among the many who pushed for the change was Dr. Hassan Mat Daud, who was then director of the Biotechnology Research Center of the Malaysian Agricultural Research and Development Institute (MARDI).

Dr. Hassan remains to be a prominent figurehead in the Malaysian biotechnology scene. He is currently the director general of the Agro-Biotechnology Institute Malaysia (ABI) which he joined after his stint at MARDI. He spearheads the growth of the budding institute. Dr. Hassan has gone far since his early days in MARDI as a research assistant during the 1970s. He obtained a BSc and MSc in Genetics at the University of Illinois. With his academic degrees, he continued as a research officer at MARDI and began basic genetic research on rice. Upon obtaining a Ph.D in biotechnology, he returned to the country and served as a research officer at MARDI, dealing with molecular markers for crop improvement and DNA fingerprinting. When he was appointed Director of the Biotechnology Research Center in MARDI (BRCM), despite the busy schedule, he coordinated research on cloning the papaya ringspot virus protein gene for transformation purposes. Today, he is in charge of establishing ABI as one of the nation's foremost research institutes for agro-biotechnology.

"Being appointed as director-general, I was given the responsibility by the leadership (in the Government) to get the institute up and running," says Dr. Hassan. "I take charge of implementing and monitoring the whole progress of the institute, including the infrastructure, human resource, and R&D programs. At the moment we are up-to-date with our aims and are well ahead of our schedules for our projects. We are filling in gaps with expertise from other institutions, and have just concluded recruiting research officers for some of our projects."

However, the hurdles and challenges of establishing a research institution, especially on the scale of government aspirations are numerous. At the moment, there is no infrastructure in place to serve as the location of the institute; however this is overcome through collaborations with various other established institutes and universities including MARDI which hosts its research officers. By being able to access other labs and operate within and outside of the respective institutes, ABI research officers are generally given the keys to resources they need.

Communicating Science

Dr. Hassan has been instrumental in communicating science to the public for many years. Being a respected scientist in the region, he has been training and educating new scientists in the country. Being part of the initiative that established ISAAA, Dr. Hassan can be said to be the father of science communication in Malaysia. In his days as Director of BRCM, he attended and organized various conferences and seminars, disseminated science

information through TV programs, stimulated young minds by giving talks in schools, and sharing information to the public. "I remember the establishment of ISAAA was borne out of the necessity for researchers and the public to understand issues. However, at that point in time, it was the scientists who were bombarded by the press. For example, one major issue then was the utilization of GM soya beans mixed with non-GM soya. We were swamped by queries and bombarded by everyone, while lacking in sufficient information ourselves. To get the true story, who could we turn to? Also, there were gaps in information and links to the various stakeholders of agro-biotechnology that needed to be addressed. Hence, ISAAA was established, and the Global Knowledge Center on Crop Biotechnology (KC) and Biotechnology Information Centers (BICs) were formed to help us link up with scientists and on-goings in the scientific world."

Malaysian Biotechnology Information Center (MABIC) is one of the many organizations under the KC umbrella. Being connected to the various information centers of ISAAA, MABIC has been banking on its international connections to provide the Malaysian stakeholders with the latest updates on science as well as opinions from the various experts around the region. Dr Hassan was instrumental in bringing MARDI and MABIC together for various collaborations in organizing seminars and workshops being a distinguished fellow of MABIC.

Dr. Hassan explains biotechnology concepts at a stakeholders' meeting.

"With the help of MABIC, we were able to get greater inputs from various experts in the region and the West," says Dr. Hassan. "ISAAA, through MABIC, has contributed much guidance and ideas in promoting biotechnology in Malaysia, especially to entrepreneurs. They have been crucial in assisting us with project management input and advice while keeping a hand on the pulse of the industry."

Now and Beyond: Peering into the Future

Dr. Hassan mentions that he is a man running out of time, as the average age of retirement for government servants is 58. He is 56 years old today, and still has two years to achieve whatever he has planned for ABI and the scientific community in Malaysia. "I am running out of time. Biotechnology is about to take off, and I hope to be able to play a major part in it before I leave (ABI). I have two years in the government, and I will strive to do my best to accomplish as much as possible," he says determinedly. "I hope to implement what I have planned for ABI as much as possible, especially in commercialization and R&D. We have to start the ball rolling, as this opportunity that has been given by the government is not easy to come by."

"On the other hand, I hope to see greater inroads being forged by ISAAA, MABIC and all the BICs," he continues. "They have done a lot in promoting biotechnology especially in agri-biotechnology in the region. However, I do hope that they would be more active in participating in national initiatives, as they have the background and knowledge capacity which will be beneficial for all parties involved. ISAAA and the BICs should also find new areas to implement its capabilities to the maximum, like continuing projects similar to the papaya ringspot virus resistance gene project if there are sufficient resources." ❑

Jane Otadoh

Helping to Realize Kenya's Biosafety Law

By Margaret Karembu and Daniel Otunge

Very few people live to realize their childhood dreams, and live them passionately. Jane Otadoh, an assistant director of agriculture, in Kenya's Ministry of Agriculture is indeed one of the few who have realized their childhood dreams. As a child, Jane grew up admiring her grandfather who was among the first colonial extension workers. "I was always fascinated by his work and by plants," says Jane. "My dream was to serve the public and more so in the agricultural field just like my grandfather."

It is a dream Jane has taken to another world of more responsibilities and challenges, a world of modern biotechnology. Jane has risen through the ranks to take charge of the Biotechnology and Biosafety branch in the Ministry of Agriculture. Her grandfather might not have lived to understand issues of modern biotechnology. But Jane has lived to be one of the pioneer Ministry of Agriculture officials to steer the country on matters of modern biotechnology. First exposed to issues of modern biotechnology through an introductory short course on plant biotechnology in Japan, and two follow-up trainings in the U.S., Jane is now fully entrenched in modern biotechnology work.

After training exposures in the subject, Jane was charged with the responsibility of establishing the Biotechnology and Biosafety branch in the Ministry of Agriculture. "I was the first officer to head this branch," states Jane. The core responsibility of the branch is to coordinate technical issues on biotechnology, communicate biotechnology issues to extension officers and create public awareness on biotech issues in the country through liaison with relevant stakeholders. It is a position that Jane has rightly earned. A firm believer in science and technology, Jane has vigorously fast tracked and continues to pursue scientific knowledge and build her professional career as a modern agriculturist.

Jane studied agriculture for her undergraduate study at the Baraton University of East Africa in Kenya. She is currently undertaking a Masters degree in Plant Biotechnology at the University of Nairobi's Center for Biotechnology and Bioinformatics. In addition, she has undertaken several specialized short training courses with relevance to biotechnology such as seed management and organization in Sweden; introductory gene manipulation for agriculture in Japan; biotechnology and food safety in the U.S.A.; gene detection, biotechnology and biosafety policy analysis, Biosafety Clearing House, and risk assessment and management in Kenya.

"Science and technology is about innovation of technologies, discoveries of new ideas. We are in a world that is dynamic and almost every thing is evolving," says Jane. "We can not keep up with the changes if we do not embrace science and technology." In agriculture, modern biotechnology tools are required for this country to attain food security and economic development in general. Modern biotechnology, she explains, complements traditional methods of introducing new varieties since it has the potential to address some issues that are beyond conventional breeding techniques. "However, the choices should be those that are applicable and relevant to our situation. In addition,

"We are in a world that is dynamic and almost everything is evolving. We can not keep up with the changes if we do not embrace science and technology."

the products must be confirmed safe to human beings and the environment."

In her coordination role at the Ministry, Jane works very closely with other stakeholders. However, she singles out the International Service for the Acquisition of Agri-biotech Applications (ISAAA) as an organization that has greatly contributed to her success, particularly in the area of communication of biotechnology issues and public awareness and sensitization.

Risk Communication Training

"ISAAA has trained me on risk communication," says Jane. "In 2007, I was among five Kenyans selected to participate in a sub-regional Risk Communication Training Course in Arusha, Tanzania. The three-day workshop titled *Enhancing communication skills on modern biotechnology issues in Eastern and Central Africa: Approaches and methods of risk communication* was sponsored by the U.S. Grains Council and organized by ISAAA *Afri*Center in conjunction with the Tropical Pesticides Research Institute (TPRI) of Arusha, Tanzania."

The workshop aimed at training specialized communicators well versed with risk communication principles that would influence public acceptance of modern biotechnology in the region; provide participants with an opportunity to share experiences on different strategies and approaches of communicating perceived high-risk issues; develop messages, strategies, and organizational policies responsive to audience concerns on biotechnology products; and, positively influence and catalyze enactment of facilitative biosafety legislations for promoting research, deployment and trade on biotech products.

Over 50 high-level biotechnology stakeholders, drawn from Ethiopia, Kenya, Malawi, Tanzania and Uganda, participated in the highly interactive workshop. Key trainers were two internationally renowned agricultural biotechnology risk communication experts Prof. Eufemio T. Rasco, Jr. of the University of the Philippines and Dr. Willy de Greef of Belgium. They were complemented by a team of resource persons drawn from each of the participating countries.

"The workshop participants were a rich mix of parliamentarians, journalists, researchers, farmer leaders, academicians, development experts, government officials, seed traders, civil society representatives, and regulators. This one course has greatly contributed to my success in subsequent tasks at the Biotechnology and Biosafety branch of the Ministry. My communication skills were sharpened and I have been able to develop my day-to-day biotech messages. We were taught how to prepare an effective communications strategy

Workshop participants learn about risk communication principles.

and approaches for reaching out to different categories of stakeholders. And, it is such skills that helped us engage parliamentarians during the legislative process of debating the Kenya Biosafety Bill 2008. The Bill was finally approved into law by Parliament and assented to by the President as an Act – the Kenya Biosafety Act in February 2009."

"Another area where I fully applied the skills learned at the Communications' course was during the drafting of the National Biotechnology Awareness Creation Strategy, BioAWARE, an initiative of the Ministry of Agriculture and key biotech stakeholder groups in the country," remembers Jane. The Strategy, whose objective is to improve public awareness on all aspects of biotechnology and biosafety through participatory generation and dissemination of accurate information, was officially launched by Kenya's Agriculture Minister Hon. William Ruto in September 2008. It is envisaged that successful implementation of the Strategy will lead to better public understanding of biotechnology and its applications, and hasten knowledge-based decision making processes. It is also an important policy document outlining the measures and guidelines on coordination of biotech communication and knowledge-sharing efforts in the country. All biotech communication activities will now be channelled through the BioAWARE secretariat that has fully embraced partnerships and stakeholder participation.

Networking with Stakeholders

"I have worked closely with ISAAA in the planning and organization of the monthly Open Forum for Agricultural Biotechnology in Kenya. OFAB, a monthly lunch meeting that takes place every last Thursday of the month, provides an opportunity for key agri-biotech stakeholders to network, share knowledge and experiences, and, explore new avenues of collaboration in bringing the benefits of science and technology to the African agricultural sector." The OFAB-Kenya is a collaborative initiative between ISAAA *Afri*Center and the African Agricultural Technology Foundation (AATF). The forum (in Kenya) was launched by the then Minister for Science and Technology, Hon. Noah Wekesa in 2006. ISAAA *Afri*Center serves as Chair of the Kenya Programming Committee. OFAB members have hailed the forum as ideal for networking and for tangible outcomes such as collaborative projects and new linkages (OFAB Kenya).

Jane says her involvement with ISAAA has helped her gain better knowledge on current global issues in modern biotechnology. "I have participated in all the annual launches done in Kenya over the last four years on the global status of commercialized biotech/GM crops which I have found most useful. I use the reports as reference materials and also share with senior government officials and extension staff whom I interact with frequently. I particularly use these materials to respond to various parliamentary questions, contribute to speeches on biotechnology for my bosses, and in preparing for workshops for various interest groups as they arise," says Jane.

"Together with ISAAA, we developed information, education, and communication materials such as posters and fact sheets for use by parliamentarians and the public. I use most of these materials when preparing for talks on biotechnology to interested parties and distribute others at stakeholder fora such as agricultural exhibitions and the Annual Nairobi International Trade Fair. Inclusion of tangible data on different aspects of biotechnology has been most attractive. People want facts that relate to the real world, not generalizations of either benefits or risks. Politicians will always ask you, "What is there for my country and constituents in the village?" And, sharing the figures on global trends, number of countries and rising number of farmers adopting the technology quell their curiosity," Jane emphasizes.

"I have gained vast knowledge and experience which I will fully utilize to reach out to the public and also in helping address the myriad of concerns from our stakeholders particularly farmers and civil society groups."

She singles out ISAAA Pocket Ks (fact sheets) and videos documenting technology transfer processes for the tissue culture technology on banana in Kenya and Bt cotton in India as resources that are very enlightening. However, she feels that some of these materials need to be tailor-made to target different groups according to their need and understanding of the subject.

Jane's work with ISAAA has not gone unnoticed. She receives a lot of requests for more information, collaborations, and facilitation of workshops at different levels, with farmers groups, extension staff and non-government organizations topping the list. "And unlike in the past when I would shy away, I readily accept the offers having the resources, the knowledge and skills to interact with these groups."

For Jane, realization of her dream has just begun. "I have gained vast knowledge and experience which I will fully utilize to reach out to the public and also in helping address the myriad of concerns from our stakeholders particularly farmers and civil society groups." ❑

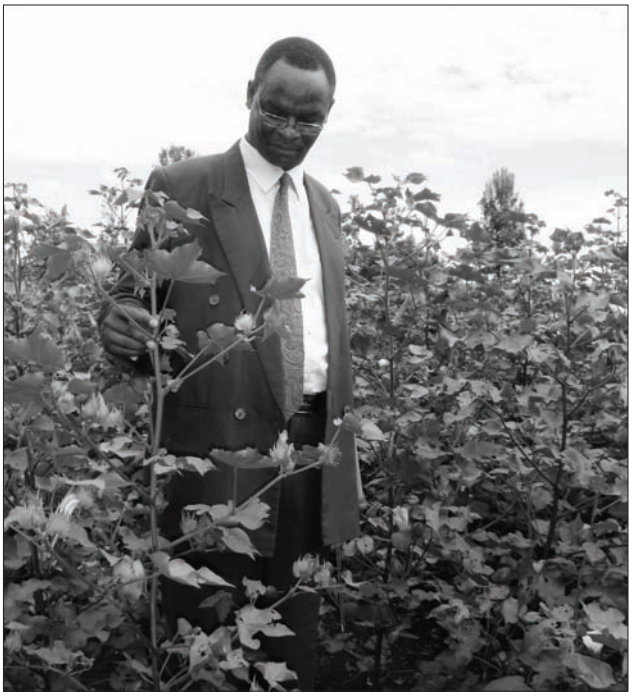
Charles Waturu Nderito

Playing A Lead Role in Biotech Development

By Margaret Karembu and Daniel Otunge

"We have no choice but to embrace biotechnology. We either formally embrace it or it will finally find its way into the country through the backdoor." This message is not surprising coming from a man who has spent much of his life in research, a man who sees science and technology as the engine to drive Kenya through Vision 2030. Vision 2030 is the new development blueprint (2008-2030) that aims to make the country a newly industrializing "middle income country" by the year 2030 through among other things promoting an innovative, commercially-oriented and modern agricultural sector. "There is no development without science and technology. No country in the world ever developed without embracing science and technology and Kenya will not be an exception," states Dr. Charles Waturu Nderito.

Dr. Waturu is director of the National Horticultural Research Center (NHRC) of the Kenya Agricultural Research Institute (KARI). The NHRC focuses on research in horticultural crops including vegetables, fruits, flowers and macadamia nuts. Under fruits, the priority commodities are banana, mango, papaya, avocado and passion fruit. Vegetable commodities include cabbage, tomato, onion, French bean,



Dr. Waturu at a cotton field in Kenya.

snow pea, sugar snaps, African leafy vegetables, Asian vegetables, herbs and spices. The major flower crops are lilies (oriental, Asiatic and Easter lilies), alstroemeria, gerbera, anthuriums, gladiolus, tuberose, eryngium, morbydick and arabiucum.

He is also the principal investigator of the Bt cotton research project in Kenya. Research focuses on the trial release of transgenic cotton, which is active in controlling a number of bollworms of the lepidopteran family. The aim is to establish the efficacy of the gene (Cry IAc protein) on these insects under field conditions where pest pressures are experienced. It is expected that as with other cotton growing countries such as India, China, and United States, the cotton varieties carrying this gene will exhibit resistance to the bollworm complex of the cotton.

Indeed, Dr. Waturu's conviction on the strategic importance of modern biotechnology in driving Kenya's economy to greater heights is not based on emotions. These are informed beliefs from a seasoned researcher and a firm believer in science. He takes issue with those opposed to the technology being introduced in Kenya accusing them of not being sincere in their arguments as to why Kenya should be an exception to embracing modern biotechnology yet other scientists globally are very busy innovating new biotech products. "What is special about Kenya that it cannot develop and apply modern biotechnology?" he asks.

Dr. Waturu warns that Vision 2030 will remain a pipe dream unless the government seriously invests in science and technology. "The country must be ready to develop and acquire new technologies for development, and particularly so in the field of agriculture. With the sector being the driver of the economy, the country needs all available and proven tools including modern biotechnology to boost agricultural productivity and consequently revitalize the economy. On its part, the government must devote reasonable resources for science and technology through budgetary allocations, and not rely on donor money alone for research and development."

"It is this belief in the technology," Dr. Waturu continues, "that drove me into seriously pursuing the introduction of transgenic cotton as a way of fighting the cotton bollworm, one of the most destructive cotton pests in the country. The Government has identified the cotton sub-sector as vital in the revival of the economy and views introduction of the transgenic Bt-cotton as one of the ways to awaken the subsector. And, as demonstrated elsewhere in other countries such as South Africa which commercialized transgenic cotton in the late nineties, expected benefits to farmers include increased yield and net return due to reduced use of chemical insecticides saving in spraying time, reduced risks to the farmer's health and cleaner environment. The technology will help to manage one of cotton growers'

biggest production challenges in the country – the lepidopteran insects. Transgenic Bt cotton protects the plant from insects that are resistant to chemical insecticides, provides season-long protection and allows beneficial insects to survive thus improving the state of the environment. It has been shown in communal growers' fields in Makhatini flats in South Africa for example that there is yield increase of up to 453 kg per hectare which translates into 33.4% increase in value and a saving of six sprays per season."

Passion for Biology

Dr. Waturu traces his love for science right from high school where he chose to pursue science subjects, with a passion for biology. "I was always interested in scientific discoveries, and as fate would have it, I finally ended up with my dream profession of being a scientist. After high school, I joined the University of Nairobi, from where I graduated with a B.Sc in Botany and Zoology in 1981. I later went to the University of Reading, (United Kingdom) for my M.Sc. and Ph.D in Crop Protection.

Aware of the environmental concerns on the introduction of transgenic crops, Dr. Waturu is also involved in baseline biodiversity impact studies of transgenic Bt cotton on wild ecosystems in the East African region. The project aims to assess the impact of the introduction and use of transgenic Bt cotton on the native cotton species biodiversity and arthropod biodiversity in the Eastern African region. The objectives are two-fold: to study and evaluate the ecological consequences of gene flow between transgenic Bt cotton and feral cotton populations and wild cotton relatives in Kenya, Tanzania and Uganda; and, assess the impact of transgenic Bt cotton on arthropod biodiversity in the three countries.

South Africa Tour

Dr. Waturu's strong conviction on the positive contribution of biotechnology in boosting agricultural activities has been further enhanced by what

Dr. Waturu in South Africa with parliamentarians and Makhatini cotton farmers.

he acknowledges as his regular contacts and participation in several activities organized by the International Service for the Acquisition of Agri-biotech Applications (ISAAA) *Afri*Center. He particularly cites a study tour to South Africa in 2006. "Besides learning from fellow researchers and policy makers, I had the opportunity to visit and see farmers growing and harvesting Bt cotton and maize. The difference between the Bt maize and conventional maize was like black and white. The cotton fields were magnificent with no pest attacks. The enthusiasm, the hope and excitement displayed by the farmers growing the genetically modified (GM) crops was incredible," states Dr. Waturu. "If I had any doubt, it was completely cleared. What was even more mesmerizing was the fact that what the farmers were leaving in the field as waste when harvesting the cotton was like what our farmers harvest in a good year!"

The study tour to South Africa was among a series of similar activities conducted by *Afri*Center in partnership with AfricaBio (South Africa) and the African Biotechnology Stakeholders Forum (ABSF) that were aimed at exposing legislators to real biotech products in the field and also interact with local and regional scientists conducting research

"The enthusiasm, the hope and excitement displayed by the farmers growing the genetically modified (GM) crops was incredible."

on the same. The overall goal was to support enactment of biosafety laws for safe and responsible adoption of the technology in Africa.

"Through these kinds of activities, ISAAA played a very important role in addressing myths and concerns through "seeing-is-believing" by this very important category of stakeholders. It also helps in getting the needed political support for enabling policy implementation. This is a clear demonstration of ISAAA's commitment as an organization to facilitate the adoption of GM technologies and safe applications in a commercial set up," says Waturu.

Empowered to Influence Other Scientists and Stakeholders

He feels that his close interaction with ISAAA has greatly empowered him to influence other fellow scientists and Kenyans in general on the importance and need for the commercialization of biotechnology crops and products in Kenya. He is now involved in various advocacy and public awareness programs.

Courtesy of ISAAA *Afri*Center, many stakeholders, including legislators and other policy makers have visited KARI-Mwea where the Bt cotton trials are being conducted. "Whenever, they come, we explain to them what we are doing and the advantages of the new technology," notes Dr. Waturu. "To many, it is usually an eye opener and an opportunity to get to see and touch the transgenic cotton as well as getting facts right about GM crops. The response is usually very positive, and parliamentarians in particular are always left wondering where all the negative talk about GM crops comes from. They even demand that the seeds be made available without further delay unaware of their responsibility in putting a regulatory system in place. Some of the stakeholders wonder when the GM cotton seeds would be available so they can also plant. Thanks to the positive impacts of these efforts, a Biosafety Act is now in place."

"I have gone a step further in the public awareness campaigns by being very open and closely working with the mass media in the country and region. Several stories have been aired and published on the project."

"Further, my involvement with ISAAA as an Associate of the *Afri*Center has helped me make contributions that have helped shape the destiny of other countries. For example, I was part of the team that was invited to Nigeria to advice the authorities on the introduction of modern biotechnology as an ISAAA representative. Nigeria has since approved confined trials of transgenic cowpea."

"Besides these activities, ISAAA has a lot of other resources – particularly videos and publications, that I find very useful and which I regularly refer to whenever seeking new data or information on biotech crops or the technology itself. The videos on Tissue Culture Banana and Bt Cotton in India for instance are very educational and entertaining, so is the one on Biotechnology Capacity in the country. The annual updates by Dr. Clive James on the status of biotech crops are a very good source of information and data on adoption trends globally. Another publication that I recommend to key stakeholders as a "must read" is the *Status of Biotechnology in Kenya – A Handbook for Policy Makers.* These videos and publications have the necessary information that stakeholders require for successful commercialization of GM crops," states Dr. Waturu.

"To many, it is usually an eye opener and an opportunity to get to see and touch the transgenic cotton as well as getting facts right about GM crops. The response is usually very positive, and parliamentarians in particular are always left wondering where all the negative talk about GM crops comes from."

Not just a passive consumer of ISAAA publications, Dr. Waturu is also a contributor. For instance, he has contributed to the publication of ISAAA facts sheets and message maps on Bt cotton. He is currently preparing a Q&A book on Bt cotton. However, he feels that ISAAA needs to produce more publications and materials targeting farmers and politicians.

Awards and Inquiries

Dr. Waturu's work in the field of biotechnology has not gone unnoticed. His Bt Cotton Project was voted the best overall KARI research project during the KARI Bi-annual scientific congress in 2008.

Other than the award, Dr. Waturu states that the profile of the Bt cotton work is very high. "There are a lot of inquiries about it and when the transgenic cotton will be out in the market virtually from all players in the cotton industry – from farmers to ginnery owners to politicians," states Dr. Waturu.

To Dr. Waturu, his ultimate goal and to which he is now dedicating all his efforts to is to play a leading role in the development and commercialization of Bt cotton in Kenya. "And with the newly enacted legislation, the Biosafety Act 2009, this will now facilitate the roll-out and commercialization of the Bt cotton and other GM crops under development in Kenya. Hopefully, the other East African countries will follow suit and join Burkina Faso's example," he concludes. ❑

REFERENCES

Juanillo, Napoleon. 2003. The Social and Cultural Dimension of Agricultural Biotechnology in Southeast Asia: Public Understanding, Perceptions, and Attitudes Towards Biotechnology. University of Illinois at Urbana-Champaign and the International Service for the Acquisition of Agri-biotech Applications (ISAAA).

Open Forum on Agricultural Biotechnology in Africa. http://www.ofabkenya.org.

Surayud Cabinet. 2006. The Nation. http://www.nationmultimedia.com/2006/10/23/politics/politics_30016995.php (Accessed November 5, 2008).

Thailand's National Biotechnology Policy Framework 2004-2011. Business in Asia.com. http://www.business-in-asia.net/biotech_policy.html (Accessed November 5, 2008).

Thailand Biotechnology Annual 2008. USDA Foreign Agricultural Service Gain Report. http://fas.usda/gov.gainfiles/200807/146295161.pdf (Accessed November 5, 2008).

Academics & Scientists

Raising Perception of Credibility

In the eyes of various stakeholders, university professors and public sector scientists are often perceived to occupy the highest rung on the credibility ladder and are identified to be among the most trusted and sought-after information sources. University scientists and research institutes are seen to be highly concerned about public health and safety issues and are deemed capable of assessing and managing benefits and risks.

The important role of universities and research institutes in the development of agricultural biotechnology is highlighted by the fact that they become key sources of public information regarding the technology. Nisbet (2001) says that "In an increasingly complex society, the public and policy makers turn to universities and their experts for reassurances and reliable information about the unintended consequences and risks of technological development." University scientists are often called upon to testify at government proceedings and are the most likely to be quoted or cited by the media.

Interestingly, studies confirm that trust as an attribute of credibility is related to acceptance of technology. Brossard et al. (2007) state that studies also argue that trust is more primary than information. They forward the assertion of Hansen et al. (2003) that "trust enables individuals and organizations to act without knowledge." The fact that university professors/scientists are rated highly as information sources, and that the trust attributed to them can be even more important than information itself show their crucial role in the biotechnology debate.

In many academic settings, professors also fulfill other tasks such as research and extension. In addition to teaching basic science courses and supervising students, they are also proponents and implementers of research activities. Stories reveal that they popularize science-based information through presentations in lectures, seminars and workshops; conduct quiz contests for students; and write publications. They spearhead efforts to enhance the science curriculum by institutionalizing a general education biotechnology course in universities, and prepare a teacher's manual for teaching biotechnology. Professors and full time scientists prepare publications and proposals, engage the media through interviews and article rebuttal, participate in capacity building efforts, answer queries of non-technical audiences, and apply risk communication principles with clients. To do all these tasks require up-to-date science-based information obtained from publications, websites, and videos, as well as participation in seminars and workshops.

Emil Q. Javier

Trail Blazing Biotech in the Philippines

By Mariechel J. Navarro

The Philippines has had a head start in biotechnology research and development and in its regulatory and commercialization system. In 2003, it became the first Asian country to approve Bt corn for planting on farmers' fields and remains to be the only one to date. Several products in the pipeline are crops such as Bt eggplant, virus-resistant and delayed ripening papaya, golden and blight resistant rice, and virus resistant abaca. "Much of this was made possible through collective leadership, a strong group of scientists who believed in transgenics for modern agriculture, and government support," says Dr. Emil Q. Javier, president of the National Academy of Science and Technology (NAST), and former president of the University of the Philippines and Minister of Science. Dr. Javier is regarded by many academics and scientists in having provided the vision and direction for science in general and biotechnology in particular. As the current head of NAST, he takes the lead in providing critical advice to the President of the country and the legislative branch of government on issues of national importance that have science and technology underpinnings.

"Science was not something I initially thought about as a field of interest in college. It was common to think that one should pursue a career as a medical doctor, engineer or lawyer. My father, a road roller operator in the Department of Public Works and Highways, could not afford to send me to college. The easiest option would have been to enter the Philippine Military Academy but I was underaged, underweight, and below the height requirement. Help came from Dr. Dioscoro Umali, (then a professor of plant breeding at the University of the Philippines Los Baños (UPLB) and who would eventually become a National Scientist) who came to know of my plight and offered me a job as student assistant to earn my way through college."

The high school valedictorian from the rice farming community of Santa Cruz, Laguna, was a determined and a conscientious student in college. "I took up a science career by default but under the tutelage of the charismatic mentor Dioscoro Umali so that eventually I appreciated what I was taking up." Planning to be a Sugar Technology major ("It seemed to be the most popular course at that time."), he managed to take extra courses in chemistry which were not required subjects when he later shifted to plant breeding. Taking additional chemistry subjects was not a waste of time and effort as later events would show. He graduated at the head of his class with a B.S. in Agriculture (*cum laude*) in 1960.

In 1964, after a research assistant stint in UPLB, Dr. Javier took up graduate studies at the University of Illinois. "At that time there was a lot of speculations about possible breakthroughs in genetics. I was majoring in agronomy but I spent more time in microbiology and biochemistry courses. I had a feeling that these were going to be where the breakthroughs in plant breeding would take place." He attributed his well-roundedness in various fields and their interconnectedness in the choice of subjects he took. He eventually took up his doctoral degree in plant breeding at Cornell University.

Dr. Javier talks to young members of the media.

"Then President Ferdinand Marcos was very supportive of agriculture as well as of science and technology. We took advantage of his interest and proposed the establishment of the Institute of Plant Breeding (IPB). When we started IPB we organized strong laboratories for biochemistry, virology, analytical chemistry and tissue culture. Some quarters wondered about the significant bias of initial investments in these areas," says Dr. Javier.

Laying the Foundation for Biotech

"Plant breeding draws its strength from two basic sciences – genetics and statistics. I knew that modern biotechnology was on the way and guessed that breakthroughs will come from biochemical genetics, not from statistics and quantitative genetics. At that time it was not yet possible to manipulate genes with precision. But in the end one has to know how to grow the modified transgenic cell into a whole plant. Hence our well organized tissue culture efforts, initially with mass asexual propagation as immediate practical objective. That's why and how senior biochemist Dr. Evelyn Mae Mendoza and tissue culture guru Dr. Ramon Barba ended up leading the biotechnology efforts in IPB."

"But the new biology had many more applications beyond plant breeding. Hence when I became Chancellor at UPLB, I made sure that these modern tools were applied in forestry, food technology, veterinary science and the rest of agriculture. I proposed the establishment of the National Institutes of Biotechnology and Applied Microbiology. Some people made fun of me because they thought the word "institutes" was grammatically incorrect as there was only one institute. But I had a vision that eventually there would be more than one institute of its kind." When he became UP president in 1993, Dr. Javier created similar institutes with specific niches in pharmaceutical applications, industry and energy, and marine industry in the UP campuses in Manila, Diliman, and the Visayas. He indeed had the last laugh.

Strengthening Science

Dr. Javier was also tapped by then President Marcos to be Minister of Science. "Although I had an agricultural background, I was fully aware of the other concerns besides agriculture. I became the architect of the sectoral council system, establishing research and development councils not only for agriculture, forestry and fisheries, but also for health and nutrition, industry and energy, and assigned the venerable National Research Council of the Philippines to take care of basic and social sciences." Dr. Javier takes pride in his role in the establishment of the Science Career Service as a special branch of the Philippine Civil Service.

At the helm of the national university (UP system), Dr. Javier is credited for having a hand in the establishment of the National Graduate School of Engineering in UP Diliman, the National Institute of Health in UP Manila, and the UP Open University.

NAST, the government scientific advisory body which he presently heads, played a crucial role

in the debate about genetically modified (GM) crops. "The critics had nothing against the use of GM technology in pharmaceuticals, the opposition was in their use in agriculture. Fortunately, many members of NAST had strong backgrounds in agriculture, biology, genetics and biochemistry. They lent their names to the research on transgenic crops. As true, objective scientists, they were fully aware of the risks associated with the new technology and they themselves batted for a strong regulatory system."

Favorable Political Environment

"The fact that the most senior and most visible Filipino agricultural scientists were in favor of transgenic crops development helped immensely to provide a favorable political environment for biotechnology. The Chancellor of UPLB and its Dean of Agriculture, the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) Executive Director, the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD) leadership, the International Rice Research Institute (IRRI) Deputy Director General, as well as the technology advisers to the Secretary of Agriculture were openly in favor of modern agricultural biotechnology. "It was this confluence of people that worked in favor of the use of transgenics for modern agriculture." NAST supports the annual launch of ISAAA's report on the global status of commercialized biotech/GM crops where Dr. Javier often gives a commentary on biotech initiatives in the country.

Past Philippine Presidents from Ferdinand Marcos including the present have supported science and technology initiatives. President Gloria Arroyo, according to Dr. Javier, has made significant investments into science and agriculture. He also mentions the important role of the International Service for the Acquisition of Agri-biotech Applications (ISAAA) in fulfilling the role of honest

"It was this confluence of people (with strong science background) that worked in favor of the use of transgenics for modern agriculture."

broker in accessing proprietary technology and in moving it to the regulatory and commercialization phases. "The gestation period from discovery to commercialization is a long one and even longer if the support systems are not in place. This is where ISAAA is making a niche," he says.

In addition, Dr. Javier "reads cover to cover" the e-newletters of ISAAA and the Biotechnology Information Center in the Philippines. "I always access the news and use as leads the links to original documents or publications. If I find something interesting I ask my assistant to look up the material. This information provides me updates as NAST president."

Aside from being NAST president, Dr. Javier continues to multi-task as chair of the Asia Rice Foundation, member of the Science Career Council in the Civil Service Commission, and the Secretary's Technical Advisory Group of the Department of Agriculture, head advisor of the Biotech Coalition of the Philippines, and member of the Board of Directors of the Philippine Foundation for Science and Technology, and the Nutrition Center of the Philippines. For all his achievements, he has been given awards and citations by several bodies including the University of Illinois, University of the Philippines System, Third World Academy of Sciences, Phi Kappa Phi Honor Society, the Association of Southeast Asian Nations (ASEAN), and the governments of the Republic of Korea and Taiwan.

Who would have known that the student who took science by default, took the unbeaten path

by taking subjects outside his field, accepted criticisms in stride with his vision of institutional directions and priorities, established an institute with an "s", and anticipated the developments of biotechnology before its time, would eventually influence significantly the direction of S&T in the Philippines? Dr. Javier took the road less traveled and in doing so, he transformed visions into institutional realities. ❑

Lynette Kisaka

Taking Modern Biotechnology to Schools

By Margaret Karembu and Daniel Otunge

While genetics has been taught for decades in schools and colleges, its application in modern life has created new challenges for science teachers, especially those teaching biological sciences.

Ms. Lynette Kisaka, Head of Biology Education at the Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA) admits that modern biotechnology has brought new dimensions and challenges in the teaching of subjects like biology and agriculture. Her words cannot be taken lightly for a woman who has dedicated much of her professional life to studying and teaching biology. "I studied Botany and Zoology for my undergraduate studies at Kenyatta University in Kenya. I went straight into teaching Biology after my graduation in 1987. I was back in the University in 1992 to pursue my graduate studies in Zoology, specializing in Parasitology. Upon my graduation in 1994, I continued with classroom teaching of my favourite subject - biology until 2001 when I joined CEMASTEA," states Ms. Kisaka.

The CEMASTEA in Africa is an educational institution located in Nairobi, Kenya, but serving the whole of Africa. Its overall goal is the improvement of science and technology education at the secondary school level in Africa. CEMASTEA was first established as a home of the project "Strengthening of Mathematics and Science at Secondary Education" (SMASSE), a joint initiative of the government of Kenya through the Ministry of Education, Science and Technology and the Government of Japan through the Japan International Cooperation Agency (JICA). CEMASTEA was later adopted by the African Union's New Partnership for Africa's Development (NEPAD) and has membership from about 23 African countries. The Center's main objectives and functions include: enhancing the capacity of mathematics and science educators in Africa; strengthening the networking of mathematics and science educators; enhancing dialogue between mathematics and science educators and policy makers for the betterment of mathematics and science education; and promoting analytical work in mathematics and science education in Africa.

But, even with her many years of experience in the subject, Lynette has been grappling with how to effectively teach biology or even train other teachers to effectively teach the subject with the new dimensions and challenges brought about by modern biotechnology. According to the lady teacher, many teachers are finding it extremely hard to fully comprehend issues of modern biotechnology and how they can incorporate them in their lessons. Their plight has not been helped much by polarized debates, controversies and misconceptions surrounding modern biotechnology.

Lynette in the Teachers Course in Kenyatta University.

Training Teachers on Biotech

CEMASTEA runs the SMASSE program - an In Service Education and Training (INSET) for teachers. Lynette explains that the program, which was initiated in 1998 on a pilot basis, initially targeted secondary school teachers but has now been expanded to include primary school teachers. "Due to the popularity of the program, a national program was rolled out in 2003, attaining national coverage in 2008. Key teachers are selected from districts countrywide, who are then trained as Trainers of Trainers (TOTs) to train other teachers at their districts." So far, the center has trained 1,500 TOTs who have in turn trained over 18,000 teachers in the 109 centers countrywide in the various science subjects – biology, chemistry, physics and mathematics. A particular emphasis is placed on practical approaches to the teaching of biology in order to help the teachers get hands-on experiences and resolve misconceptions about the subject, Lynette explains. "One of the units we teach at SMASSE is genetics where biotechnology is handled as an emerging issue and, this has been one of the areas we have really been struggling with."

However, an initiative by the International Service for the Acquisition of Agri-biotech Applications (ISAAA) appears to have responded straight to the Center's dilemma as far as the teaching of modern biotechnology was concerned. In August 2008, ISAAA held a two-week intensive training for the TOTs on modern biotechnology at Kenyatta University under the Department of Biochemistry. The workshop was facilitated by local and international resource persons with expertise in different aspects of biotechnology and biosafety. The workshop's goal was to enhance the capacity of science teachers in integrating agricultural biotechnology in relevant teaching disciplines through hands-on exposure to basic concepts and global issues on modern biotechnology. Twenty-five high school biology teachers drawn from all the provincial regions in Kenya participated. These teachers were also Biology TOTs under the CEMASTEA program in their respective Districts.

Lynette was among two CEMASTEA trainers who participated in the workshop and helped in selecting the participants. The theme of the workshop fell within ISAAA's mission of building capacity of national programs and promoting knowledge, information and experience sharing on all aspects of agricultural biotechnology. Realizing the important role of teachers as opinion leaders and community role models, the workshop was designed to empower the trainees with factual information on biotechnology to

improve their classroom teaching and use their acquired knowledge to reach out to neighboring communities. This was an important step towards creating general awareness on biotechnology, besides demystifying the subject among students, ultimately trickling down to their communities.

"The workshop was highly interactive and included both lectures and hands-on practical sessions. The laboratory sessions were designed to train us on how to design simple experiments using improvised locally available materials such as extraction of DNA from plant materials, tissue culture techniques, DNA sequencing using paper cuttings and constructing lamina flow hoods using cardboards. This aspect was particularly important for ensuring replication of the same in schools where advanced scientific infrastructure is lacking. It was also meant to demystify biotechnology concepts in a way that would build our confidence in integrating it in teaching," says Lynette.

"Besides," Lynette continues, "we had an opportunity to visit local institutions undertaking biotechnology activities such as Genetic Technologies Limited (GTL) and the Kenya Plant Health Inspectorate Service (KEPHIS). The climax was a participation in the open forum - the Open Forum on Agricultural Biotechnology (OFAB) where Calestus Juma, a Professor of the Practice of International Development, Harvard Kennedy School and reknown scholar gave an overview of acceptance pathways of emerging technologies and how to deal with public perceptions on the same. These exposures helped us to further enhance our knowledge on the practical and commercial applications of biotechnology in Kenya and globally."

Training Course - An Eye Opener

Although Lynette had been exposed to biotechnology issues earlier (in 2002) during a visit to the International Rice Research Institute in the Philippines as part of an exchange program, she had never gained so much knowledge and understanding of biotechnology issues. "The two-week training course was such a big eye opener not only for me, but also for the 25 other trainees. Through the course, I gained deeper understanding of biotechnology issues and was convinced the course is crucial for all biology teachers throughout the country. Not only did it deepen our knowledge and understanding but also made us aware of where to get credible information and resources for our teaching," states Lynette.

"These exposures helped us to further enhance our knowledge on the practical and commercial applications of biotechnology in Kenya and globally."

"It was an exposure that has even changed my perception on products of genetic engineering (GMOs). I am now deeply embedded in biotechnology debates especially with the heightened debate on the Kenya Biosafety Bill. I am now increasingly finding myself clarifying a lot of misconceptions among my peers and to my theologian spouse, Mr. Kisaka. Listening to some of the polarized debates in the mass media, I find myself calling upon the resource persons who trained us to get more engaged in participating in such debates to share the correct information and messages." Lynette strongly believes we have an inherent ability that God gave us – to tap and expand our knowledge, which can be used to utilize environmental resources wisely. "My only caution is that application of biotechnology should be guided by ethics while safeguarding against adverse environmental and health risks that might arise," she emphasizes.

Avenues for Sharing New Value Systems

The lady teacher is optimistic that since this first lot of trainees was drawn from highly influential and senior biology teachers, examiners and heads of biology departments, they will greatly contribute to creating appropriate public awareness and clear the misconceptions about modern biotechnology. "People are generally skeptical about the technology because they lack the knowledge about it and have been grossly misinformed."

With her newly acquired knowledge, Lynette is confident that she can contribute to the required change – change in attitude and knowledge about modern biotechnology. And she has identified various fora through which she intends to share her knowledge, shape or change opinions and entrench new value systems especially at the secondary school level. One such avenue is the Association for Development of Education in Africa (ADEA) that also serves as a forum for teachers from 31 African countries to meet and share experiences and new knowledge in science, technology and innovation.

"The ADEA is a very important network, for it can be used to disseminate information on biotechnology to teachers in the 31 countries that are members of the network," says Lynnete. "I want to use the association to rally teachers around teaching biotechnology and how to make such teaching more practical for maximum understanding by students who are tomorrow's leaders."

Another avenue she believes to be important in entrenching biotechnology into societies' value systems is through the integration of modern biotechnology into school curriculum. A firm believer in the power of science and technology for development, Lynette emphasizes the need for deliberate effort to translate strong science education at school and college levels into technological products. She laments that there is little translation of teaching science into science and technology for society. "We have very good marks and grades in sciences at schools and colleges. But there is very little output nationally in science and technology. If we cannot make a break in science and technology, we might as well forget about development as a country."

"People are generally skeptical about the technology because they lack the knowledge about it and have been grossly misinformed."

"And, one area where science taught in schools and colleges must be translated into tangible technological innovations is in agriculture, for I believe modern biotechnology will be one of the vehicles to boost agricultural productivity amid a myriad of production constraints– land pressures due to population increases, climate change, droughts, pests and disease outbreaks."

Lynette considers application of biotechnology in the food security strategy of the country a first priority given the high number of people (close to 3 million) perpetually in dire need of food aid in Kenya in any given year. The year 2008 was particularly bad with nearly 10 million people declared as food insecure. "It is only when you have satisfied the basic needs of food that people can now start thinking about other things. Once you adopt a technology that has demonstrated potential to increase productivity and achieve self-sufficiency in food needs such as biotechnology, then people will start thinking about development," states Lynette. "I am very convinced that biotechnology will help this country attain food security for its citizens." ❑

Annie Clara Arokiasamy

Teacher and Student of Biotech

By Mahaletchumy Arujanan and K. Cheng Liew

To ensure the development of biotechnology, it is important to formulate effective pedagogical techniques to ensure that the younger generation will have greater appreciation and understanding of the subject matter. Hence, the Malaysian government's thrust to put biotechnology into the forefront strongly relies on the very people responsible for educating the young – the teachers.

Ms. Annie Clara Arokiasamy has been a biology teacher in several national schools around the country for the past 15 years, and has been awarded by the Ministry of Education for her long and distinguished service. She graduated with a Bachelor in Science with Honors in Microbiology from Universiti Sains Malaysia (USM) and completed her Diploma in Education and Masters in Education (Science) from the same university.

"My clients are my students," says Annie. "Teaching is my core business. Though we don't teach biotechnology as a subject in school, it is taught as an important component of the biology syllabus under the topic of genetic engineering which was introduced in 1995." She recalls the uphill task in understanding the topic back then as little information was available to the public. Being a dedicated teacher, she bought related books on the subject. Today, she is comfortable expounding on the subject matter to her students. She also relies on the Internet and its wealth of information as a good source by which she could give her students a clearer view on the subject.

Biotech Workshop for Teachers

Annie was pleasantly surprised by a biotechnology workshop for teachers on *"Enhancing Effective Pedagogy"* organized by the Malaysian Biotechnology Information Center (MABIC) in collaboration with the Ministry of Education's Center for Curriculum Development and the Malaysian Palm Oil Board (MPOB). This workshop aimed to keep teachers abreast with the latest applications of biotechnology and provide them with teaching resources that can improve their teaching. A group of 40 teachers from Selangor and Kuala Lumpur were invited to join Dr. Ravigadevi Sambanthamurthi, head of the Advanced Biotechnology and Breeding Center at MPOB. Teachers were divided into two groups with each group going through a one-day hands-on laboratory session on DNA extraction, PCR technique, and DNA finger printing with DNA extracted from oil palm leaves. Several lectures were given such as on the applications of biotechnology in the palm oil industry which provided an insight on the various tools to increase productivity, address challenges such as diseases and pests, and produce quality planting material.

Annie mentions that it is a positive move for teachers to be educated first hand. "It is a great experience," she says. "In the past when I did my major in microbiology, I was not exposed to such scientific techniques. I learned the basics about DNA fingerprinting from books. The workshop is

"It is a positive move for teachers to be educated (about biotech) first hand."

an eye opener as it gives me first hand experience which I am able to share with my students."

"However, it would be better if we could bring this into the classroom so that students can experience it themselves," she notes. "Due to financial constraints, few schools have laboratories which are equipped to run such experiments for students. It would be a very good learning experience for them. Most students find it difficult to visualize the concepts of genetic engineering and DNA fingerprinting in their minds."

Annie finds the activities by MABIC to be very useful for advancing science and technology in the country, particularly in providing early stimulation and interest among students. "I hope that MABIC will be able to conduct similar and more workshops in the future." ❑

Anil Kumar Gupta

Building Capacity on Biotech and Biosafety

By Bhagirath Choudhary and Kadambini Gaur

The G.B. Pant University of Agriculture and Technology (GBPUAT) in Pantnagar, Uttarakhand, India has a history of developing innovative products for agriculture and was the first university in the country to blend technology with agriculture. Nobel Laureate Dr. Norman E. Borlaug eulogized the university as the *Harbinger of Green Revolution* in India. Recognizing the potential of biotechnology in agriculture, the university was the first in north India to establish the Department of Molecular Biology and Genetic Engineering to impart teaching to graduate and post-graduate students in agricultural biotechnology. It is included among the ten best biotechnology schools of India. Noting the strength and sincere efforts in promoting agriculture research, India's Department of Biotechnology identified it as one of the Centers of Excellence in Agricultural Biotechnology. Research areas include management of biotic and abiotic stresses, improvement of nutritional quality and value addition, clonal propagation of elite planting materials, and capacity building in bioinformatics and biosafety.

The Ministry of Environment and Forests, Government of India has identified the university's Department of Molecular Biology and Genetic Engineering as one of the four biosafety centers under the Global Environment Facility (GEF)-World Bank project to enhance institutional capacities on biosafety and help the ministry to implement the Cartagena Protocol on Biosafety.

Dr. Anil Kumar Gupta is professor and head of GBPUAT's Department of Molecular Biology and Genetic Engineering at the College of Basic Sciences and Humanities. He received his post graduation in biochemistry from GBPUAT and Ph.D in biochemistry from Rajasthan University, Jaipur, Rajasthan.

Career Journey

Dr. Anil Gupta has a rich experience of having worked in several medical institutions (All India Institute of Medical Sciences, New Delhi; MLB Medical College, Jhansi; GSVM Medical College, Kanpur; and Cancer Research Institute, Gwalior) before he joined the GBPU. His field of interest being molecular biology and biotechnology, he grasped the basic paradigms of agricultural biotechnology by attending several training programs in the field of genetic engineering. His interest in agriculture enabled him to develop transgenic Brassica harboring the *osmotin* (a pathogenesis related protein) and *annexin* (an anti-oxidative burst protein) genes for conferring resistance against Alternaria blight. Dr. Gupta is project investigator of edible vaccine development using transgenic tomato plant against Japanese encephalitis virus.

Biosafety is a key concern for Dr. Gupta. He is a member secretary of Institutional Biosafety Committees at Pantnagar and Indian Veterinary Research Institute, Izatnagar. He helped to prepare the biosafety regulations for the Government of Uttarakhand and published several research papers and co-authored several books on biotech/biosafety. Dr. Gupta is also a reviewer for several journals including the Indian Journal of Agricultural Biochemistry, Indian Journal of Experimental Biology, Indian Journal of Biotechnology and is a project reviewer of the Council of Scientific and Industrial Research of India's Department of Biotechnology. Dr. Gupta also successfully completed the first phase of the

Dr. Anil Kumar Gupta in his laboratory at the Department of Molecular Biology and Genetic Engineering, College of Basic Sciences and Humanities, G.B. Pant University of Agriculture & Technology (GBPUAT), Pantnagar.

Global Environment Facility-World Bank funded program on Capacity Building on Biosafety at the university. His sincere efforts have been appreciated at the university and state levels.

Shaping Young Minds

Dr. Gupta has made significant contributions in implementing and popularizing biotechnology in the University. He feels it is essential to guide students in areas of science and technology that will enable them to lead in the frontier areas of molecular biology and genetics. "It is vital to familiarize students with current status and future prospects of agricultural biotechnology with our acknowledged leadership to create their interest. It is essential to incorporate a course on biosafety in the curriculum and carry out quality research work in the area," he asserts. He is dedicated to impart quality education, training and research in the area and also in extension of knowledge activities. "Modern technologies, especially biotechnology, are expected to make a large impact in bringing purpose and precision to every walk of life. These technologies when harnessed properly will permit

optimum utilization of natural and genetic resources for the welfare of humankind," he tells his students who are excited to learn about the new science under his able guidance. As a scientist and as a teacher he feels the responsibility of delivering latest scientific information and sharing experience with students.

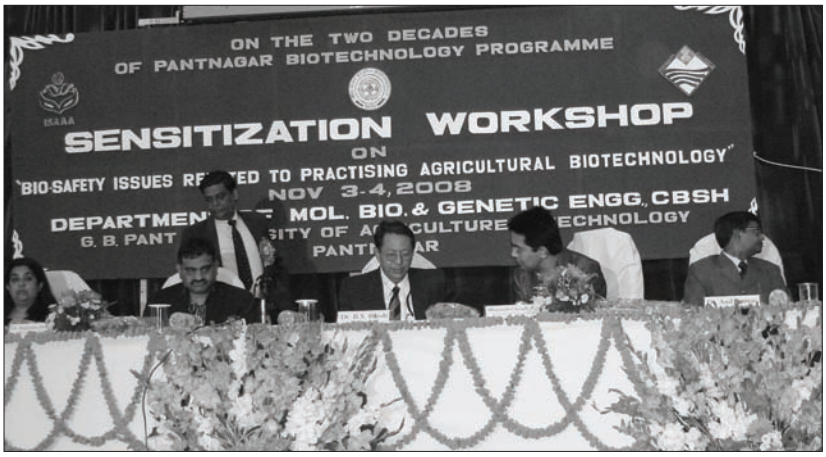
Biotechnology publications released by GBPUAT's Department of Molecular Biology and Genetic Engineering.

Enriching Knowledge on Crop Biotech

Dr. Gupta has a long involvement and relationship with the International Service for the Acquisition of Agri-biotech Applications (ISAAA). He finds ISAAA's publications to be very useful in keeping his students informed about latest developments in the biotech sector. "The interesting and informative materials provided by ISAAA in the form of videos, Pocket Ks, CDs and booklets really help students, researchers and academia in understanding the emerging scenario of biotech crops. These information materials really help in answering queries of all stakeholders especially beginners opting to take a career in agricultural biotechnology. We are updating our knowledge base on the current status of biotech crops globally, in-country, and other biotech related news," he notes.

The organization of awareness workshops is essential to help in capacity building in the areas of biotechnology and biosafety. "These workshops are important to increase awareness among all stakeholders such as scientists, farmers, policy makers, advisors, research scholars, extension officers, television and media personnel involved in scientific reporting about new technologies and developments," he says. In November 2008, ISAAA and Pantnagar University jointly organized a sensitization workshop on *Biosafety Issues Related to Practicing Agricultural Biotechnology*. More than 150 participants from academia, state government and local media attended the workshop and government officials participated as resource speakers. ISAAA publications such as Brief 37 and its Executive Summary on the global status report of commercialized biotech crops, Pocket Ks, and Bt cotton video were distributed to the participants. "The biosafety sensitization workshops will not only help in chalking out biosafety norms in the state but also give an insight to participants about transgenic crops from renowned resource persons," he adds. On this occasion, the Department celebrated two decades of biotechnology at Pantnagar and released various documents on crop biotech including, *Biosafety Issues Related to Practicing Agriculture*

"The application of crop biotechnology offers the opportunity to alleviate marginal and subsistence farmers to get out of their dependency on government assistance and to increase agricultural productivity."



Biotech workshop: from left, Dr. Ranjini Warrier, Director, Ministry of Environment & Forests; Dr. Rajnerdra Dobhal, Director Uttarakhand State Biotechnology Program; Dr. B.S. Bisht, Vice Chancellor, GB Pant University of Agriculture and Technology; Mr. Bhagirath Choudhary, ISAAA; Dr. Anil Kumar Gupta, Head, Department of Molecular Biology & Genetic Engineering, GBPUAT.

Biotechnology, Frequently Asked Questions (FAQs) on Biotechnology and Biosafety, and Q&A on Bt Cotton in India.

Crop Biotechnology: Promising Future

"Crop biotechnology holds tremendous potential in increasing agricultural productivity and ensuring food security. In recent years, it has emerged as one of the most exciting, promising and challenging areas of research. The application of crop biotechnology offers the opportunity to alleviate marginal and subsistence farmers to get out of their dependency on government assistance and to increase agricultural productivity. The introduction of new crop varieties with insect resistant and herbicide tolerant genes is quickly changing the landscape of agriculture at the global level," says Dr. Gupta. "However, it is imperative to create awareness and public campaign programs to educate all stakeholders including farmers, consumers, policy makers and extension officials about the benefits of agricultural biotechnology. Besides, there is need to organize programs for school children and mobile exhibition and mimes *(nukkar natak)* about biotech crops at every nook and corner of the country so that myths circulated by biotech critics can be counteracted."

> ***"It is imperative to create awareness and public campaign programs to educate all stakeholders including farmers, consumers, policy makers and extension officials about the benefits of agricultural biotechnology."***

Dr. Gupta suggests that "ISAAA should conduct public awareness activities on risks and benefits of GMOs, develop information packages for appropriate target groups in the state/country, and increase GMO awareness and its implications for trade. Stakeholders must be made aware of the multiple benefits of GM crops in terms of yield advantage, reduced use in pesticides and herbicides, and decrease in farm costs as proven in cotton. The synergistic and mutually beneficial partnership between academia-industry-farmers can advance the country's agricultural biotechnology sector," he concludes. ❑

Sony Suharsono

Applying Risk Communication Principles

By Mariechel J. Navarro and Bambang Purwantara

Dr. Suharsono is a lecturer and researcher at the Bogor Agricultural University (BAU) in Indonesia which hosts about 20,000 students. He is concurrently director of the Research Center for Bioresources and Biotechnology, a university-based research center involved in the development of biotechnology, conservation and utilization of bioresources. The Center also supports graduate education, and provides scientific services.

As lecturer, he teaches basic and molecular genetics, genetic engineering, and introductory biotechnology to both undergraduate and graduate students in the Departments of Biology and Biotechnology. His research interests are soybean and jatropha for biofuels using a combination of conventional technology and biotechnology. "I look forward to the day that biotech soybean will be eventually commercialized in Indonesia as we still import 60% of our soybean requirements," says Dr. Suharsono.

The research director initially wanted to be a doctor but his family could not afford to send him to medical school. "My father is a forester but I did not want to pursue forestry. I thought that working with plants was easier than with trees. I thus decided to take up an agriculture degree," he reminisces. He obtained a two- year scholarship to complete his agriculture degree at the Bogor Agricultural University where the top 5 percent of high school students were given a 15-month stipend. This was a great opportunity for someone like him who came all the way from Central Java. On top of the scholarship, he was offered work by the University upon graduation. BAU eventually sent him to France to pursue further academic training. He got his Masters in Plant Production from *Universite de Nantes* and his Ph.D in Plant Cellular Biology from the *Universite de Bordeaux II* in France.

Dr. Suharsono is active in the biotechnology scene in Indonesia. "I am often invited by the Indonesian

Dr. Suharsono at work in his lab.

Biotechnology Information Center (IndoBIC) to be a resource person on the current status of genetically modified (GM) crops in workshops and roadshows. Roadshows are designed to bring technical experts to universities and encourage audiences to interact with them and share experiences on how the technology affects their lives. They serve as a venue for updates and technical briefing," he says. For example, IndoBIC had a workshop at the University of Jambi, Sumatra. Dr. Suharsono discussed the role of biotechnology in support of agricultural production. He also organized with the Program for Biosafety Systems (PBS) and IndoBIC, a workshop on the current status of biosafety of genetically modified (GM) crops. He was appointed as chairman of this event. "I am surprised that many students and even lecturers do not have their facts right about biotech and in the process view it in a negative light," notes Dr. Suharsono. He suggests that roundtable discussions be held not only for students but also for people like lecturers who are "highly ranked but have

limited knowledge. The strategy is to involve them in sharing and exchange of information as they can learn new things without feeling that their authority is being questioned. It is also a very good idea if the lecture on the development and safety of biotechnology especially GM crops can be given to all first year students of bioscience-related disciplines."

Communication Workshop

In September 2006, Dr. Suharsono and eight other Indonesian colleagues were invited to attend the *Biotech Issues and Communication Workshop: Enhancing Communication Skills on Biotechnology* held in Manila, Philippines. The International Service for the Acquisition of Agri-biotech Applications (ISAAA), in collaboration with the SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA) and the U.S. Grains Council, managed and implemented the four-day workshop which was also attended by participants from Malaysia, Philippines, Thailand, Vietnam, Kenya, and the U.S. The workshop aimed to train key decision makers to communicate effectively issues surrounding biotech seeds and food to their local stakeholders. Specifically, it provided participants from the region with the latest information on issues surrounding biotech crops; equip participants with communication skills to enable them to respond proactively to high concern, controversial situations; share country experiences on communicating biotechnology; and identify excellent communicators in the region who will be able to assist ISAAA in public awareness work.

A combination of technical lectures, risk communication workshop, communication experience-sharing among countries, and field tour was used to meet the set objectives. Resource persons discussed the global biotech scenario, food safety, environmental safety, and socio-economic and trade issues. A risk communication expert

Dr. Suharsono (third from left) and his colleagues during the Biotech Issues and Communication Workshop in Manila.

introduced communication techniques to deal with high, concern and controversial situations through lectures and exercises. Case studies from Indonesia, Philippines, Thailand, Vietnam, and the U.S. were presented to provide the challenges and strategies in communicating biotechnology. A field tour to a farmer's biotech corn field (Bt corn, RR corn, and corn with stacked traits), and contained trials of biotech papaya and eggplant gave a first hand exposure to biotech crops. A briefing on the Golden Rice project also provided information on the benefits of the technology.

Responding to Negative Issues

"I found the workshop very informative and useful. In particular, I learned how to react to negative newspaper articles on crop biotechnology, handle media interviews, and deal with non-government organizations that have different views about the technology," says Dr. Suharsono. He recalls that some people were concerned about the possible allergenicity of GM crops (or foods), as reported by some articles in newspapers. "To respond to this issue I explained that all agricultural products, whether developed through conventional means or biotechnology, are potential sources of allergens. But before releasing GM crops, many tests and assays are conducted so that only safe GM crops

"I found the workshop very informative and useful. In particular, I learned how to react to negative newspaper articles on crop biotechnology, handle media interviews, and deal with non-government organizations that have different views about the technology."

are released for consumption. GM crops have to be tested for food and environmental safety before commercialization." For future workshops like the risk communication workshop, he recommends inviting more people from different disciplines especially those from the social sciences who don't have much information about biotechnology. "Efforts should be made to facilitate attendance in workshops of scientists and researchers from the University research centers."

In addition to the ISAAA and BIC workshops, Dr. Suharsono finds the Pocket K series of articles on issues and concerns on crop biotechnology as well as the Executive Summary of the annual global status of commercialized biotech/GM crops very useful to update him on various topics. "By reading the Pocket K series, people know that GM crops are not dangerous to people as noted by some articles in newspapers. From the information on the global status of GM crops, people also get to know that biotech crops are cultivated and used in both developing and developed countries. IndoBIC should produce more publications for laymen on biotech in Bahasa Indonesia as stakeholders really need these materials to better understand the technology," he concludes. ❑

Shireen Assem

The Challenge of Simplifying Information for Stakeholders

By Ismail Abdel Hamid

"Plant science is a very interesting area. I have always found it interesting to explore nature and learn about living organisms and the environment. I used to live in a house surrounded by a nice garden. In this garden we used to grow flowers such as rose, jasmine and some ornamental plants, as well as some citrus trees like lemon and oranges. I think I had my first plant biology lesson there. When I was young, my mind was always busy thinking about how plants grow and how it takes its nutrition from the environment; why some plants need to be in the shade while others need the sunlight more. As I got older, my curiosity about nature and the plant kingdom increased including my appreciation for science. All these factors inspired me to become a scientist," recalls Shireen Assem. Dr. Assem was that little girl and is now the Head of Plant Molecular Biology Department of the Agricultural Genetic Engineering Research Institute (AGERI) in Cairo, Egypt.

Not content with merely appreciating plants, Dr. Assem specialized in plant science as an undergraduate and eventually took a Ph.D in biochemistry and plant genetic engineering from Cairo University. She further honed her expertise by attending a Fulbright Postdoctoral Fellowship at the University of Central Florida in Orlando on genetic engineering of the chloroplast genome. In between her studies she availed of professional upgrading through trainings and visits to other institutions in Egypt and the U.S. on plant molecular biology, plant tissue culture, and transformation techniques. Her current research endeavors are on the development of plant transformation technologies for monocot, improvement of maize productivity, and production of plant-derived pharmaceuticals.

"Science is life. Everything around us is made by science. Scientists always think about how to make life easier and safer for people. We develop modern technologies to improve our way of living. As the environment became polluted, lands suffer desertification and diseases become severe, scientists will always work together to learn more and develop proper technologies to fight these problems. The future is for science and technology," Dr. Assem asserts. "Many developing countries suffer from high population growth and lack of food security and affordable medicine. Agricultural biotechnology applications through the production of genetically modified (GM) crops are needed in these countries to face the challenges of food deficiency, low farm productivity, and global warming. In Egypt, crop biotechnology is not a new issue. We started biotechnology laboratory work in 1990 at the National Agricultural Genetic Engineering Laboratory which became AGERI in 1992."

Career Foundation

Dr. Assem joined AGERI as a junior researcher. She started doing research on natural products from medicinal plants. Her supervisor encouraged her to attend a training course on plant molecular biology. This course was her first experience on genetic engineering and molecular biology and it served as her foundation for her career in crop biotechnology.

Dr. Assem conducting research work on maize.

"Public concern about biotech crops is very high and this means more effort should be done with regard public awareness. The Egypt Biotechnology Information Center (EBIC) plays a vital role in this through its continuous activities with the media. Simplifying concepts of biotechnology and delivering simple information allows the public to make decisions about accepting biotech crops," says the lady scientist. She had her first opportunity to attend a workshop sponsored by EBIC in 2004. "I had just published a research article entitled *Expression of hepatitis B surface antigen (HBsAg)*

"Public concern about biotech crops is very high and this means more effort should be done with regard public awareness."

in transgenic maize (Zea mays L.*)* During that workshop, I presented my work which caught the interest of media people who were attending the workshop. Everybody was interested to understand how plants can work as biological bioreactors to produce some vaccines and pharmaceuticals."

Proper Perspective About Biotech

She eventually attended several workshops organized by EBIC particularly a presentation on the annual global report on the commercialization of biotech crops. "I also participated in EBIC media workshops. It gives me as a scientist, a proper perspective on how to communicate about biotechnology. Working with the media is an important activity for scientists. A scientist should deliver scientific data in a very simple way. After attending the workshops I realized the importance of getting in touch with the media and the public since our research is mainly directed to improve the life of the poor and help us attain self sufficiency with field crops. We should work closely with the public to identify their needs and find solutions to their problems."

Various people and school students from both Egypt and other Arab countries visit AGERI. "Those people sometimes have difficulty in understanding biotechnology when it is explained in English. The information needs to be translated and simplified. I find that ISAAA publications translated by EBIC into Arabic are a very good source to help explain our research initiatives as they are written in a very simple and easy language. They help raise public awareness about biotechnology and increase public acceptance regarding genetically modified organisms (GMOs)."

Participation in BIC Activities

Dr. Assem says that she has gotten positive feedback about her work which she attributes to her participation in EBIC activities. "I'm looking forward to more opportunities to participate in public awareness and understanding of biotechnology. It gives me a chance to simplify my work and I always think of other ways to illustrate data for kids and media for instance. It becomes part of my daily thinking when I get new data, how it could be rewritten to help others, not just for scientists." She suggests that more workshops be conducted regularly for scientists, media, and decision makers.

"In 2008 Egypt commercialized for the first time Bt maize. It is just the start. We have to keep in mind the agricultural challenges in our country and how biotechnology can offer and contribute to their solutions. Salinity and drought are priority issues now in agriculture." She adds that "If biotechnology offers us better crops then we have to accept it. We need to encourage our farmers to benefit from this technology. We also need to reach women and children in upper Egypt and rural areas, because most of them are uneducated and suffer from malnutrition, anemia and other diseases. Raising their awareness about biotech will help encourage them to grow biotech crops and accept GM food to fight hunger and malnutrition."

Dr. Assem is optimistic about biotechnology. "My dream is to see the first 100% Egyptian biotech crop to be released and commercialized. I think this is not too far away since we have the knowledge, the experience and the tools for that. Our country together with other neighboring African countries should join hands and focus on developing our own technology to solve the problems based on our needs. We don't have to rely on others, because we know better about our crops and environment," she says. ❑

Charles Mugoya

Communicating Modern Biotechnology within the Sub-region

By Margaret Karembu and Daniel Otunge

The nature of Dr. Charles Mugoya's work requires that he interacts and communicates with all cadres of people – from highly technical scientists, senior policy makers, development partners, journalists, to farmers - an engagement that requires very high level communication skills. To many scientists, this would indeed be a very big challenge, for communicating with the greater public and people without a science background can be a daunting task. Undeniably, scientists are largely known to "communicate" effectively only to fellow scientists who understand the technical jargon.

However, Dr. Mugoya, the Programme Manager, Agrobiodiversity and Biotechnology Programme of the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), is one of the few exceptions with the ability to tailor his communications to particular audiences. ASARECA, a non-political organization of the National Agricultural Research Institutes (NARIs) of ten countries - Burundi, D. R. Congo, Eritrea, Ethiopia, Kenya, Madagascar, Rwanda, Sudan, Tanzania and Uganda - aims at increasing the efficiency of agricultural research in the sub-region in order to facilitate economic growth, food security and export competitiveness through productive and sustainable agriculture. The Agro-biodiversity and Biotechnology Programme was created to subsume activities under two previous ASARECA networks: The Biotechnology and Biosafety Programme (ECA-BIO) and the Plant Genetic Resources Programme (EAPGREN). The Programme integrates agricultural biotechnology and agro-biodiversity by using biotechnology as a tool to enhance utilization of agro-biodiversity. The EAPGREN activities which focus on capacity building in plant genetic resources are presently implemented as a project under this program.

Dr. Mugoya narrates his responsibilities at ASARECA: "I frequently find myself in situations where I am required to translate highly technical scientific information into simple messages that can easily be understood by politicians and the many other people that I interact with on a day-to-day basis such as farmers, journalists and donors. As part of my work, I provide intellectual, strategic and technical leadership to national programs of the 10-member states of ASARECA and also in the development of project proposals. I am also responsible for mobilizing resource/assistance from member NARIs, partner institutions and donor agencies for undertaking the ASARECA Biotechnology and Biosafety Programme."

In addition, Dr. Mugoya has to synthesize and edit reports from various projects within the program and prepare periodic progress reports and technical papers for presentation to a wide range of audiences.

What then is Dr. Mugoya's secret?

While many scientists advance their professional and career paths along their scientific areas of specialization, Dr. Mugoya, a highly trained and experienced scientist, added another path to his career development path – science communication.

"I have worked closely with the International Service for the Acquisition of Agri-biotech Applications (ISAAA) in several of their science

"From this (media) workshop, I learned a lot about mass media operations and how to package my messages for impact. Interacting with media experts enriched my understanding of how to address tough questions from journalists and my partners. I acquired skills in public relations, networking and partnerships and would highly recommend replication of such workshops in the region."

communication training workshops, and these have really sharpened my communication abilities," says Dr. Mugoya. He singles out two of these – the *Inter-Agency Media Workshop on Covering Biotechnology in Eastern and Central Africa* held in Addis Ababa, Ethiopia in 2006 and the *Biotechnology and Biosafety Communication Strategy Development* workshop for COMESA (Common Market for Eastern and Southern Africa) region in 2008 in Nairobi, Kenya.

The regional inter-agency workshop on *Improving Media Coverage of Biotechnology in Eastern and Central Africa* brought together a rare mix - scientists and journalists on the same table to deliberate on biotech communication matters in the region. Hosted by the United Nations Economic Commission for Africa (UNECA) and in collaboration with the Agricultural Biotechnology Support Program (ABSPII), the United Nations Educational, Scientific and Cultural Organization (UNESCO), and ISAAA *Afri*Center, the three-day hands-on training workshop had 29 participants, including journalists from Burundi, Cote d'Ivoire, Ethiopia, Ghana, Kenya, Rwanda, Tanzania and Uganda. Representatives of the collaborating institutions, communication experts and researchers from the region served as resource persons. Additional support came from the Program for Biosafety Systems (PBS) and ASARECA.

One unique feature of this workshop was the testing and adoption of a UNESCO Multi-media training kit (MMTK) for the promotion of development communication. MMKT is a package of tools for journalists working in media houses as well as Information/Communication Officers in development-oriented organizations. It succinctly guides the user in navigating through the whole communication planning process to ensure balance and accuracy in reporting development issues. Key features of the MMTK include: sources of information; problems of finding new sources of information; selling the story to the Editor; reasons why Editors reject stories; getting past the Gatekeepers; developing new story angles; developing story outlines; covering both sides of the story; covering controversial issues and eventually writing the stories.

"From this workshop, I learned a lot about mass media operations and how to package my messages for impact. Interacting with the media experts diffused the suspicion I had about journalists' "intents" and enriched my understanding of how to address tough questions from journalists and my partners. I acquired skills that I use to tailor my presentations in ways that journalists and information officers can quickly pick as information sources for their stories. As well, I acquired skills in public relations, networking and partnerships and would highly recommend replication of such workshops in the region," states Dr. Mugoya.

These are skills Dr. Mugoya really appreciates. With his wide and deep knowledge of modern biotechnology issues, he plans to use his communication skills to become a regional biotechnology advocacy champion, a fit he hopes to achieve first by becoming a networking and capacity building expert. "I also plan to use my skills in mentoring budding scientists in modern biotechnology."

Development of Communication Strategy

"The other interaction with ISAAA *Afri*Center that I found most rewarding was my participation

Dr. Mugoya at the COMESA Communication Strategy Development Workshop.

in the regional workshop on *Development of a Biotechnology and Biosafety Communication Strategy for COMESA Region* in 2008. The workshop was designed to inform the development of a needs-based communication strategy for the region under the RABESA (Regional Approach to Biotechnology and Biosafety Policy in Eastern and Southern Africa) initiative. The findings of an assessment on the current status of biotechnology/ biosafety policies, laws, regulations and frameworks were shared, which initiated very productive discussions on how to generate content for an effective communication and advocacy strategy. I learned about the various steps and key questions to guide development of a focused communication strategy including:

1. Purpose of communication (Why)
2. Target audience (To whom)
3. Message (What)
4. Means of message transmission (How)
5. Message conveyer (By whom)
6. Feedback and follow-up (Participatory Monitoring and Evaluation)

In a nutshell, the facilitators guided us through the practical application of these questions and the considerations to bear in the task at hand, thus:

a) COMESA member countries are at different levels in the biosafety development process;
b) Some countries' biosafety laws are enabling while others are prohibitive;
c) Low levels of knowledge exist about biosafety policies and guidelines;
d) There is high suspicion and mistrust among countries;
e) Varied public misconceptions on biotechnology exist;
f) There are prejudice from interest groups such as organic farmers and activists."

Dr. Mugoya adds, "At the end of the workshop, we were able to come up with the key elements to be considered in developing the COMESA biotech/ biosafety communication strategy including need for:

- Specific messages for each target audience;
- Use of appropriate communication channels for specific target audiences;
- Audience research to obtain credible information for strategy development;
- Both regional and national advocacy and outreach plans;
- Sustained advocacy and outreach campaigns; and,
- Use of multiple communication channels to meet the needs of the strategy.

At the COMESA Ministers of Agriculture meeting in Khartoum in March 2007, implementation of RABESA-II was endorsed to hasten the harmonization process. This was in recognition of the benefits that a harmonized approach to biotechnology development would offer including: capacity building support through designated regional centers of excellence, synergized regulatory approval procedures, mitigation against potential impacts of genetically modified organisms

(GMOs) on trade, access to emergency food aid, and, enhanced information sharing. An important milestone in a harmonized approach would be consolidated templates with minimum acceptable requirements in the form of guidelines and procedures for fast tracking commercial growing and trade in agri-biotech commodities and access to food aid with GM content. The communication and advocacy strategy is aimed at catalyzing the harmonization process within this largest trading bloc in Africa, COMESA.

"Besides acquiring skills in effective communication, ISAAA has also enriched my knowledge on trends in modern biotechnology. Information and data from ISAAA's annual global status of commercialized biotech/GM crops reports have been useful background information for instance in preparation of workshop presentations and project proposal literature."

He, however, feels ISAAA should also provide separate global reports on available biotechnologies relevant for developing countries and crops undergoing field trials especially in public institutions from developing countries. This, he feels would build confidence among public sector researchers, farmers consumers and policy makers.

Regional Authority

These kinds of resolutions and recommendations can only come from a man with a deep passion for science and technology. Indeed, inspired into the world of science out of curiosity in unraveling the secrets behind life especially in the biological sciences, and in a strong belief in the power of science to positively impact human welfare, Dr. Mugoya has never looked back.

Through relevant training in biological sciences - BSc. in Botany and Zoology from Makerere University, Uganda, MSc. in Agricultural Entomology from University of Nairobi, Kenya and Ph.D in Applied Entomology from Rivers State University of Science and Technology, Port Harcourt in Nigeria, coupled with relevant work exposure both regionally and internationally in science and technology issues, Dr. Mugoya has gained deeper knowledge of the subject, thus becoming an authority in the region.

After his Ph.D in 1991, Mugoya worked as a resident scientist for the International Centre for Insect Physiology and Ecology (ICIPE) in Zambia up to 1995, to join the National Council for Science and Technology in Uganda from 1996-2004. Here he worked as an Associate Executive Secretary and Regional Coordinator for the Swedish International Development Cooperation Agency (SIDA)-funded BIO-EARN Programme. In 1998, he was appointed as Project Coordinator of the UNEP/GEF Project to guide development of the Uganda National Biosafety Framework. In 2002 he coordinated a second project of the UNEP/GEF programme on the implementation of the National Biosafety Framework.

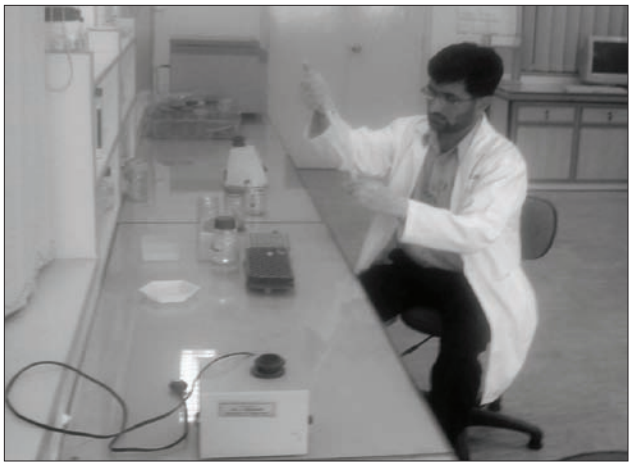
He sees the role of science and technology in Uganda from a much broader perspective - for meeting Uganda's felt needs toward realization of short and long-term national development goals through technological innovation and scientific advancement. "These can be achieved through fostering creative basic research to promote scientific advancement and expanding sources of technological innovation. It can also contribute to increased agricultural productivity, ensuring food security and social stability and improvement of the quality of life. Another role of science and technology in sustaining the growth of the national economy and to improve its efficiency is through the development of key technologies to increase the national competitiveness of existing industries," Dr. Mugoya concludes. ❑

Muhammadi

Library Visit Reveals Rich Source of Biotech Information

By M. Iqbal Choudhary

Pakistan is an agricultural country covering a total area of 19,671.63 million acres, of which 5,411.49 million acres are cultivated. Agriculture forms the largest sector of the national economy because it is strongly linked with food security, poverty alleviation, income and employment-generation, and rural development. At the national level, Pakistan's policy is to harness the potential of biotechnology as a key contributor to the development of the agricultural sector. Agricultural biotechnology is perceived to offer efficient and cost-effective means to produce a diverse array of novel, value-added products and tools for promoting the efficiency of crop improvement and food production.



Dr. Muhammadi at work in his lab.

Dr. Muhammadi is a research officer at the Biotechnology Wing of the International Center for Chemical and Biological Sciences, University of Karachi, Pakistan. He has a doctoral degree in molecular genetics from the University of Karachi's Department of Genetics where he did his research on the genetics of biopolymer production by indigenous soil bacteria. After working as a lecturer in biology at the Ghazi Foundation College for six years, he is now into full time research that covers industrial microbiology and biotechnology, particularly on the production of bioproducts by bacteria such as polymers, organic acids, antimicrobial compounds and bacteriocins, as well as their molecular genetic basis and their manipulation.

"I believe in the use of science and technology to develop new technologies especially for developing countries. Pakistan, as an agricultural country, needs new technologies and resources to address current and future challenges," says Dr. Muhammadi. "Applications of S & T should address needs of people. I look forward to greater development and use of new emerging sciences to enhance people's welfare. The tremendous scientific research all over the world in both developed and developing countries suggests a brighter and fruitful future."

Dr. Muhammadi adds that crop biotechnology is directly contributing to the alleviation of poverty and malnutrition. "After the success of the Green Revolution, the Gene Revolution, or the use of biotechnological interventions, plays a vital role by not only increasing crop productivity but also taking care of the increasing threat of biotic and abiotic stresses on crops. It has the potential to increase food production, reduce dependency on chemicals, and lower cost of raw materials in an environmentally friendly way."

At the end of the 20th century, Pakistan had few public institutions working on biotechnology. Currently, there are 28 public organizations and a sufficient number of well-trained manpower working on different aspects of crop biotechnology – from plant tissue culture to genetic manipulation of resistant species and transformation. Dr.

PABIC's Library.

Muhammadi says that since 2002, the Higher Education Commission, National Commission on Biotechnology, Pakistan Agriculture Research Council, Pakistan Atomic Energy Commission and other public sector organizations have been sponsoring a number of national projects, international cooperation and trainings, enhancement of manpower and higher education in crop biotechnology. "The sincere and successful continuation of these efforts may lead Pakistan to an era where hope for self-sufficiency in crop production may be met," opines the Pakistani researcher. "Various crop varieties (cotton, rice and chickpea) have already been developed but none have been commercialized so far despite the issuance of the National Biosafety Guidelines in 2005. Nevertheless, the Government continues to encourage cutting-edge research in biotechnology."

Information Updates

Dr. Muhammadi learned about the International Service for the Acquisition of Agri-biotech Applications (ISAAA) from its website. "I get information on approved guidelines, rules and regulations for the legal exchange and transfer of biotechnology especially in development countries. This information is important to build capacity for managing modern biotechnology. I also learn about the different activities and services that ISAAA conducts for developing countries, such as facilitating the safe transfer and sharing of crop biotechnology applications. I suggest that ISAAA hold short term trainings for scientists and organize more educational opportunities for farmers and consumers on the applications of crop biotechnology."

The molecular geneticist's initial familiarization with the activities of the Pakistan Biotechnology Information Center (PaBIC) happened when he visited its library. "I had the opportunity to go through the various information resources such as publications and workshop reports. Public awareness is critical for acceptance of biotechnology. PaBIC has made some basic work toward this end through the translation of booklets into the local language. It has also developed an active linkage among the biotechnology institutions in Pakistan. It provides a common forum for academic scientists to share their scientific views among themselves and with other stakeholders. It also conducts seminars and workshops on different aspects of biotechnology."

Dr. Muhammadi is tapped by PaBIC to share his research activities on bacteria and their biotechnological potentials. This effort, he believes, is an attempt to convince stakeholders in his country about the need for biotechnology. "I hope that my sincere devotion and dedication towards research and active participation in ISAAA activities will generate positive feedback. Being a young molecular geneticist/biotechnologist of a developing country, it is my responsibility to utilize my abilities to advance biotechnology in Pakistan. To learn and share, there is much to do in science and technology," says Dr. Muhammadi. ❑

Md. Amzad Hossain

Research Updates from Seminars and Workshops

By Khondoker Nasiruddin

Dr. Md. Amzad Hossain, principal scientific officer of the Biotechnology Laboratory, Bangladesh Sugarcane Research Institute (BSRI) in Pabna, has been working in the field of sugarcane research and stress physiology for the last 22 years. He completed his undergraduate course in agriculture at the Bangladesh Agricultural University (BAU) in 1984. After completing his Master of Science degree in agriculture, major in crop botany (stress physiology) from BAU in 1989, he was awarded a biotechnology fellowship under the World Bank Supported Agriculture Research Management Project. He obtained a Ph.D degree in biotechnology specializing in micropropagation somaclonal breeding from the Agricultural Biotechnology Division, Shinshu University, Nagano, Japan. Immediately, he joined the Biotechnology Laboratory of BSRI in 2001 and has worked as a sugarcane biotechnologist since then.

Dr. Hossain is one of many distinguished scientists in Bangladesh who have dedicated their lives to the search for greater scientific advancement. He is involved in planning, programming and implementing biotechnology and frontier research at BSRI. Research on *Agrobacterium*-mediated genetic transformation and DNA fingerprinting of sugarcane, development of drought and salt tolerance sugarcane through tissue culture techniques, regeneration of plants for somaclonal variation, and rapid multiplication of elite sugarcane varieties, and Stevia (an elite sweetening medicinal herb) are being done in his laboratory.

Challenges of Biotech Research

Resource poor farmers in a country such as Bangladesh inspire Dr. Hossain to use the tools of biotechnology to better their lot. Due to lack of sophisticated equipment and costly chemicals, however, DNA-based research that uses tools such as genetic fingerprinting for identification of crop varieties, molecular characterization of varieties and germplasms, QTL (quantitative trait loci) determination, genetic mapping and MAS (molecular marker assisted selection) are not yet being used. I am challenged to develop easy and efficient methods of quality DNA isolation using locally available and simple equipment and low cost chemicals without liquid nitrogen."

Apart from his busy research hours he is engaged in teaching and academic activities. He started as a teaching assistant for a laboratory course for fourth year undergraduate and Master's course students at the Faculty of Agriculture, Shinshu University. He is currently an external examiner in biotechnology and genetic engineering and supervises MS and Ph.D students in different national universities in Bangladesh. He also trains officials of the Department of Agricultural Extension, sugar mills, and non-government organizations as well as farmers on sugarcane production technologies. Dr. Hossain has published over 75 peer reviewed articles in local and international journals as well as booklets and leaflets on sugarcane production and by-product utilization technologies.

The Bangladeshi scientist and teacher is a member of professional organizations such as the Bangladesh Association for Plant Tissue Culture and Biotechnology, Bangladesh Association of Biotechnology and Genetic Engineering, Bangladesh Association for the Advancement of Science and Bangladesh Society of Sugarcane Technologists. He serves in various capacities in professional bodies such as the Federation of Asian Biotechnology Associations and Bangladesh Association for Biotechnology and Genetic Engineering (BABGE).

Attendance in Workshops

Dr. Hossain attends workshops, trainings, and seminars on development and field trial of genetically modified crops, biosafety related aspects and molecular techniques of biotechnology organized by the International Service for the Acquisition of Agri-biotech Applications (ISAAA) and similar organizations. "Updates on crop biotechnology are very useful to keep us abreast with research developments. I become aware of research results from biological as well as social scientists on crop biotechnology through these activities. This information is always valuable in my research."

"Crop biotechnology is one of the remedies to problems of food shortage, pests and diseases, malnutrition, and health issues," says Dr. Hossain. "I look forward to the day that products of advanced crop biotechnology are commercially available in Bangladesh." ❑

Cynthia Hedreyda

Molding Students into Future Scientists

By Mariechel J. Navarro

Dr. Hedreyda (right most) talks about biotechnology at a local workshop.

The passion and commitment for teaching, research, and extension is difficult to explain. Dr. Cynthia T. Hedreyda, professor and scientist, and concurrent director of the National Institute of Molecular Biology and Biotechnology of the University of the Philippines (UP) Diliman, says "I just found myself enjoying both teaching and microbiology research. After graduate school, my desire to be able to help train young students to be future teachers and researchers inspired me to involve students in my research with the goal of not just helping them fulfill the requirements of the degree program but encouraging them to publish and pursue a career in science." In addition, Dr. Hedreyda works with teachers and high school students to promote popular awareness of biotechnology in the Philippines.

"Updates on crop biotechnology are very useful to keep us abreast with new developments and to enhance our lectures."

Dr. Hedreyda majored in biology and genetics in UP Los Baños, and pursued her Ph.D in microbiology at the University of Georgia, USA. A faculty member of UP Diliman for the last ten years, she teaches students in molecular biology and biotechnology and has supervised 58 undergraduate students and eight masteral and doctoral students. These students have merited international publication awards, best paper awards, and best oral research presentations in various scientific fora. Aside from teaching about three to four courses per semester, she is active in research. Her research endeavors span a wide array of interests such as industrial enzymes, bioremediation, and wildlife conservation. In recognition of her research work, the National Research Council of the Philippines gave her an achievement award in biological science, while the UP designated her as Scientist under the University's Scientific Productivity System.

On top of her academic and research commitments, Dr. Hedreyda's foray into popularizing biotechnology is worth mentioning. "My involvement is through the undergraduate and graduate courses I teach and through the extensive seminar and laboratory training workshops I spearhead to promote awareness of biotechnology in the country." She conducted nationwide seminar series for teachers on biotechnology in cooperation with the Philippine Society for Microbiology, Inc. and supported by the Philippine Department of Agriculture, U.S. Department of Agriculture, and the International Service for the Acquisition of Agri-biotech Applications (ISAAA) in 2001-2002. Since 2007 she has been spearheading the conduct of the National Biotechnology Quiz

Dr. Hedreyda welcomes participants during the National Biotechnology Quiz Contest.

contest for high schools in cooperation with the Philippine Society for Microbiology, Inc. the Biotech Coalition of the Philippines, and with the support from ISAAA. The quiz contests consist of regional contests held in six provinces with the winners vying for grand final awards in Metro Manila. "We have witnessed young high school students who are so enthusiastic not only to win but to learn more about biotechnology. We were so impressed that high school students could answer tough biotechnology questions meant for college students," Dr. Hedreyda says.

In addition, she conducts regular hands-on laboratory workshops at her institute for teachers, students, and people from the industry and government agencies. "Participants always give excellent evaluation to our resource persons and our young research associates and graduate students who serve as laboratory facilitators. They really commend these young future scientists for their expertise in teaching and performing experiments as well as for their patience and willingness to teach beginners."

Integration of Biotech in Curriculum

Noting the importance of biotechnology in national development, the lady professor took the lead in

implementing a project to encourage and train teachers and administrators of Philippine State Universities and Colleges (SUCs) to institute a general education (GE) biotechnology course or to integrate extensively, topics on biotechnology in currently offered biology subjects in cooperation with the Department of Agriculture and the Commission on Higher Education. "While there is limitless information on biotechnology, there is not enough popular awareness on the subject," explains Dr. Hedreyda. She prepared a teacher's manual or syllabus for teaching the biotechnology course complete with Powerpoint presentations, held a workshop for representative teachers from the SUCs, and assisted the schools in conducting echo seminars to other teachers who will be assigned to teach the course. As a result of this endeavor two state universities, the Cavite State University and the University of Southern Mindanao now offer a 3-unit biotechnology course to their respective college students. The University of Rizal System is also set to start a GE biotech course in the second semester of school year 2008-2009.

"Updates on crop biotechnology are very useful to keep us abreast with new developments and to enhance our lectures. I have become aware of research results of biological as well as social scientists that are relevant to crop biotechnology. This information is always valuable in providing students with the best training and education in biotechnology," notes Dr. Hedreyda.

As sources of updates, she finds the "workshops organized by ISAAA as always informative and well managed. Workshop materials and kits are adequate and useful and the activities are participatory. We also use ISAAA publications such as Pocket Ks (pamphlets on biotechnology issues and concerns) and Briefs, and videos in teaching the GE biotechnology course entitled Biotechnology and You; as materials in training workshops on molecular microbiology for beginners and specialized topics; in the institutionalization of a GE biotechnology course in state universities and colleges; and as review materials for high school students who participate in the National Biotechnology Quiz contest. They are all extremely useful."

Biotech Popularization Activities

Feedback on her popularization efforts has been positive with students and participants of workshops appreciating the videos and publications. ISAAA videos on the experiences of developing countries capture years of research and development from the perspectives of different stakeholders in less than 20 minutes.

"ISAAA should continue supporting colleges and universities who are involved in teaching biotechnology and those who are involved in extension activities for the popular awareness of biotechnology in the Philippines," Dr. Hedreyda suggests. "Products of advanced crop biotechnology are crucial in solving problems of increasing population everywhere. Crop biotechnology is one of the remedies to food shortage, appearance of more potent pests and disease causing organisms, problems of malnutrition and decline in animal and human health in our country. Educating people about the processes and products of new technology is important."

Dr. Hedreyda sees herself actively promoting awareness of biotechnology in the country in the years to come because there is still much to be done. "I will support the teaching of a GE biotechnology course even to non-science majors in public and private universities. I will also continue to conduct basic and applied research in biotechnology and will always support research activities of colleagues on crop biotechnology," commits the lady professor. ❑

Muhammad Herman

Keeping Biotech Research "Alive" in Indonesia

By Mariechel J. Navarro and Bambang Purwantara

Many young children dream about becoming a medical doctor one day. Perhaps it is the positive experience of a child's visit to a doctor or the thought of being also able to cure people and make them well that inspires this dream. Muhammad Herman shared this dream while growing up – he eventually became a doctor but instead of specializing in the treatment of people he now works with plants and indirectly helps people benefit from biotechnology research. "I applied at the University of Gadjah Mada, Yogyakarta, Indonesia thinking I would study for a medical degree," Dr. Herman reminisces, "but I got admitted to the Faculty of Agriculture instead. I rationalized that if I could not become a doctor who treats people, I would work with plants instead and still be useful by sharing technology." Today, the 59- year old Dr. Herman is a noted research scientist and head of the Molecular Biology Research Division, Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development (ICABIOGRAD), under the Indonesian Agency for Agricultural Research and Development (IAARD), Ministry of Agriculture in Bogor.

"In Indonesia, there are not many players in crop biotechnology research and efforts are scattered," says Dr. Herman. "Yet, there is a future for biotechnology in the country – it can play an important role in improving crop productivity and crop quality which are not achievable by conventional technology alone. Biotechnology complements the use of conventional technology and contributes to protecting the environment by using less pesticides and fertilizers." Dr. Herman is thus a key player in the biotechnology arena in the country and assumes an important role in helping to provide a positive environment for the technology and in fostering greater awareness of this field.

During Dr. Herman's final year as an undergraduate at the University of Gadjah Mada where he majored in entomology and specialized in nematology, a senior scientist from the former Central Research Institute for Crop Foods (CRIFC), visited their school and selected him to receive a six month incentive allowance to guarantee his acceptance of a research position with the Institute in Bogor after graduation. He started with the Plant Pathology Research Division of the Bogor Research Institute for Food Crops under the CRIFC, Ministry of Agriculture in 1977 which he joined upon graduation. Dr. Herman rose through the ranks and has remained loyal to his institute. He obtained his MS and Ph.D degrees in plant pathology from the University of Georgia, Athens,

Dr. Herman (second from left) talks about the status of biosafety regulations in Indonesia during an international biosafety workshop.

USA in 1987 and 1990, respectively. He took up a postdoctoral fellow on genetic engineering of sweet potato at the Michigan State University from 1993-1995. To widen his expertise, he also attended trainings in Japan, the Philippines, India, United States, and Canada, on such topics as nematology, rice biotechnology, biosafety, food safety, and intellectual property rights.

Biotech Activities

As head of the Molecular Biology Research Division of ICABIOGRAD, Dr. Herman supervises 50 employees of whom 27 are research scientists. ICABIOGRAD has three other divisions (Cellular Biology and Tissue Culture, Biochemistry, and Genetic Resources). The MolBio division uses two approaches - genetic engineering and the application of molecular markers. Eight on-going research activities funded by the Government of Indonesia include efforts to develop tomato resistant to cucumber mosaic virus (CMV) and tomato leaf curl virus (TLCV); potato resistant to leaf blight; rice and corn that utilizes nitrate more efficiently; soybean tolerant for aluminum toxicity using molecular markers; rice tolerant to drought, resistant to bacterial leaf blight and blast diseases; mapping of jatropha using molecular markers for high oil content; and gene isolation for insect resistance derived from nematodes.

As a scientist, Dr. Herman's research project activities include the development of transgenic soybean resistant to pod borer, sweet potato resistant to feathery mottle virus and late blight disease; transgenic papaya for delayed ripening; and transgenic tomato resistant to tomato leaf curl virus and cucumber mosaic virus. From 1996-2002 he was also the country coordinator of the Agricultural Biotechnology Support Project (ABSP), Phase I; and country coordinator of ABSP, Phase II from 2003-2007.

"Among our research activities, rice resistant to bacterial leaf blight and blast diseases developed through the application of molecular marker techniques, transgenic potato resistant to late blight, and tomato resistant to multiple viruses will have the greatest potential to develop a product in the next few years. Recently, ICABIOGRAD initiated collaboration with the private sector to develop a public-sector crop. ICABIOGRAD has been developing rice resistant to bacterial leaf blight and blast diseases using molecular marker techniques, and the private sector continues to grow the rice in several locations for seed multiplication and conducts multilocation tests for varietal release and registration," explains Dr. Herman.

With his expertise and experience, Dr. Herman holds concurrent positions such as coordinator of plant group of biosafety and food safety technical team; vice chair of the Indonesian Society of Agricultural Biotechnology, and Secretary of National Committee on Genetic Resources, and member of the Biosafety Working Group under the Ministry of Environment. He was a member of the draft team of regulations and law, e.g. biosafety regulation in the Ministerial Decree, biosafety and food safety regulation in Joint Ministerial Decree, Plant Variety Protection Law, ratification for Cartagena Biosafety Protocol, government regulation on Biosafety of Genetically Engineered Products, the Accession of the International Treaty of Plant Genetic Resources for Food and Agriculture Law, and the bill on the Conservation and Utilization of Genetic Resource Law.

Biotech Awareness

"We should be engaged in greater awareness and understanding of biotechnology so that a greater number of people, especially the youth, will know more about it," Dr. Herman explains. He gives short lectures to high school and college students. His institute has an immersion program where students spend 1 (for high school) or 3 months to one semester in the case of undergraduates. They also have a week long exhibition and open house where the public can see activities such as demonstrations and facilities, especially to encourage students to know more about biotech. It is during these sessions that he gives half to one day lectures on biotechnology.

"We should be engaged in greater awareness and understanding of biotechnology so that a greater number of people, especially the youth, will know more about it."

Among the publications published by the International Service for the Acquisition of Agri-biotech Applications (ISAAA), Herman finds most useful the Pocket Ks (Pockets of Knowledge) or series of packaged information on crop biotechnology issues and products produced by the Global Knowledge Center on Crop Biotechnology. "The Indonesian Biotechnology Information Center (IndoBIC) has translated these materials into Bahasa Indonesia and these are distributed during the open house and exhibition for the public. They are handy and easy to understand," Dr. Herman elaborates. In particular, he likes the general biotech topics such as frequently asked questions and answers about crop biotech. He also finds useful the CD videos on biotechnology developed by IndoBIC which he shows during sessions with elementary to middle and high school students. "It is easier to relay concepts or give information in a form which the audience prefers such as video. Simple information about DNA is clearer to a general audience when presented in a video format." He also wrote a brochure for laymen on issues and facts about biotechnology and two book volumes on genetically engineered plants and its regulation in Bahasa Indonesia published by the Department of Agriculture. Among his references are ISAAA Briefs on the global status of commercialized biotech/GM crops, and the first ten years of GM crops – global socio-economic and environmental impacts.

Collaboration with IndoBIC

Dr. Herman has a collaborative exchange with IndoBIC. His institute either co-sponsors activities with IndoBIC or invites IndoBIC to its activities. He is invited by IndoBIC as a resource person in its seminars and workshops. For example, in a workshop with media to build positive perception toward biotechnology applications in Indonesia, Dr. Herman oriented practitioners from the tri-media on local research initiatives in the

"It is easier to relay concepts or give information in a form which the audience prefers such as video."

country and toured them to confined field trials of transgenic crops, and Institute laboratories. Through this collaborative endeavor, several articles on crop biotechnology were written and published in various newspapers such as the *Radar Bogor, Media Indonesia, Republika,* and *Pakuan Raya* and featured in television programs. In a risk communication workshop organized by IndoBIC, Dr. Herman was again a resource person where he discussed agricultural products that local scientists are working on as well as issues often raised about crop biotechnology. The workshop tackled these questions: What biotech crops are being researched on in Indonesia? What are the common issues raised about biotechnology? What communication techniques should stakeholders such as scientists, university faculty, and government officials use to enable them to be effective biotech communicators? The workshop enabled participants to be updated on biotechnology and at the same time be equipped with skills to effectively communicate with the media through sessions on message mapping, popular science writing, doing recorded interviews, and writing written statements for media.

In like manner, ICABIOGRAD organizes its own activities and invites IndoBIC staff to participate and be a resource person. One such activity was a national seminar on agricultural bioethics in Indonesia where the BIC head made a presentation on various bioethical issues related to research, development, and commercialization of agro-biotechnology products; and a technical working group meeting on biosafety where IndoBIC was a participant.

Due to budgetary constraints at ICABIOGRAD, money often goes to research and hardly to communication activities such as development of popularized publications for laymen. "There is an institute division on research collaboration and publications but we give more priority to research rather than media-related activities. There is need for more biotechnology activities to continuously increase awareness of different stakeholders about the technology. Housewives and members of Parliament should be updated about biotechnology. As major government decisions are decided by Parliament, relevant members should be briefed about biotechnology. IndoBIC can play a greater role in conjunction with other research institutions," Dr. Herman suggests.

Optimism for Biotechnology

Support to biotechnology research is not given much attention by the government and the President has not given any strong statement of commitment. Nevertheless, Dr. Herman remains optimistic about the technology's role in Indonesia. "We need to convince policy makers to allot additional funding for research and development as Indonesia cannot be left behind. A question from policy makers is always "Where is the product after doing years and years of research?" Only a clear product such as those being studied by the research institutes will hopefully change the biotech landscape in Indonesia in the near future". ❑

Iekhsan Othman

From Toxins to Biotech

By Mahaletchumy Arujanan and K. Cheng Liew

The academic profession in Malaysia is one that is vibrant yet strongly competitive. Rare are the academicians that despite their busy teaching schedule, manage to maintain their research output while also trying to educate society on the various intricacies of science. Professor Iekhsan Othman is one such individual, whose dedication to teaching and research has seen him rise to become one of the foremost science educators in Malaysia. Currently a professor of biochemistry he is also head of the Department of Biomedical Sciences at Monash University Sunway Campus. He is academic coordinator for the School of Pharmacy and also chairperson of the School Research Committee. Since July 2006, he has been one of the Fellow Directors for the Malaysian Biotechnology Information Center (MABIC) and thus, part of the vibrant local biotechnology community.

Prof. Iekhsan is a neurotoxicologist with substantial experience with Malaysian toxins. He specializes in the isolation and characterization of the mechanisms of toxins from Malaysian snakes such as the *Naja naja kaouthia* (Indian cobra), *Ophiohagus hannah* (King cobra), *Bungarus candidus* (Malaysian kraits) and *Bungarus fasciatus* (Indian kraits). Professor Iekhsan is also the only scientist in Malaysia who is carrying out research on marine toxicology especially on jellyfish toxins, pufferfish toxins and saxitoxins from dinoflagellate. Toxicology is the study of natural toxins produced by living things and how such toxins end up killing its victims. Research in the area typically involves isolating specific active molecules in the venom, discovering the mechanisms by which they bind to tissues and cause death.

Humble Beginnings

"My involvement in science was just by default from being exposed to the science stream after completing my Lower Certificate of Education. It just developed into something for me to apply and pursue at a higher level," recalls Prof. Iekhsan. "After completing my A-levels, I was able to actively commit to the sciences by taking up a Bachelor's degree in Biochemistry from the University of Bristol."

After obtaining his undergraduate degree, a hunger for knowledge and a desire to know more at a higher level made him specialize in neurotoxicology at Imperial College of Science, Technology and Medicine, London University. He was involved in looking at the application of neurotoxins as probes for the study of neurotransmitters. Upon his return to Malaysia, he continued his toxin research on local snakes and animals, an area of research which did not extensively involve many scientists.

In 1988, during his first sabbatical, he was awarded a grant under the prestigious Fulbright Scholar programme to carry out research in the United States. For nine months, Prof. Iekhsan was the Visiting Scientist to the Dermatology Laboratory in the University of Maryland, School of Medicine under the supervision of Professor Joseph Burnett who had been working with jellyfish toxins. The interest in working with jellyfish started with a

referral addressed to University Hospital regarding a jellyfish sting that a tourist got on vacation in Batu Feringghi. This begun his involvement in marine toxicology and jellyfish research. At that time, no Malaysian scientist had been involved in the study on marine toxicology in general, and Malaysian jellyfish in particular, although many studies have been done by researchers overseas.

In addition to looking at the nature and mechanisms of actions of these toxins, Prof. Iekhsan carried out research to seek antidotes against these toxins so as to neutralize and relieve the painful effects. He has successfully identified several Malaysian plants that are useful for treating snake venom poison and jellyfish stinging.

Assuming the Role of Teacher and Student

Aside from his academic involvement in poisons, Prof. Iekshan has been actively involved in promoting science and technology, and biotechnology in Malaysia, particularly through information and education.

"The root to discovery is through new findings in various subjects. I believe that there is no other way to know more, and it is imperative to understand and do our own research," he comments. "However, as scientists we have a commitment to impart knowledge and through teaching and informing, we become more knowledgeable ourselves - it is a wonderful experience. This is important as we play a pivotal role in contributing to science and technology innovation by increasing the interest of the general public. This is the reason why I chose to become an academic, because I like teaching. Especially more so in a higher learning environmental setting, we have a tremendous value added impact as students know what they would want to achieve in such settings."

It is through this willingness to learn and teach, being both the teacher and student, that Prof. Iekshan has managed to involve himself in various other projects that are not related to his field of research. He is a committee member in the management panel of the National Biotechnology Directorate where he is involved in the approval process of project grant applications. He is not hesitant to help good grants get the support of the directorate, especially in the field of crop biotechnology where it is at the forefront of providing technology for food.

> *"It is critical for people that have been involved to also provide their input, share their experiences, and apply the lessons they've learned."*

"I believe that such technology is more significant for the overall well-being of the country, and the impact of such projects on productivity as well as food quality. However, we have to be vigilant in looking at food safety as we are an agri-based country."

Communicating Risk: Understanding the Issues

Prof. Iekshan has also been working with the Malaysian Biotechnology Information Center and The International Service for the Acquisition of Agri-biotech Applications (ISAAA) on various issues on biotechnology. Most significantly, he participated in several workshops dealing with crop biotechnology and risk management. In 2006, he joined MABIC in attending a risk management workshop organized by ISAAA in Los Baños, Philippines. The various techniques and issues raised during the workshop have allowed him to bring back such lessons to Monash University, and apply the various methods into his field.

"Thanks to the lessons learned from the risk communication workshop it was possible to adapt the various techniques into a medical school

Professor Iekhsan viewing a corn thresher.

setting. A risk communication workshop addressed issues of medical care, whereby participants learn techniques to cope when dealing with patients with chronic disease and the terminally ill," he says. "It was possible to impart risk communication factors in patient care and healthcare, such as through techniques in explaining disease in terms of life quality."

Prof. Iekshan commends MABIC for being instrumental in organizing the workshop and assisting in various aspects. He believes that through the many activities being organized on various aspects of biotechnology, MABIC and ISAAA play a crucial role in involving the different stakeholder groups in understanding science. He acknowledges that such involvement is critical in allowing society to get a better understanding of the current state of scientific advancement.

"I hope that MABIC and ISAAA continue to play more central roles in the development of science and technology in the region," he says. "It is important for the goodness of things that we as scientists are able to educate and inform people. Through the activities conducted, I hope to see past events being revisited, updated and enhanced, as I believe that the learning process is never-ending and never static. It is critical for people that have been involved to also provide their input, share their experiences, and apply the lessons they've learned." ❑

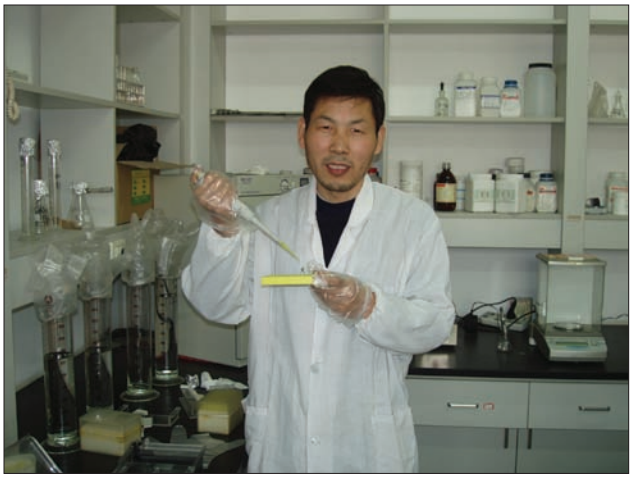
Zhengbin Zhang

Using Chinese Crop Biotech Update as Reference

By Zhang Hongxiang and Tian Zhang

Zhengbin Zhang is a researcher at the Center for Agricultural Resources Research, Institute of Genetics and Developmental Biology, Chinese Academy of Sciences (CAS). Concurrently, he is a peer reviewer of *China Biotechnology*, a leading scientific journal. The journal is published by CAS in partnership with the China National Center for Biotechnology Development (CNCBD) and the Chinese Society of Biotechnology (CSBT).

Dr. Zhang holds a doctoral degree in plant physiology from the Northwest Sci-Tech University of Agriculture and Forestry in China and did his post-doctoral research at the Institute of Crop Science, Chinese Academy of Agricultural Sciences. He has been engaged in plant genetics and breeding as well as anti-drought and anti-stress physiological-biochemical research for 25 years with focus on wheat anti-drought genetics and



Zhengbin Zhang at his lab.

breeding. Dr. Zhang has published several books on wheat research, one of which is *Drought Resistant Breeding in Wheat and Wheat Breeding Science*. As a professor he teaches students about water management in wheat.

Dr. Zhang believes that agriculture is progressing along with today's rapid scientific and technological development, and the appearance of transgenic technology has brought about a significant evolution in the crop cultivation history. "It is very important to improve the quality of wheat, a grain crop with the biggest cultivation area in the world." He says that China's genetically modified (GM) wheat has witnessed substantial progress in theoretical and basic research thanks to scientific and technological projects such as the National "863" Program, a national high-tech R&D program under the Ministry of Science and Technology; and the National Transgenic Plant Research and Industrialization Program supported by the State Council. However, much work is still confined in the laboratory. Dr. Zhang adds "Research in anti-drought GM organisms is slow, and the country should offer more support. With specific intellectual property rights and the discovery of important functional genes, more efforts at transgenic research in China are anticipated."

As the peer reviewer of *China Biotechnology* and a member of CSBT, Dr. Zhang is pleased to witness the cooperation between CSBT and the International Service for the Acquisition of Agri-biotech Applications (ISAAA). CSBT is a non-profit organization that aims to promote academic communication and biotechnology commercialization. He believes that the cooperation will help CSBT to further promote development of agricultural biotechnology research and commercialization and exchange of local and international information.

"After receiving the Chinese version of the weekly e-newsletter Crop Biotech Update (CBU), I found out that it can be a reference for my work since it has a lot of comprehensive information. I hope my students can also receive such information so that they can view science and crop biotechnology issues more comprehensively. In addition, I think the Chinese translation of the CBU can also be

The Crop Biotech Update Chinese translation.

a valuable reference for officials and staff of the Agricultural Management Department, Ministry of Science and Technology, and the National Development and Reform Commission."

Dr. Zhang is not only concerned about scientific research but also pays attention to the promotion of transgenic technology. Recently, he published an article titled *Transgenic Wheat Progress amidst Disputes* in *Life World*, a magazine published by the Institute of Botany, CAS. He notes in this article that wheat is a major nutritional source of people but the public has given more attention to whether the wheat should be produced through transgenic means or not. Dr. Zhang says "Disputes about transgenic wheat go beyond science to include economic and trade issues. However, the public should recognize genetic engineering from a scientific basis. Social scientists and biologists or members of the science and technology sector should create more opportunities to communicate with the public, so that the public can have a correct understanding of what a transgene is." ❑

Naglaa Abdallah

Keeping Up-to-Date with Biotechnology

By Ismail Abdel Hamid

Dr. Naglaa Abdallah is a professor at the Department of Genetics, Faculty of Agriculture, Cairo University and a senior scientist at the Agricultural Genetic Engineering Research Institute, Agricultural Research Center, Egypt. She obtained her Ph.D in molecular genetics from Cairo University in 1986 and has been a genetics professor since 1996. In school year 1998-1999 she received the Genetic Engineering award from Cairo University for her cloning and molecular studies on *Bacillus thuringiensis* (Bt) genes, and the Biotechnology State award for scientific research in agricultural biotechnology in 2000-2001 for her work on molecular characterization of geminiviruses.

In addition, Dr. Abdallah is the editor-in-chief of *GM Journal* (Landes Biosciences, Austin, Texas, USA) and a member of the editorial board of the *Arab Journal of Biotechnology*. Since 2005 she has been a member of the National Committee on Genetics which is composed of 30 scientists who are tasked to build a database for scientists in that field, organize workshops, and propose solutions for consideration of the Ministry of High Education, among others. She is also a member of the special committee for academic curricula development, Faculty of Agriculture, Cairo University.

"Biotechnology is one of the latest advances in the biological sciences; it can revolutionize our understanding and utilization of facts of life,

all forms of life. Biotechnology can help tackle agricultural problems, clean our environment, contribute to solving our health problems, increase our income and make our life easier. In the past few decades, biotechnology has accelerated its pace in improving all aspects of human life," says the lady professor.

The lady professor took several fellowships in the USA and Germany in the field of genetic engineering. "Exposure to the Western culture through fellowships encouraged me to work on biotechnology in 1986 after receiving a fellowship at the Ohio State University to work on molecular cloning and gene transfer." She now also teaches undergraduate and post-graduate courses and conduct workshops, in addition to supervising several research thesis advisees in that field.

Dr. Abdallah is project investigator/co-investigator in several joint scientific projects involving transgenic plants resistant to biotic stresses (virus, fungi and insects) and abiotic stresses (heat and salt). Specifically, she is working on pest and stress resistance to tomato, sugarcane, fig, and melon. "Based on my experience, biotechnology plays an important role for both developed and developing countries. It has the capability to help developing countries face the challenge of food insufficiency. I work on Tomato Yellow Leaf Curl Virus which can destroy tomato farms. This problem encouraged me to find a suitable solution using biotechnology tools to help tomato farmers in Egypt and other countries. Tomato is only one example. Cereal crops are also worth focusing on – by improving its productivity we can help in poverty alleviation," Dr. Abdallah explains.

Egypt supports the use of modern technology as one of the strategies to solve agricultural challenges. Dr. Abdullah notes that the country has invested in human capacity building such that it has now trained scientists to use modern

Dr. Abdallah is project investigator of research involving transgenic plants.

biotechnology tools to develop plants that face biological and abiotic challenges. "Increase in farm productivity through enhanced crop varieties and better insect and disease management is a top agricultural priority. I believe in the positive future for agricultural biotechnology in my country," says Dr. Abdullah.

Biotech Developments

Keeping up to date with the fast developments in biotechnology is important for this lady professor. "I attended several workshops organized by the International Service for the Acquisition of Agri-biotech Applications (ISAAA) through the Egypt Biotechnology Information Center (EBIC). EBIC organized several activities on national, regional and international levels that helped me in my teaching and laboratory work. Undergraduate and graduate students always ask about the risk of using genetically modified (GM) crops and I use the information in the ISAAA website and publications to answer their questions."

She adds that "The annual global status report on the commercialization of biotech crops is a landmark publication for all agricultural

biotechnologists. The Arabic translation of the report summary and the PowerPoint presentation of key figures and tables are used in most of my presentations and lectures. My students visit the EBIC website frequently to download useful information for their reports."

Dr. Abdallah also says that EBIC meetings with agricultural extension workers are very important. "It needs more effort to simplify difficult scientific data for them but I am happy to cooperate with EBIC in such activities. It is the right of extension people to know the scientific basis of what they hear about and may eat one day, and it is our duty as scientists to deliver clear and transparent information. EBIC plays a pivotal role in gathering us in one meeting. I have also participated in some EBIC meetings and conferences with media specialists. These meetings are different from those with agricultural specialists. With media I have to further simplify the information and deliver some of it in a written format. Scientists are always wary to communicate with media but EBIC facilitates interaction and builds our confidence with them."

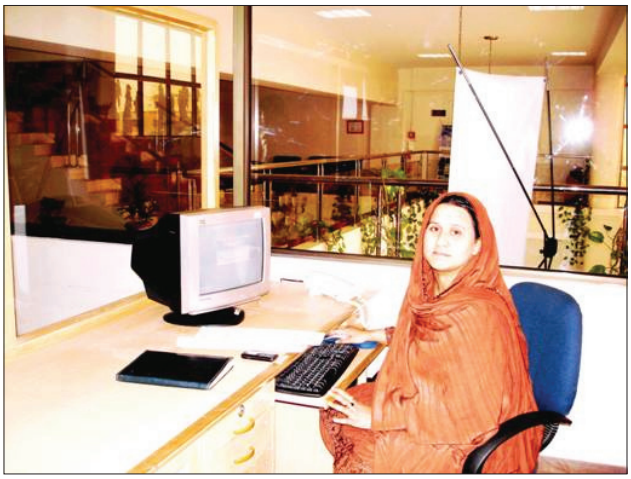
"Being acquainted with ISAAA and EBIC activities through workshops, publications and email, I am able to use published information as examples in my teaching. Also, I distribute the ISAAA publications to my colleagues and students. Students are excited about the field of biotechnology and want to participate in discussions with experts to get their opinions. I rely on ISAAA and EBIC publications because they are based on scientific evidence and are very credible. It also provides me with updated, simple, and user friendly information on global agricultural biotechnology." ❑

Saddia Gelani

Future is in Plant Research

By M. Iqbal Choudhary

"Plant research is vital for the world's future where mankind has to reach a balanced and sustainable relationship with the rest of nature and its environment. We are increasing in population and this means a rapid growth in the demand for food, feed, fiber, and fuel. On the other hand, we are rapidly depleting our fossil fuel reserves, and there are severe limitations on the amount of land and water available for agriculture. In addition, political problems and distribution costs suggest that we need, as far as is possible, to enable the bulk of food to be produced close to where it is needed. Eventually, if that does not happen, the hungry will move in large numbers to where there is food. Enhancing agricultural productivity in developing countries requires new approaches



Dr. Gelani looks forward to the day Pakistan will introduce GM crops.

"As a researcher, new information is necessary to engage in meaningful discussion."

that provide incentives and funding mechanisms that will translate new innovations in plant science into concrete benefits for poor farmers." Dr. Saddia Gelani articulates these thoughts as she ponders on how scientists like her can contribute to solving food problems.

As a research officer of the Research Institute of Chemistry, International Center of Chemical and Biological Sciences, University of Karachi in Pakistan, Dr. Gelani believes that her work on tissue culture and genetic transformation of crops such as sugarcane, rice, and banana will address food issues. A main focus of her work is on stress physiology and various stress tolerance mechanisms of crop plants.

The lady scientist obtained her undergraduate degree in biology from the Government College for Women, Madina Town and her advanced degrees from the University of Agriculture, Faisalabad. After a brief stint as a biology lecturer in a government college for women, she moved on to a research career. "My exploring nature always leads me to discover new ways to ensure food security so that my countrymen will not suffer from starvation."

Country's Prosperity and New Technologies

Dr. Gelani says that a country's prosperity depends on the discovery of new technologies. "The future of science and technology looks brighter because there is continuous chain of inputs from scientists, research scholars and students." She adds that "In Pakistan, there is a future for crop biotechnology. It can play an important part in improving crop performance, yield potential, stress tolerance (especially on marginal land), and nutrition."

People are now more aware about biotechnological knowledge and trends. Dr. Gelani explains that knowledge about developments in the field is crucial for various stakeholders. As a researcher, new information is necessary to engage in meaningful discussion. "I visit the Pakistan Biotechnology Information Center and use many of their publications to enhance my research. It provides links to biotechnology-related articles. I also visit their virtual library and download many related materials." To widen PaBIC's reach, the lady scientist suggests that it should have more workshops to be conducted in different locations in Pakistan to bridge the communication gap. "PaBIC is playing a key role in disseminating information and facilitating the exchange of ideas about biotechnology."

Dr. Gelani looks forward with excitement to the time that Pakistan will eventually introduce genetically modified crops in the country. In particular she thinks that transgenic cotton is promising with its built-in resistance to pests. The cotton variety will reduce the use of chemical pesticides and lower farming costs. She notes that there are now ten genetically modified crop plants that have been submitted to the National Biosafety Committee for evaluation and approval.

"I feel that I am young in the biotech field that still needs nourishment and care. But dedication and hard work will see me through," opines Dr. Gelani. ❑

Umi Kalsom Abu Bakar

Learning About IPs, Biosafety, and Commercialization

By Mahaletchumy Arujanan and K. Cheng Liew

Since its conception from an act of Parliament in 1969 with the primary objective of developing and promoting new and improved appropriate technologies in agriculture, the Malaysian Agricultural Research and Development Institute (MARDI) has managed to maintain itself at the lead of Malaysian agro-technology. The technologies being produced by the Institute increase productivity and efficiency, while modernizing the agricultural sector as well as maximizing income from farming. MARDI has been identified as one of the Centers of Excellence in agricultural biotechnology under the National Biotechnology Policy. In the Ninth Malaysia Plan (2006-2010) the government will inject funds of up to RM300 million (US $84.7 million) into the institution.

One of the key centers to benefit from the large windfall of research funding is the Biotechnology Research Center of MARDI (BRCM). Located at the top of a hill overlooking the vast hectares of MARDI, the Biotech Research Center building seems to be the ideal setting for the desert home of a wealthy landowner. On the way up, the roads are lined with various plots used for field trials dotted with a variety of local fruits. More interestingly, there are several isolation green houses for biotech plants. Once inside the research building, one is greeted by a cool sterile setting, with a view through large glass windows of a laboratory buzzing with activity as technicians and scientists pace the floor. On the right is a large exhibition room, showcasing the various pride and joy of the Center, the culmination of much sweat and toil in research. In a corner near the entrance, an inconspicuous glass door bears the sign, Dr. Umi Kalsom Abu Bakar, Director.

Pioneer as Molecular Biologist

A humble woman dedicated to science and the development of the BRCM, Dr. Umi has been conducting research in MARDI for about 22 years. On July 15, 2006 she was appointed Director of the BRCM. Graduating with a Masters degree from Southern Illinois University in molecular biology in 1985, Dr. Umi returned to the country and began her career up to her stature today from being a research officer in MARDI. She later obtained her Ph.D in plant molecular biology from the University of Nottingham, United Kingdom in 1995.

"I remember the time I first joined MARDI. I just came back from the U.S. and there was an ad in the newspaper for a molecular biologist with MARDI. At that point in time, I knew that MARDI was dedicating itself to the development of biotechnology and I decided to apply," she reminisces. "It was daunting at first, as I came from a non-agriculture setting, and didn't really have much experience in agriculture. Moreover, I was the only molecular biologist around, and found it hard to communicate with most people as nobody knew what I was talking about. Only a couple of years later, when we had people coming back with degrees in molecular biology did I begin to have people I could share my science with, and we have been close research companions since."

That spark back in 1985 set off what would be the bonfire that would power MARDI's

Dr. Umi shares her experiences in papaya research.

biotechnological aspirations. Looking around the exhibition room, it was evident that the "investment" has paid off with the shelves and display cases showcasing the recent innovations of the scientists in BRCM as well as various commercialized products in the fields of plant, food and diagnostic biotechnology. Among MARDI's earlier breakthroughs are tissue culture and its application in plant breeding, and in the production of elite planting materials. Dr. Umi adds that the BRCM is currently applying cutting-edge research in the area of molecular biology, genetic engineering, bio-processing and diagnostics, with the vision to modernize and transform the agricultural sector.

Reaching Out to the Public

The outreach of the science community towards the general public is one responsibility that can not be ignored. This is even more so, since the conception of the National Biotechnology Policy connotes a strong push for its development. Dr. Umi has been actively pursuing various avenues in spreading the word so as to improve understanding and enhance the general public's perception of the fast-paced field of science. This is manifested in various activities including school visits, public lectures, and media interviews. "In essence, this generally means that we explain and provide information whenever we are asked about biotech," she says. "We highlight the potential of the technology, explain how it works, and address the questions of various stakeholders in hope that by educating the public, they would be more willing and more responsive to biotechnology."

Interfacing with MABIC

"We also collaborate closely with the Malaysian Biotechnology Information Center (MABIC) in organizing public lectures and workshops," she elaborates. "We are constantly in close contact in actively setting up events whereby we can have an avenue to communicate our science. Whenever we are invited by MABIC to conduct workshops, we participate happily as I believe that spreading the word on science is in line with the government's policies and we hope to be able to facilitate the development of the industry through our endeavors."

True enough, Dr. Umi has been one of the major supporters of MABIC activities in Malaysia in her capacity as a distinguished fellow of MABIC, and one of the forefront science communicators in the country. She also participated and organized countless workshops, seminars and talks on biotechnology. Under her guidance, MARDI has also released an illustrated guide to the basics of biotechnology aimed at secondary school students. They also have an open door policy towards schools visits, and MARDI has constantly been visited by secondary school students.

Not one to rest upon her laurels, Dr. Umi still devotes much of her time to her research work despite the various requirements expected from her management position. She is currently involved with plant gene discovery and bioinformatics initiatives. In addition, she is part of

"We now need to learn how to protect our technology, then opt whether to charge for its transfer. Only then, would we be able to push our products to new markets while establishing our branding."

the Papaya Biotechnology Network of Southeast Asia, a regional initiative among Indonesia, Malaysia, Philippines, Thailand, and Vietnam, organized to address two major constraints to papaya production (the papaya ringspot virus and significant post-harvest losses) while also serving as a regional benchmark in the acceptance and policy-making process of biotech crops through ISAAA. MARDI is also an integral part of the ISAAA network and has cooperated on many major projects, and attended various project and coordination meetings, as well as supported internships within their facilities. Through their involvement with ISAAA, the institute has focused strongly on the commercialization of biotech products.

"It has been an eye-opener for us. If we had not been involved with ISAAA, we would not have been exposed to many issues like biosafety, public acceptance, intellectual property (IP), and commercialization," she comments. "We wouldn't be able to understand and address these issues sooner, especially in terms of biosafety. By not addressing these issues, it would have been virtually impossible to commercialize our products, as we wouldn't have been able to understand the various aspects involved."

Striving Onwards: The Future

"We are currently looking at new trends where we hope to generate partnerships with various companies. From the beginning we have always been generating technologies to benefit target groups. Currently, we hope to place more emphasis on the commercialization process through our Business Unit at MARDI and MardiTech Corp Sdn. Bhd.," says Dr. Umi. "As we now know that research can be spelled into IPs for our researchers, we need to utilize available implementation mechanisms and make sure that they are available in full force. We now need to learn how to protect our technology, then opt whether to charge for its transfer. Only then, would we be able to push our products to new markets while establishing our branding."

Today, Dr. Umi's passion in biotechnology has not waned, and she constantly updates herself on the various issues in the field through the Crop Biotech Update, a weekly e-newsletter published by ISAAA. In fact, she constantly delights in forwarding articles that catches her interest to her acquaintances to update them on happenings in the industry. Her zeal stems from the strong potential science has to offer in improving society and the economy. According to Dr. Umi, "Biotechnology has the potential to provide ways to generate more income for entrepreneurs to drive the growth of the local biotechnology industry. We see biotech as a tool in creating more quality products from local agriculture and rich biodiversity. It allows us to produce food that is cheaper, with a higher quality and is competitive in the global market. Biotech is the improvement of the process along the value chain of agriculture, from farm to plate." ❑

M. Shahidul Haque

Contributing to Biotech Education and Research Development

By Khondoker Nasiruddin

Dr. M. Shahidul Haque is a professor at the Department of Biotechnology, Faculty of Agriculture, Bangladesh Agricultural University (BAU). He joined BAU as lecturer in the Department of Crop Botany after obtaining an undergraduate degree in agriculture from the same university. He eventually finished his masters and doctoral degrees at the Graduate School of Bioagricultural Sciences, Nagoya University, Japan. He was encouraged by his Japanese supervisors to engage in the study and research of biotechnology.

Dr. Haque returned to Bangladesh and continued his research on virus elimination and development of virus resistant crops. He was offered a postdoctoral position in his previous laboratory in Nagoya University to continue his research on genetic engineering for virus resistance in garlic. Virus elimination using shoot meristem is well established and is being practiced in many plants. However, Professor Haque proved that virus free plants can be produced from root meristem and established a novel method of producing virus- free garlic plants.

Dr. Haque was awarded the MONBUSHO and the Japan Society for the Promotion of Science fellowships in Japan in the field of biotechnology and genetic engineering. During his stay in Japan, Dr. Haque attended and presented papers in several national and international scientific conferences and workshops.

Together with other colleagues at BAU, he helped establish a Biotechnology Department. After his postdoctoral research, Dr. Haque joined the newly established Biotechnology Department where he has been teaching since 2005. He is also engaged as project investigator (PI) or Co-PI in several joint scientific projects involving transgenic plants resistant to biotic and abiotic stresses. Specifically, he is working on garlic plants resistant to viruses such as onion yellow dwarf virus, leek yellow stripe virus, garlic common latent virus, and virus resistant cucumber plants. He is a member of BAU's Academic Council and a member of the Editorial Board of Progressive Agriculture and Biotechnology, and Molecular Biology Journal of Bangladesh.

Dr. Haque worked as a national consultant for the establishment of the Biosafety Framework for Bangladesh. He made valuable contributions in developing a layman's booklet and posters in Bangla on biosafety. As a member of this group of 12 scientists, he was also tasked to build a database for scientists in the biotechnology field, organize workshops, and contribute to the preparation of a Biosafety Framework, among others. He is a fellow of the National Science and Technology in Bangladesh.

Bangladesh and Biotechnology

Bangladesh is an agricultural country with 140 million people. There is food shortage and arable land is decreasing at a rate of above 1 percent every year due to the construction of roads, highways, houses, river erosion, flood and salinity. "Biotechnology is one of the latest advances in the biological sciences that can revolutionize

"I use the information in the ISAAA website and publications, especially the Pocket K booklets, to be able to answer and provide examples to those who make any query."

our agriculture. It can help tackle agricultural problems, clean our environment, contribute to solving our health problems, increase our national income, and make our life easier," says Dr. Haque. "Biotechnology research started in Bangladesh during the 1980s and in the past few decades, it has accelerated its pace in improving all aspects of human life. Development of crops resistant to abiotic stresses like salinity and drought and biotic stresses like insect, virus and fungi and improvement in the productivity and nutritional status of crops can help in poverty alleviation in Bangladesh," Dr. Haque explains.

The Government of Bangladesh is in favor of the use of modern technology as one of the strategies to solve agricultural challenges in the country. The country is trying to develop human resources and train scientists to use biotechnology tools to develop plants that face biological and abiotic challenges. "The Ministry of Science and Information and Communication Technology is always giving top priority to agricultural research and granting research funds to agricultural research institutes. I believe in the bright future for agricultural biotechnology in my country, says Dr. Haque.

Acquiring and disseminating information has been always a top priority. "During the last few years, I attended several workshops, seminars and trainings organized by the International Service for the Acquisition of Agri-biotech Applications (ISAAA) through the Bangladesh Biotechnology Information Center (BdBIC). BdBIC organized several activities on national, regional and international levels that updated me in my teaching and research work. As a head of the Department of Biotechnology, I had several opportunities to chair many national and international seminars organized by ISAAA. The workshops related to risk assessment and management of GM crops and contained trials of GM crops are the most notable among those I attended. I use the information in the ISAAA website and publications, especially the Pocket K booklets, to be able to answer and provide examples to those who make any query."

He also adds that "The annual global status report on commercialized biotech/GM crops is a landmark publication for all agricultural biotechnologists. I use the report summary and the PowerPoint presentations in some of my presentations and lectures and have seen others doing so. My students visit the ISAAA website frequently to download useful information for their reports."

Prof. Haque always gives top priority to educating students about modern biotechnology. He adds that "ISAAA and BdBIC activities through workshops, publications, and emails update me and I am able to answer students' questions and in classroom teaching. I often distribute to my students ISAAA publications which I find very credible. Materials provide me with updated, simple and user- friendly information about global agricultural biotechnology. Students and journalists are excited about biotechnology. ISAAA and BdBIC also arrange trainings and workshops for journalists and agricultural extension workers and I had the opportunity to attend as a resource person. Discussions between ISAAA personnel with journalists and extension experts are very effective for biotech development in Bangladesh". ❑

Kodiswaran Kandasamy

Promoting the Adoption of Cutting-Edge Technology

By Mahaletchumy Arujanan and
K. Cheng Liew

Scientists have long been the innovators and advocates of biotechnology, churning out cutting-edge research outputs. Dr. Kodiswaran Kandasamy is one of many distinguished scientists in Malaysia who have dedicated their lives to the search for greater scientific achievement. Heading the Plant Tissue Culture Laboratory (PTC lab) of the Forest Research Institute Malaysia (FRIM), Dr. Kodiswaran has devoted much of his efforts in establishing a niche in the local research community while developing the strengths of the PTC lab to complement the local industry. He has also been actively involved in developing the human capital of Malaysia by training students, R&D personnel, and scientists in his laboratory as well as lecturing in several local institutions.

"What we are doing is mainly promoting biotechnology, especially in establishing plantations for the timber industry," says Dr. Kodiswaran. "Such techniques are standard for oil palm and rubber plantations, however it is not yet being readily taken up by the timber industry. We are promoting the establishment of plantations to also assist in environmental conservation as we hope to prevent vast tracts of land being clear-felled." By introducing plant tissue culture plantlets of forest species, Dr. Kodiswaran hopes to address the lack of planting material that is stalling the timber industry from utilizing plantations as a main source.

"We are targeting the various industries that use timber, particularly the furniture industry," he states. "However, for such technologies to be taken up, the industry needs to be convinced of its returns. By providing quality planting materials, maximizing its quantity per hectare, while introducing new varieties, we hope that we shall be able to kill two birds with one stone by helping the government in its push for the timber industry, while protecting the environment from further degradation."

Dr. Kandasamy explains tissue culture techniques to workshop participants.

The Scientist's Roots

Dr. Kodiswaran's long involvement with the scientific world has been illustrious, to say the least. He is known to be one of the foremost plant tissue culture specialists in the country. This involvement began in his childhood, where he grew up being curious of the world around him, and by satisfying that curiosity by experimenting with all sorts of plants, insects and animals found in the rubber plantations of his childhood. Through such devotion to detail, he matured into a student of excellent caliber while developing his interest in biology. After one year of medical sciences training at the National University of Malaysia (UKM), he was determined to return to the subject of his passion, botany. He went on to do his Masters and Ph.D at the Unit for Advanced Propagation Systems (UAPS), Wye College, University of London. Upon completion of his degree, he was hired as an academic staff of Wye College, before returning home to serve the country in 1997.

"As a scientist, it is important to be able to get the message across by allowing them (people of non-scientific backgrounds) to understand what we're doing."

It was as though the completion of a circle, he remembers, for during his undergraduate days, he queried the then dean of life sciences in the Malaysian National University (UKM) on what were the job prospects of a botany student. The answer was "you can plant trees along the roads." When he returned, he was involved in a project that produced 1,000 plants of each of the 10 different varieties of caladiums for the street beautification of Kuala Lumpur during the visit of Queen Elizabeth II in 1998.

Communicating Science

Dr. Kodiswaran attended and participated in various events of the International Service for the Acquisition of Agri-biotech Applications (ISAAA) and Malaysian Biotechnology Information Center (MABIC). These events included the organization of a media workshop for journalists in plant tissue culture technology and its commercial application in August 2007, and another for secondary school science teachers in August 2008. Both events were conducted to allow the various stakeholder groups to obtain a first-hand view on the widely-utilized technology. As a researcher, he believes that "the transfer of knowledge to the various stakeholder groups is imperative for the advancement of science in the region as it helps boost public acceptance of this form of technology while stimulating more interest in the sciences."

For the 45-year old researcher, it was an eye-opener to observe the perception and understanding of non-scientific audiences towards technology. He finds that it is a great challenge to be engaged in providing accurate information so that correct perception and understanding is created. However, he is not daunted by the uphill task as he holds on to his strong belief that the need to translate scientific and technical knowledge to a suitable level for easy comprehension by non-scientific audiences is vital for the growth of society.

"As a scientist, it is important to be able to get the message across by allowing them (people of non-scientific backgrounds) to understand what we're doing," he says. "We're letting them look and see for themselves. Let them understand that we're not doing Frankenstein science. When they go back and show that they are beginning to understand how scientific research works, it is immensely gratifying."

Since the first media workshop, there have been multiple requests by various parties, including teachers, which are deemed to be an encouraging sign by Dr. Kodiswaran. Even several secondary schools have been contacting him to let them have a feel around the laboratory through basic training, and even help them set up similar facilities. In addition, a number of articles were published in the local press following these activities stimulating great interest from the general public and industry towards taking-up the tissue culture technology as a commercial venture. "We have been getting calls from industry people who mentioned that they have read articles on FRIM, whereby they find that there is great commercial potential in the work we do, and would like to collaborate, in terms of providing planting material, and getting our expertise in setting up a tissue culture laboratory."

Peering into the Future

With his breadth of experience, Dr. Kodiswaran is well-versed in industry trends, and he considers science and technology as being vital for the survival of both the human race and the

environment. It is the only sector that is involved in the creation of new and useful products and services. Hence, he strongly advocates that "S&T should be the essence of all government policies regardless of its developmental status, especially in ensuring sufficient human capital development in this sector."

Looking at the state of biotechnology in the country, Dr. Kodiswaran acknowledges that crop biotechnology is still very much in its infancy stage. This is partially due to the past emphasis on industrialization. However, "with current support and government policies underway, the local agricultural industry is poised to bank on the support of crop biotechnology applications, in particular agro-biotechnology tools." Examples raised include the use of plant cell, tissue and organ culture technology in producing elite planting materials, genetic engineering technology to value add crop production, and optimize farm inputs and outputs. He believes that the application of crop biotechnology, coupled with the combined effort through private-public partnership, will potentially be able to address the global food crisis.

"I look forward to leading a bigger and a more dynamic team of researchers in pushing such technologies towards developing value-added crops to address the current and future food shortage. Simultaneously, I hope to actively involve myself in greater human capital development through teaching and supervisory activities with the local universities." By continuously developing technologies and products relevant to the industry, Dr. Kodiswaran hopes to play a crucial role in promoting the adoption of cutting-edge technologies such as crop biotechnology. ❑

Kailash Chandra Bansal

Dedicated to Biotech Research

By Bhagirath Choudhary and Kadambini Gaur

Prof. K.C. Bansal is Professor of Molecular Biology and Biotechnology, and the Coordinator of the Indian Council for Agricultural Research (ICAR) Network Project on Transgenic Crops at the National Research Centre on Plant Biotechnology, Indian Agricultural Research Institute (IARI), New Delhi. His research interests include functional genomics and transgenic development through nuclear and chloroplast transformation for abiotic stress tolerance and nutritional enhancement in crop plants. He developed crop genotypes with enhanced tolerance to abiotic stresses. He indigenously cloned several novel genes and promoters, and developed useful gene constructs for the development of improved crop genotypes. He shared these gene constructs with various institutions in the country for improving abiotic stress tolerance in different crops. Prof. Bansal's research

group developed transgenic wheat, mustard, and tomato with enhanced tolerance to drought, salinity and cold stresses. In addition, he developed transgenic tomato with extended shelf life to save post-harvest losses that runs into millions of dollars. For the first time, he also developed chloroplast transformation systems in brinjal and mustard to develop improved genotypes. "I believe in helping my countrymen through science, particularly through modern science and the tools of biotechnology," he says.

Prof. Bansal, who has about 100 publications in reputed national and international science journals, believes that "Science and technology has a great potential in shaping the life of people especially of the poorer population. In a country like India where in the early days, people experienced famines, the science-led growth of agriculture and development of high yielding crop varieties saved people's lives."

From Hisar to Harvard

Prof. Bansal completed his Masters of Science from Haryana Agricultural University, Hisar and Ph.D. from Indian Agricultural Research Institute, New Delhi, with a Gold Medal. He did his post-doctorate in Harvard University, Cambridge, USA. "When I was at Harvard University in 1990, I saw a video film on Bt tobacco, which clearly demonstrated the power of plant genetic engineering. Thereafter I decided to come back to India, and started developing transgenic crops with improved tolerance to abiotic stresses, and enhanced nutritional quality," he says.

A recipient of several national and international awards and honors, he was awarded the prestigious Rockefeller Biotechnology Fellowship in 1996 to work at Rutgers University, USA. He is a recipient of Professor Hira Lal Chakarvarty award of the Indian Science Congress Association, conferred on him by the Honorable Prime Minister of India. The

Prof. Bansal chairing the Q&A session during the two-day sensitization workshop on "Biosafety Issues Related to Practicing Agricultural Biotechnology" organized by GBPUAT and ISAAA.

numerous rewards and recognition did not slow him down as he feels that a lot more needs to be accomplished for promoting research and agri-biotechnology in India. "If we continue using this technology in a much more precise and effective manner to help our farmers produce more with less input and with better quality, this will lead to higher income and better economy build up in the nation as compared to other developing nations," notes Prof. Bansal.

The scientist was a member of the Indian delegation to participate in joint seminars on agricultural biotechnology to Tunisia and Argentina. Recently, he headed the Indian delegation to Washington DC for a joint study program on biosafety of GM crops.

Passionate Teacher: Inspiring Young Future Scientists

Prof. Bansal's sincere efforts resulted in many stories of student achievement and success. He has been instrumental in human resource development in the National Agricultural Research System by providing training and guidance to more than 200 young scientists and teachers.

"It is a moral responsibility to make sure that accurate information is provided to the public and for that scientists need to work with media as well."

"Right from my childhood I believed in reasoning. I had a concern to help my fellow colleagues and people around me," says Prof. Bansal who fosters the same in his students. He has guided 10 M.Sc. and Ph.D students who have won national awards including the Jawaharlal Nehru Award of ICAR for best thesis work. Understanding the importance of crop biotechnology, he inspires young research associates and students to learn more about this promising field. "The International Service for the Acquisition of Agri-biotech Applications (ISAAA) Briefs and the weekly Crop Biotech Updates are extremely useful. This information is helpful in providing students the latest development in the area of biotechnology," he explains.

Effective Communication/Disseminating Scientific Information

Scientific research is not the sole focus of Prof. Bansal as he believes it is equally important to communicate with the public. He is instrumental in communicating science to the public so that correct messages reach society. He has been actively involved in campaigns to raise public awareness regarding GM technology. Prof. Bansal has been involved with ISAAA activities in India for a couple of years now. He was a resource speaker in media workshops, press conferences and various programs organized with public sector institutions. In 2005, he coordinated a media workshop in the local language organized by the Indian Agricultural Research Institute, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), and ISAAA.

Expressing his concern over the negative media coverage he feels "it is a moral responsibility to make sure that accurate information is provided to the public and for that scientists need to work with media as well." He emphasizes that scientists and media need to work together so that significant contribution can be made towards generating public interest in the technology. "We need to inform people about the potential of the technology by which we can develop improved crops, which were not possible with conventional tools of breeding, such as Bt cotton." He adds, "With modern science it is now feasible to increase crop production to meet the demand of an ever growing population. It is possible to have a clean environment and at the same time mitigate the adverse impacts of global climatic change." ❑

REFERENCES

Brossard, Dominique, James Shanahan, and T. Clint Nesbitt. 2007. Perspectives on Communication about Agricultural Biotechnology. *In* The Media, the Public and Agricultural Biotechnology. CAB International, United Kingdom. Pp. 9-11.

IndoBIC Quarterly Reports, 2007-2008.

Indonesia Conducts Risk Communication Workshop. 2006. ABSP II Southeast Asia Newsletter. Vol. II, No. 4. October 2006. Los Baños, Laguna, Philippines.

Indonesia Holds Media Workshop. 2006. ABSP II Southeast Asia Newsletter. Vol. II, No. 3. July 2006. Los Banos, Laguna, Philippines.

International Service for the Acquisition of Agri-biotech Applications (ISAAA). 2006. Report on the Biotech Issues and Communication Workshop: Enhancing Communication Skills on Biotechnology. Los Baños, Laguna, Philippines. 29 pp.

Nisbet, Matt. 2001. Caught in the Ag Biotech Crossfire: How U.S. Universities Can Engage the Public About Scientific Controversy. http://www.scicop.org/genx.agbiotech/. (Accessed October 22, 2008).

Research Center for Bioresources and Biotechnology. http://www.rcbio.org/index.php?option=com_content&task=view&id=59&Itemid=88. (Accessed November 5, 2008).

Religious Sector

Keeping Faith in the Technology

The efforts of science particularly when their use for humanity is discussed inevitably involve the realm of ethics. Value judgments determine whether something is perceived as good or bad, right or wrong, and provide a basic framework as to how people may react to certain issues and concerns. Questions about values are often outside the domain of scientific knowledge and rely on a cultural diversity of personal and introspective perceptions. As science enters value-laden areas, stakeholders need to be engaged in the ethical, legal and social implications of science and technology or biotechnology in particular. Considerations of the moral and ethical issues make a significant contribution to building trust in science policy. Devos et al. (2007) suggest a need to "move from a merely scientific evaluation and risk-based policy towards a socially more robust evaluation that takes the non-scientific concerns at stake in the genetically modified organisms debate seriously."

Gaskell et al. (2005) report that in the United States, religious beliefs are strongly related to critical attitudes to science and technology. They note that there is a minority "in favor of ethically informed decision-making and public engagement in science, with less positive views about technology, in particular emerging and controversial technologies."

Interestingly, religious leaders (whether Christian or Islam) were identified by Asian respondents as trusted sources of information on biotechnology although their knowledge level was low (Juanillo, 2003; Torres et al., 2006). The latter study adds that religious leaders from Indonesia, a Muslim country, had a very conservative view of agricultural biotechnology. In the Philippines, a predominantly Catholic country, the biggest challenge for biotechnology as perceived by stakeholders was moral/ethical issues rather than technical soundness and utility.

Two religious sector leaders, one an Islamic scholar and the other, a Roman Catholic priest, share their foray into the biotechnology arena and their optimism for crop biotechnology as a tool to help improve man's quality of life.

Shaikh Mohd Saifuddeen bin Shaikh Mohd Salleh

Islamic Scholar

By Mahaletchumy Arujanan and K. Cheng Liew

Muslim scholars have a rich history of innovation and invention. In the fast-paced, ever-expanding field of science and technology today, Muslims are ever vigilant in keeping themselves well-informed on the various facets in science and keeping abreast on its relation to Islamic teachings.

Shaikh Mohd Saifuddeen bin Shaikh Mohd Salleh, is the Executive Director of **Yayasan Ilmuwan**, a non-profit research organization in Malaysia. He was formerly a Senior Fellow of the Institute of Islamic Understanding Malaysia (IKIM), and is known in the country to be actively involved in the discussion and deliberation of Islamic and scientific issues, including biotechnology. He also sits in several committees, including the Scientific Advisory Committee of the Malaysian Biotechnology Information Center (MABIC); Research Ethics Committee of Universiti Teknologi MARA (UiTM); and Organ Donation Task Force of the Ministry of Health.

Shaikh has been involved with issues pertaining to Islam's response to science and technology since 1998. With science and technology being a fast developing field, with its impacts making waves and being felt by everybody almost immediately, he believes that "society has to be prepared to face these impacts, challenges and changes. For Muslims, it spells the imperative need for information and understanding in order to ensure that their response is in line with Islamic teaching." He is an intermediate who liaises with scientists and technologists, as well as Muslim scholars, and endeavors to allow them to have in-depth discussions on the changes brought about by cutting-edge technologies and advanced science.

Crop Biotechnology and Islamic Perspectives

In this day and age when food security is a pertinent issue, crop biotechnology is getting to be increasingly important. For a country like Malaysia, where the population and demand for food supply are increasing, it is crucial to venture into potential technologies that could contribute to the solution. Shaikh regards crop biotechnology as being of great potential in helping answer these issues. However, developments within the field should be conducted with respect to Islamic teachings in mind. "As long as there is no contradiction and is proven to be beneficial, crop biotechnology products may be permissible for the Islamic world," adds Shaikh.

"Islam has several mechanisms to see whether something is permissible or not. One of which is the 'maqasid ash-shariah' or purposes of Islamic law. Classical scholars outlined five main purposes, namely protection and preservation of religion, life, mind (intellect), progeny and property. Recent scholars have added another one - protection and preservation of the environment. To me, these purposes of Islamic law can act as a checklist for anything. If we can satisfy ourselves that crop biotech does not pose any threat to any one of the six purposes, in fact if crop biotech improves the

To date, there is only one fatwa pertaining to GM food. Specifically speaking, the fatwa issued dealt with the issue of swine gene. After much deliberation, the fatwa issued by the National Fatwa Council on July 12, 1992 states the following:

i) Any product, food or drink processed using biotechnological methods incorporating swine DNA is against the precepts of shariah and is therefore not permissible (haram).
ii) 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 products, foods and drinks could not be justified as there are still other viable alternatives that can be considered.
iii) The dangers of the usage of prohibited materials are greater than the benefits that it would bring. With this fatwa as a guide, the issue of using swine DNA in GM food is clear. However, the usage of DNA from other animal sources needs to be studied by the ulama.

(Source: "Biotechnology and religion: Are they compatible?" 2004. BIC News. Published on 15th March 2004)

quality of the six things that Islam protects, then there should not be any problem regarding the acceptance of crop biotech. But the important thing is that, we should deliberate on these matters with facts and not emotions, and we must get scientists to sit down with Islamic scholars on a regular basis so that continued dialogues can be held."

Involvement in Biotechnology

Shaikh's involvement with biotechnology began at IKIM. A number of seminars on biotechnology were organized to discuss its relevance from the perspective of Islam. His interest and involvement in the subject continued and grew as he began attending workshops organized by the International Service for the Acquisition of Agri-biotech Applications (ISAAA) and MABIC. These include a workshop on media awareness on biotechnology held at Monash University, another workshop at EiMAS (Department of Environment) on biotechnology, biosafety and biodiversity, and a conference on *The Development of Agricultural Biotechnology in Islamic Countries: Sharing the Experience on Issues and Challenges* in Cairo, Egypt. The Cairo workshop discussed issues related to the compatibility of Islam and biotechnology. Islamic scholars from various countries reiterated that Islam is not in contradiction to the development of biotechnology if the technology is employed to improve human health and lifestyle without any negative implications to the environment. However, it was also noted that much effort is required to bridge the communication gap between Islamic scholars and scientists. "I found the workshop useful particularly the new information about biotech from other countries. While the workshop was basically an enabling event I was successful in networking with people from other parts of the world."

The executive director has given talks and written several articles on the perspective of Islam on biotechnology and its relevant issues. He uses these opportunities to explain what is being done in the Muslim world, in particular Malaysia, when it comes to biotech. More importantly, Shaikh uses facts and figures from ISAAA/BIC publications to

"I personally am of the opinion that Islamic scholars can play a role in disseminating a better understanding of biotechnology to the society as they are highly regarded in the Muslim community."

Shaikh (fifth from left, second row from the top) is joined by other delegates at the Cairo conference on biotechnology and Islam.

help him present the Islamic views in contrast to the global perspective on crop biotech. An example is *Biodiversity, Biotechnology and Biosafety: An Islamic Perspective*, a collaborative publication among the Ministry of Natural Resources and Environment NRE, MABIC and **Yayasan Ilmuwan**, which is now a standard text on biotechnology and Islam. He also finds the biotech topical series of Pocket Ks very useful and are at arms reach at the office when he needs them. He uses these publications to get figures as well as technical facts for talks and papers. "All Pocket Ks are handy for me, as issues that arise out of biotech are wide-ranging. With the technical facts, I can source for Islamic inputs on the matter," he says.

Shaikh believes in dialogue. By creating more avenues to involve various stakeholders in biotechnology, it is possible to have a more comprehensive and encompassing view of the science. This is essential as science and technology continues to advance with overlapping trends. He believes that specialization in very specific fields will no longer be feasible in the future as one will have to depend on other areas in order for advancements to be made. For example, four areas have been marked as the technologies for the 21st century, namely genomics, robotics, informatics and nanotechnology. While these four areas seem to be separate, in truth they overlap each other. "Therefore, I foresee that advancement in S&T in the coming future will require greater cooperation from experts," he comments.

Speaking on a more personal level, Shaikh professes that he is hoping to see more programs involving scientists and Islamic scholars to discuss biotechnology. "I personally am of the opinion that Islamic scholars can play a role in disseminating a better understanding of biotechnology (in particular on its permissibility) to the society as they are highly regarded in the Muslim community. This would be an effective form of dissemination, especially to the Muslim community in general who holds their scholars in high regard." ❑

Fr. Emmanuel Alparce

The Morality of Genetic Engineering

By Jenny Panopio

The religious sector is one key stakeholder that can significantly influence attitudes and perceptions of the public about agricultural biotechnology. In the Philippines, religious leaders were considered both by policy makers and their fellow religious leaders as trusted sources of information on agricultural biotechnology (Torres et al., 2006). This is not surprising because the church has a lot of influence on the normal day to day lives of Filipinos.

One prominent supporter of agricultural biotechnology that emerged from the Roman Catholic Church is Rev. Father Emmanuel 'Noli' Alparce. Before his current stint as Vice Rector of the Dulce Nombre de Maria Cathedral Basilica in Guam, he was the Executive Director of the Social Action Center (SAC) of Sorsogon, one of the agricultural provinces in the Philippines with coconut, corn and abaca as major products. Father Noli was tasked to look for interventions that could help SAC in their programs dealing with ordinary social problems related to agricultural productivity and the challenges being faced by resource poor farmers. The SAC is the arm of the Roman Catholic Church that deals with human problems related to poverty, malnutrition, corruption, justice and peace.

With poverty and malnutrition as pressing concerns in the country, Bishop Jesus Varela tasked Father Noli to look at a new technology being introduced in the Philippines. "My Bishop was the one who was very eager to learn more about biotechnology. At that time in 2000, Bt corn was being introduced in the country. He asked me to take a look at this technology and see if it could help solve problems regarding lack of food and malnutrition. If it could, then, why shouldn't we consider this technology? And if it is really safe, then we can share products of this technology with the poor people," says Fr. Noli.

On May 8, 2001, Jaime Cardinal Sin, the archbishop of Manila at that time, made a similar point in a pastoral statement on genetic engineering in agricultural products. He stated that "genetic engineering is acceptable only if all risks are minimized. Otherwise, one may easily succumb to temptations of productivity and profit at the expense of the people and environment. And as long as foreseeable dangers are not fully identified, studied and avoided, safe alternative procedures should be used, and if none, testing and development of the technology should be avoided altogether."

Fr. Noli, having some background in agriculture and genetics from his undergraduate studies at the University of the Philippines Los Baños, took it upon himself to learn about agricultural biotechnology. He was at first hesitant on the application of biotechnology in agriculture because of several environmental, human safety and ethical concerns he read and heard about. He was mostly concerned about the manipulation of life and the power of the technology to the extent of playing God.

Fr. Noli gives an overview of the Department of Agriculture biotech information initiatives during the seminar on agri-biotech reporting.

"I got enlightened about the process and benefits of genetic engineering for agriculture when I attended a week-long workshop in 2001 on *Agricultural Biotechnology: Facts, Fears and Future Directions.* I actively participated in the discussion and the organizers noticed me, they were happy and impressed especially since I was the only one coming from the church sector." Afterwards, Fr. Noli's understanding on the science and safety issues surrounding biotechnology deepened as he attended one seminar after another. He was able to fully appreciate the technology when he was chosen to be part of the International Visitors Program of the U.S. Embassy Cultural Affairs to learn about the process of genetic engineering. From that study tour, he became aware of the science-based risk assessment procedure where the environmental and food safety of GM crops are well-studied prior to commercial release.

"When I came back to the country, I was a defender of biotechnology even in many countless conferences that I would be attending. I would vocally defend on the side of morals." Father Noli believes that biotechnology is moral because it addresses problems of poor farmers and it has a lot of potential in positively impacting humanity.

"Biotechnology is moral because it addresses problems of poor farmers and it has a lot of potential in positively impacting humanity."

Fr. Noli's involvement in the biotechnology information campaign intensified as he served as the Chair of the technical committee on public information, education and communication (IEC) of the Department of Agriculture's Biotechnology Program for more than five years. He was able to collaborate with other partners who were also actively involved in biotechnology IEC drive, particularly those sponsored by the International Service for the Acquisition of Agri-biotech Applications (ISAAA) and Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) Biotechnology Information Center.

"Our technical committee evaluated proposals, provided funding, monitored and evaluated impact and effectiveness of IEC programs on agricultural biotechnology. SEARCA-BIC was one of the proponents of our IEC program and I personally joined several IEC activities organized by them in several parts of the country," remembers Fr. Noli.

The Priest Talks on Ethical Concerns

Being an advocate of biotechnology coming from the religious sector, Fr. Noli was often tapped as the resource person on several IEC initiatives on agri-biotechnology particularly on the ethical concerns of biotechnology. From his advocacy work, he was able to utilize several ISAAA- developed materials on biotechnology. He shares that "ISAAA has been our partner in

the information campaign on biotechnology and we used and distributed several IEC materials which they developed. One particular material that helped me convince non-believers of biotechnology and correct misconceptions is ISAAA's video documentary on farmers' experiences in planting Bt corn in the Philippines. This material has been very effective and very helpful, as it documents the first success story on the adoption of a biotech crop in the country."

Fr. Noli believes that continuous budget support for the IEC campaign should be in-place in the country. He suggests actively educating the policy makers and their staff about the potential of the technology and benefits that can be obtained from adopting it as they approve and provide directions for the agricultural sector of the country. He hopes that initiatives of ISAAA and SEARCA BIC particularly on information dissemination, development of publications, and media education should be continued so as to reach more people particularly those in the community levels.

Fr. Noli hopes for the continued development of agricultural biotechnology in the country particularly on poor man's crops. He assures that the Church is supportive although cautious on agricultural biotechnology.

"When you talk about morals, it is simply what is right and what is wrong. If we abuse the process of biotechnology, then we are wrong. But when we use it responsibly, it can help advance the food security and also help farmers living in poverty. However, any technology, even how successful it is, will be useless if the people will not adopt the products or consume it because they are not convinced or are afraid of it. The key to realize the promises of biotechnology is information, publication and the media. And on these aspects, ISAAA and the SEARCA BIC can be of enormous assistance so that people can fully understand the technology and eventually use it".❑

REFERENCES

Devos, Yann, Pieter Maeseele, Dirk Reheul, Linda Van Speybroeck, and Danny Dewaele. 2007. Ethics in the Societal Debate on Genetically Modified Organisms: A (Re) Quest for Sense and Sensibility. Journal of Agricultural and Environmental Ethics.

Gaskell, George, Edna Einsiedel, William Hallman, Susuna Hornig Priest, Jonathan Jackson, and Johannus Olsthoorn. Social Values and the Governance of Science. 2005. Science. Vol. 310, No. 5756. http://www.sciencemag.org/cgi/content/full/310/5756/1908 (Accessed December 16, 2008).

Juanillo, Napoleon. 2003. The Social and Cultural Dimension of Agricultural Biotechnology in Southeast Asia: Public Understanding, Perceptions, and Attitudes Towards Biotechnology. University of Illinois at Urbana-Champaign and the International Service for the Acquisition of Agri-biotech Applications (ISAAA).

Malaysian Biotechnology Information Center. 2004. Biotechnology and Religion: Are They Compatible? BICNews. Petaling Jaya, Malaysia.

Torres, Cleofe, Ma. Theresa Velasco, Maria Celeste Cadiz, and Rhodora Ramonette de Villa. 2006. Public Understanding and Perception of and Attitude Towards Agricultural Biotechnology in the Philippines. International Service for the Acquisition of Agri-biotech Applications, SEARCA, and College of Development Communication, University of the Philippines Los Baños, College, Laguna, Philippines. 100 pp.

Torres, Cleofe, Madeline Suva, Lynette Carpio, and Winifredo Dagli. 2006. Public Understanding and Perception of and Attitude Towards Agricultural Biotechnology in Indonesia. International Service for the Acquisition of Agri-biotech Applications, SEARCA, and College of Development Communication, University of the Philippines Los Baños, College, Laguna, Philippines. 100 pp.

Other Partners

Broadening Links in Knowledge Sharing

The participation of different "publics" in the transparent debate on biotechnology contributes to its greater awareness and understanding. It also helps bridge the gap caused by the tensions between science and society. Each stakeholder contributes to the debate such that a "public voice" leads to the formative stages of decision-making. Gaskell et al. (2005) says that engagement with other communities on the implications of science and technology results in "socially viable paths for scientific innovation." Allowing diverse publics to contribute to discussions on biotechnology democratizes decision making. In the process, divergent interpretations of scientific phenomena and nontechnical concerns can be dealt with.

The tasks involved in knowledge and information sharing are best accomplished through networks and partnerships, and in the collective efforts of different groups. The end goals are attained faster, individual efforts complement and add to the greater good, and resources are shared across sectors.

This section shares the stories of students, representatives from industry, and similar organizations engaged in information, education and communication efforts in crop biotechnology.

Stuart Soo

The Businessman Talks Biotech

By Mahaletchumy Arujanan and K. Cheng Liew

Since Malaysia's National Biotechnology Policy was enacted in 2005, the industry has been buzzing with anticipation for greater development of science and technology as a tool for wealth creation and national well-being. The nine thrusts outlined by the policy reflect the intention of the government to leverage Malaysia's existing capabilities and move them up the value chain through commercialization. Two years down the road, the country has been building upon its infrastructure and research capacity, as it anticipates the surge of industry research and development (R&D) requirements. Discussions with personalities in the industry have yielded one pressing question - "How do we commercialize the end products of research into something that the Malaysian public can accept, and who can?" The difficulty of translating hard-edged science into savvy consumer products is one of the greatest challenges of the biotechnology industry today. The main reason behind such difficulties is the gap of knowledge in the "science" of the commercialization process.

Many research institutions and local universities have understood such challenges and have begun to hop on the bandwagon by establishing their own commercialization branches, while others have contracted companies specializing in this area of expertise, especially to aid them in the commercialization of their innovations. One such company dedicated to product development technologies is the Furley Group of companies. Located amid the drab walls of an industrial area in Puchong, Malaysia, one would be hard-pressed to correlate the place with innovation and the vibrant creativity associated with the company's expertise. However, upon entering the office, amid delicate antique teak furniture, the company seems to be a beehive of activity. Group Managing Director, Stuart Soo, is exactly alike in this manner, a genteel gentleman, who upon first impression is private and unassuming. However, his dry wit and enthusiasm prove that there is more than what may be seen at first glance.

Stuart Soo (left) discusses product development with Daniel Baskaran Krishnapillay, former FRIM director.

Mr. Stuart has been active in the business development and operation line in the Asia Pacific region for more than 30 years. Initially an outsider in technology transfer and biotech production commercialization, he graduated from the Auckland University of Technology in 1973. He worked with several multinationals before venturing into Technology Transfer Management with certification from the United Nations Industrial Development Organization (UNIDO) and The International Centre for Science and High Technology (ICS). His experiences in biotechnology began as his previous

employer bought a technology-based company with quite a number of scientists in it. Since then he has been in the line of contract manufacturing for more than 20 years before finally opting to return to the country in 2001. He worked with many companies in New Zealand, China, Hong Kong, and Thailand and is particularly experienced in the commercialization and development of nutraceutical, food and beverage products.

Product Development Process

"Around the end of 2001, after a stint in China, I decided that it was time for me to come back (to Malaysia). On the basis of my (years of) experience, I started Furley, with the help of a partner mainly to work on the transfer of technology especially in bioactive compounds," he states. "We generally deal with product development, from cradle to grave, or as we say, from the plantation to the finished products on the shelves."

To illustrate his point, Mr. Stuart perused a flow chart outlining the chain of commercialization, beginning with a scientific finding and ending with the launch of a product. "Science is only one part of the story," he says. "The process of commercialization does not only end with innovation. In fact, a long drawn out process, which involves assessing the market trends and its needs, potential profits, documentations required, project planning, cost, supply and supply chain, production design, etc., pretty much makes the process of commercialization mystifying to most."

From a vast range of products on display, it would be obvious to the spectator that Furley Group is unlike most companies. With products like optimum DHA milk formula to osteoarthritis-preventing supplement, and also the world's first all-natural skin-whitening product line with anti-oxidants derived from mangosteen extracts, Furley is gifted with the ability to bridge the gaps between innovation and commercialization to bring novel products into the Malaysian and overseas market.

"In fact, we shall be launching some of our products. We have jointly developed with FRIM (the Forest Research Institute of Malaysia), an alternative functional soft-serve ice cream [ice confection] made from whole mangosteen fruit technology which is both fat-free, cholesterol free, low sugar and high in antioxidants," enthuses Mr. Stuart. "The event would be graced by the H.R.H Sultanah Hajjah Kalsom, Sultanah of Pahang, and would be the beginning of a series of products developed with FRIM."

When queried on the projected development of such a vibrant company, Mr. Stuart was optimistic with its expansion, with an extraction plant being slated to be completed in mid-2009. Similarly, a plantation project is underway in Pahang in a joint venture with several non-government organizations (NGOs). The plantation project will see the company allocating land and imparting good farming practice and management technologies for rural farmers to manage the planting of several local herb species, with a guarantee buyback of their crops. This is in line with the recent government policy of improving the lifestyle status of rural folks.

"For the (plantation) project, we are echoing the government's call for businesses to assist rural folk by providing them land and opportunities under a 'one family one business' scheme. This will also help us solve the problem of our supply chain, as multinationals consider this issue of great importance. It is also my personal conviction, as I believe that I do not need to 'rape' our forests to do good business."

From Businessman to Communicator

Being a businessman at heart, Mr. Stuart did not anticipate the day when he would become a science communicator. Being involved with various

industry stakeholder organizations, including the Malaysian Bio-industry Organization (MBIO), he is known to be active in the industry as a proponent for biotechnology. Being a participant to various key biotechnology events, he is well known among industry players and scientists alike. However, the businessman became educator and advocate when he was invited by the Malaysian Biotechnology Information Center (MABIC) to speak at the seminar *The Convergence of Biotechnology and Biodiversity in Wealth Creation* jointly organized by Sarawak Biodiversity Centre in Kuching, Sarawak in 2007.

"It was a very interesting experience, as it was pretty much my first time to talk to the public on biotechnology and its various opportunities," Mr. Stuart says. "However, I believe that my talk was well-received, with a healthy discussion being established. In fact, we managed to begin talks on several business opportunities, including helping a Kuching-based biotech company to bring their product to the international market. I got an invitation to give another talk during the Biodiversity and Biotechnology Symposium 2008. It feels great to be appreciated," he says.

"I work closely with MABIC as well as the International Service for the Acquisition of Agri-biotech Applications (ISAAA) on various issues in biotechnology. I pick up many useful tidbits of knowledge from their various publications," he comments. "I sincerely hope to be able to continue this collaboration further in the future as I anticipate more up-to-date information on local and international events and happenings. I also hope that MABIC could initiate greater dialogue in the industry as many industry players are ill-informed about various aspects of biotechnology." ❑

Farida Habib Shah

Setting the Stage for Bioentrepreneurship

By Mahaletchumy Arujanan and K. Cheng Liew

She has been hailed as a crusader for championing the cause of biotechnology in Melaka, Malaysia and has been seen as a straight-talking, no nonsense figure in the fledging industry. Her detractors have noted her as being a thorn, but her steadfast determination and sacrifices have not been ignored. Prof. Farida Habib Shah is currently consultant advisor to the state, and is CEO of BioIT Technologies Sdn. Bhd., her own consultancy company aimed at developing biotechnology and Information and Communication Technology (ICT) startups. She is also a Fellow of the distinguished Third World Academy of Science, member of the Executive Board of Third World Organization for Women in Science as well as Honorary Professor of University Tunku Abdul Rahman, Kuala Lumpur. It is not hard to see why she is noted as a molecular scientist

Professor Farida (right most) mentors young scientists.

"Crop biotech is one of the most important tools that can contribute towards increased productivity and enhanced food security."

who packs a punch when it comes to single-handedly handling the state of biotechnology of Melaka. In fact, it was widely reported that the petite former director of Melaka Institute of Biotechnology was able to singly handle Malacca's promotions at the BIO 2005 conference, where some 1,600 exhibitors tried to sell their products and services, and form collaborations in the sector.

Inspired from learning all about the great scientists who made life-changing discoveries during her school days, Prof. Farida allowed herself to be immersed in the inquisitiveness befitting a researcher. Such inquisitiveness has rubbed off on her demeanor in life, being willing and daring enough to question and learn about things around her. By learning and discovering its various facets in her search for scientific truth, she is now walking her talk by being both in the research and in the business of biotechnology, spearheading the growth of the country's fledging industry.

She pulls no punches as well when it comes to naming the problems faced by the country in developing biotechnology. "We have strong potential if we (Malaysia) get our act together, and work on our strengths. What we're seeing right now is a gap in the value chain towards commercialization which is not being addressed," observes Prof. Farida. "Not many companies are interested in investing on commercializing research, even those that are almost ready for the market. How much more those that still need to undergo rigorous testing, field trials, and prototyping?"

Prof. Farida's outrage is not unfounded, as she believes that science and technology (S&T) is the main engine of growth and development, particularly sustainable development. Currently and in the future as more discoveries are made, S&T will and can contribute to a better quality of life, particularly in developing countries. As the country is dragging its feet in addressing issues that impede industrial development, she suggests an integrated approach towards biotechnology, where industry also looks into providing opportunities for other sectors, like agriculture. One example would be in the field of nutraceuticals, where farmers are also provided with plants to grow which would be bought back for extraction and packaging. The Melaka Institute of Biotechnology has set up a pilot plant, with funding from MARA (Council of Trust for the Bumiputra).

Harnessing Power of Crop Biotech

The CEO points out that Malaysia has the advantage of its long history in agricultural research and does not lack in brains as well. But then, the lack of funding and support in terms of commercialization is draining the country of its cream of the crop to other more supportive and conducive environments like Singapore. "My view has always been that crop biotech is one of the most important tools that can contribute towards increased productivity and enhanced food security," she comments. "The same applies to Malaysia where we are currently one of the main importers of food and not the exporter. In order to ensure enough food, the only way this can be done is by harnessing the power of crop biotechnology."

"We need to seriously look at getting our research output to the market, and develop with our own intellectual findings as well, instead of solely looking at getting big companies. For it is only through developing our home labels can Malaysia grow in this aspect," comments Prof. Farida, as she gave the example of the German government

Prof. Farida with research officers of the Melaka Biotechnology Institute.

setting offices dealing with such funding in its universities.

Prof. Farida is also professor of molecular biology, Faculty of Science and Technology, Universiti Kebangsaan Malaysia. As a strong proponent of biotechnology, her collaboration with Malaysian Biotechnology Information Center (MABIC) and The International Service for the Acquisition of Agri-biotech Applications (ISAAA) has been long-standing. She was elected as one of the MABIC's distinguished fellows. Sitting on the board, she has provided valuable insights from her range of experience with academia and the biotech industry.

Insights from International Workshop

She has attended various workshops, seminars and events organized by MABIC. Among them, one of the most prominent would be an international workshop on *The Development of Agricultural Biotechnology in Islamic Countries: Sharing the Experience on Issues and Challenges* which was co-organized by MABIC together with Egypt Biotechnology Information Center (EBIC) and the Inter-Islamic Network on Genetic Engineering and Biotechnology (INOGEB) at the Agricultural Genetic Engineering Research Institute (AGERI), Giza, Egypt.

"It is very inspiring to get a chance to see the various advances in Egypt in terms of agricultural biotechnology," she comments. "The trip was an eye-opener in terms of what we could achieve in Malaysia. The enthusiasm and cooperation of the scientists in Egypt and support of the government show the great progress in store. It is trips like these that researchers like us get a boost in morale to be able to go even further in science."

"MABIC has been supporting the Malaysian biotechnology industry by providing information and educating the various stakeholder groups involved," she says. "I receive their monthly newsletter as well as the frequent updates in current biotech issues from ISAAA which helps me keep abreast of the advancements around the world. I hope that MABIC continues its good work and keep actively supporting our fledging industry."

With regards to her future plans, she has been in talks with the Ministry of Entrepreneurship in setting up a bio-entrepreneur skills program aimed at providing training in terms of business setup and providing counsel towards those interested in setting up their own biotechnology company. Other projects with the Ministry include a pilot incubating program, and a commercialization program aimed at bridging the value chain gap.

"With more time in my hands, I might also want to work on the area of bioprospecting, from a molecular biology perspective as it has been a strong interest of mine since it was mentioned at a conference 10 years ago. Who knows what the future might bring?" ❑

The UPLB Genetics and Cell Biological Societies

Sharing Biotech Information to Students

By Noel Amano Jr.

Studies suggest that the attitude of the general public towards scientific developments in general are closely associated with trust in sources of information (Cavanagh et al. 2005). With this line of thinking, a biotechnology component has been integrated to high school and university curricula in many countries, such as Australia, U.S. and Canada (Kitto et al., 2003). Improved understanding of biotechnology is expected to provide individuals with the capability to make informed decisions.

But this is not the case in developing countries, especially in Latin America, Africa and Asia (Fritz et al., 2003). Biotechnology awareness of high school students or university students majoring in non-biology fields remains limited. Several student organizations have bridged this gap. In the Philippines, the International Service for the Acquisition of Agri-biotech Applications (ISAAA) Southeast Asia Center and the Southeast Asian Regional Center for Graduate Study and Research in Agriculture Biotechnology Information Center (SEARCA BIC) collaborate with student organizations working to disseminate science-based information on biotechnology.

Genetics Society

One such organization is the University of the Philippines Los Baños Genetics Society, or GeneSoc. The organization, which was established on December 20 1983, aims to share information on genetics, genomics and biotechnology. In the university, the GeneSoc has established interactive study groups that help students with their genetics courses and give non-biology students an idea what genetics as a science is. The organization also aims to distribute science-based information on biotechnology.

GeneSoc uses ISAAA materials in their programs.

"Biotechnology is a touchy subject," says Jickerson Lado, the organization's Executive Committee head. "The biotechnology debate has been tainted with ideologies, emotions and issues far from the technology, such as politics and globalization. We have to deal with the facts. We need science-based information on the subject and GeneSoc aims to provide students and the lay public with fair, balanced and credible information." Jickerson believes that ISAAA and SEARCA BIC play an

"The biotechnology debate has been tainted with ideologies, emotions and issues far from the technology, such as politics and globalization. We have to deal with the facts. We need science-based information on the subject and GeneSoc aims to provide students and the lay public with fair, balanced and credible information."

important role in promoting public understanding of scientific advances in biotechnology. The Genetics Society has collaborated, on numerous occasions, with ISAAA and SEARCA BIC. The KC provides GeneSoc with educational materials which the organization uses in their programs.

"It is very important that everyone be reached by fair information. As students of an agricultural university, we have been exposed to the science of genetic engineering, its basis, applications, benefits and associated risks. But we have to think of those that have no idea what the science is, which I surmise is more than half of the country's population," notes Ryan Pascual, member of the organization. "My mother for instance has basically no idea what genetically modified foods are. Well, she obtains biotech information from the mass media, the number one source of information on biotechnology, we can't deny that. But since the mass media tends to focus on sensational news stories, the public hears only part of the story."

"That is why we have these projects to educate the lay people and spread science-based information on genomics, genetics and biotechnology," says Gilmeri Mallorca, a GeneSoc member. Richard Casiguran, head of GeneSoc's Project Committee, explains that the organization is currently focusing on educating high school students. "They will be the next generation of consumers. We are anticipating that more biotechnology products will be available in the future. And we believe that the knowledge we share will help them make informed choices," Casiguran adds.

"We organize seminars and conferences, where we discuss the pros and cons of the technology to high school students," says Justin Revilleza, GeneSoc's vice president. He acknowledges that some of these students will pursue other fields, such as engineering, commerce and social science. He also said that most of the high school students won't have the chance to go to the university. "That is why we think it is important to reach and educate them," Revilleza notes.

The GeneSoc conducts an annual program of seminars, conferences and contests highlighting the importance of genomics and biotechnology, which they call the Genetics Camp. Established in 2005, the Genetics Camp started with some 20 high school student participants. This year's camp, with the theme *Superfoods: An Introduction to Biotechnology and Biofortification*, attracted more than 500 participants from over 30 high schools all over the country. Speakers from different research institutions discussed recent biotech advances such as RNA interference, iron and beta-carotene fortified sweet potatoes and Golden Rice.

Jickerson Lado explains that the Genetics Camp aims to spread information about biotechnology and the science of genetics in general. Lado says that "student participants seem interested enough about biotechnology, but when they think of the science, they usually think more of human cloning, mutant monsters, and longevity treatment. We aim to change that."

"We distribute printed educational materials in GeneSoc-sponsored seminars and conferences. We find the ISAAA publications very useful, particularly the Pocket Ks," recalls Ryan Pascual.

"They (students) will be the next generation of consumers. We are anticipating that more biotechnology products will be available in the future. And we believe that the knowledge we share will help them make informed choices."

"Pocket Ks are very nice publications, not too technical and easy enough for high school students to understand without losing the important aspects of the technologies featured." From gene chips to expression vectors, marker genes and GURTs, biotechnology can look forbiddingly complex to high school and even college students. "Of course we won't expect high school students to be that interested in science more so on biotechnology which most of them find intimidating," explains Pascual. "We have to catch their attention. And we believe that the Pocket Ks do just that. They are easy enough to digest, with graphics and interesting pictures. And the wide coverage of topics, from biofuels to biopharmaceuticals and bioinformatics, is a big plus."

"We also use the ISAAA videos in numerous occasions. We screened the video on the Bt Corn Experience in the Philippines in a recent conference," recalls Gilmeri Mallorca. She believes that these videos will be the best way to reach other groups, for instance consumers, which GeneSoc plans to include in their future information campaigns.

The GeneSoc members also acknowledge the effectivity of the Crop Biotech Update in delivering new information on agricultural biotechnology. They say that the "easy to digest, bite-size format" of the newsletter is perfect for students who prefer reading a two-paragraph article summary rather than the complete technical research paper. Most students are wired so the internet is the number one source of information. Ryan Pascual says that the Crop Biotech Update is very useful since it's available for free. Pascual is a Plant Biology major in the University and he finds the update helpful in his studies. He explains that as much as he wants to read full scientific papers, he has no access to journals. Students from developing countries have limited access to scientific journals since most university libraries cannot afford journal subscription rates. Pascual says that the CBU is the next best thing.

Cell Biological Society

The UPLB Cell Biological Society, or the UP Cells, is another organization that collaborates with ISAAA and the SEARCA BIC in spreading credible information on agricultural biotechnology for the public, media and policy makers. For the past seven years, the organization has been active in holding activities to promote molecular biology and biotechnology not only to University students but also to students of other colleges and high schools and to the lay public in general. UP Cells has been involved in various civic academic activities, including the SIHAY Biology Congress. In addition to disseminating science-based biotech

Members of the UPLB Cells demonstrate molecular biology protocols to high school students.

"In addition to educating the students, we also share information with high school teachers. We believe that this is a way of creating greater impact. We provide them with educational materials."

information, the congress aims to develop the academic potentials of today's youth in the field of modern biology and biotechnology. The annual event includes activities such as trips to biotech research institutions and laboratory facilities, biotech research competition, seminars and workshops, and inter-high school biotechnology quiz contests. In addition to the Sihay Congress, the UP Cells also conducts an annual Cell Week. The event, which includes exhibits and workshops, are held to showcase the latest advances in the fields of biotechnology and molecular biology. Students from other universities are toured to laboratories in UPLB and are allowed to experience extraction of proteins and DNA and perform molecular biology protocols, such as polymerase chain reaction and cloning.

The first SIHAY congress, with the theme *Looking at Our Own: The Coconut Biotechnology*, was made possible by a collaboration with the SEARCA BIC. The conference attracted more than 300 participants from 32 schools in Luzon. For this year's SIHAY Congress, the UP Cells highlighted the Global Status of Commercial Biotech Crops 2008 report.

"The Philippines is one of the top biotech-growing countries, although I bet that most of the students here in the University don't know that. We are conducting this program mainly to educate the students," says Rachelle Sy, president of the UP Cells. "In addition to educating the students, we also share information with high school teachers. We believe that this is a way of creating greater impact. We provide them with educational materials." Sy notes that the ISAAA publications, particularly the information sheets, the Pocket Ks and the biotech booklets, have been a great tool in dispersing objective information on biotechnology. "These publications have been received very well, especially by high school teachers," Sy adds. "They find the materials reader friendly. The facts are presented *sans* the intimidating details. We have been constantly receiving requests for these materials. I believe that the publications are being distributed to students."

"Biotechnology, like any other new technology, is met with mixed reactions. Of course biotech is no silver bullet. We acknowledge that there are certain risks associated with the technology. That is why we need to communicate the facts. We believe that ISAAA, and particularly the SEARCA BIC, have done a great job in providing reliable information on a very controversial science," Sy concludes. ❑

Biotechnology Coalition of the Philippines

Advancing Biotechnology through Partnerships

By Jenny Panopio and Rochella Lapitan

Capped with the mission of contributing to the national development goals of eradicating poverty, achieving food security, improving health and sustaining the environment, the Biotechnology Coalition of the Philippines (BCP) makes its way in advocating for the safe and responsible use of modern biotechnology in the Philippines.

BCP is a non-stock, non-profit membership association duly registered with the Philippine Securities and Exchange Commission. Launched in April 2001, it is a multi-sectoral coalition of biotech advocates from academe, farmers' organizations, industries, the church, media and the scientific community, which recognizes the potential benefits of modern biotechnology in improving lives of every Filipino.

From an Association to an Agri-biotech-Driven Coalition

"The BCP is the expanded coalition of the Biotechnology Association of the Philippines, Incorporated (BAPI)", says its executive secretary Abraham "Abe" J. Manalo.

"BAPI aimed to develop a national framework to push for biotechnology in the Philippines. However, its membership and activities were mainly focused on pharmaceutical biotechnology. At that time, they realized that a big portion of the biotechnology industry in the Philippines was not the pharmaceutical industry, but rather the agriculture industry, primarily because the Philippines is an agricultural country. By then, series of institutional meetings with the public and private sectors were conducted to underscore the need to find niches of biotechnology in the agriculture sector and to include its stakeholders in the association. Thus, the BCP was born and the rest is history," narrates Abe.

Ensuring Safety: Building the Capacity of Regulators

In July 2001, Philippine President Gloria Macapagal-Arroyo made a declaration supporting the safe and responsible use of modern biotechnology and its products as one of the means to achieve food security, equal access to health services, a sustainable and safe environment, and industry development. As an offshoot of this pronouncement, the Department of Agriculture issued in 2002 Administrative Order No. 8 (DA AO8) which serves as the guideline for the importation and release into the environment of plants and plant products derived from the use of modern biotechnology.

Insect-resistant Bt corn passed through the scientific assessment based on DA AO8 prior to its

Workshop for regulators on commercialization guidelines.

Media practitioners attend briefing on global status of crop biotechnology in a joint BCP and SEARCA BIC-sponsored seminar.

commercialization in the Philippines in December of the same year. This biotech crop is the first food and feed crop approved for commercial adoption in Asia.

"In support of DA AO8, the Department of Agriculture (DA) Biotechnology Program Implementation Unit (DA PIU) together with several partners, including the International Service for the Acquisition of Agri-biotech Applications (ISAAA), BCP, and the Southeast Asian Regional Center for Graduate Study and Research in Agriculture Biotechnology Information Center (SEARCA BIC) developed the national capacity building program in biotechnology," Abe recounts.

In early 2002, ISAAA together with the DA PIU and SEARCA BIC organized a training workshop on National Biosafety Frameworks and Implementation. The workshop was attended by regulators and would-be regulators from the National Biotechnology Program where they were introduced into the methodology of risk assessment through hands on examination of regulatory dossiers based on food and environmental safety. In this event, the need for follow up in-depth training on the process evaluation of the safety of biotech products was identified.

"That workshop was a pioneering activity that paved the way for a series of risk assessment workshops for the levels of biotech regulators in the Philippines. This was followed by another key training workshop on food safety risk assessment with the experts from AGBIOS as the key resource persons," says Abe.

The National Capability Building Program with the BCP as a key partner included interdisciplinary aspects in capacity enhancement of regulators, policy makers, scientific technical review panels, institutional biosafety committees, technology developers, and scientists who worked on the transfer, regulatory policies, commercialization and diffusion of biotechnologies.

"We at BCP were acknowledged for our efforts in conducting biotechnology risk assessment seminars for policy makers and regulators. This enabled them to make informed decisions in implementing the biotechnology regulatory framework," says Abe.

Road to Commercialization: Increasing Public Awareness on Agri-biotechnology

Biotechnology communication is essential to promote deeper understanding of issues surrounding biotechnology. Development of communication strategies and use of different modalities contribute to awareness promotion and eventually, biotechnology acceptance in the country.

"We at BCP were acknowledged for our efforts in conducting biotechnology risk assessment seminars for policy makers and regulators. This enabled them to make informed decisions in implementing the biotechnology regulatory framework."

Aside from the regulatory capacity building initiatives, BCP is also involved in organizing information, communication, and education (IEC) campaigns in grounding biotechnology in the Philippines especially during the height of protest of anti-biotech groups. The compelling alliance of the DA Biotechnology Program in partnership with SEARCA BIC, BCP, the DA National Agriculture and Food Council, the Philippine Council for Agriculture, Forestry, and Natural Resources Research and Development (PCARRD), and the scientists from the local universities, trail blazed the information drive on biotechnology and DA AO8. Several country-wide information activities were conducted to increase awareness and engender public acceptance on biotechnology.

"We simultaneously performed different communication mechanisms for target groups of stakeholders without duplicating efforts to strengthen the positive environment of biotechnology in the country. We worked as a network that paved the way for the formation of a multi-stakeholder umbrella of biotechnology agencies for a national biotechnology communication program," he shares.

Abe recognizes the concerted efforts of several players in biotechnology education and awareness campaigns. He looks at ISAAA as a credible source of information on biotechnology and provides opportunities for the coalition members to build their capacities on communicating biotechnology.

Abraham Manalo, BCP executive secretary, calls for continuing exchange of ideas between the science community and the general public.

"We usually cite ISAAA and Dr. Clive James in our presentations as we use some of his data, especially in the articles that we develop in BCP," he says. "ISAAA-developed biotech communication materials are really effective and useful, particularly the Pocket Ks which are good references for professors and students. Likewise, the ISAAA videos such as 'Asia's First: The Bt Corn Story in the Philippines' is a great documentary of a success story in the Philippines," says Abe.

"It is also remarkable that BCP board members were empowered as participants and resource speakers in ISAAA and SEARCA BIC's biotechnology-related initiatives. Drs. Benigno Peczon, Nina Gloriani, and Saturnina Halos, and Edwin Paraluman are BCP board members invited by ISAAA and SEARCA BIC as resource persons and Filipino experts on biotechnology in local and internationally organized activities," he gladly says.

A Glimpse of the Future: Big Leap for Biotechnology in the Philippines

BCP shares the vision of Philippine progress through harnessing the potentials and opportunities provided by biotechnology. "There are many areas in agricultural research and development where the new tools of biotechnology could be useful, and that is where we'll find a niche for our country," he reiterates. Quoting Dr. Peczon's point of view, he asserts that "the archipelagic regions of the Philippines may be a good setting for production of pharmaceutical crops. In this way, our country may position itself in the global market niche on biopharming."

"Progress in biotechnology industry in the Philippines may not be far reaching since we have already established our regulatory system. Our transparent and stable regulatory system is a model for other developing countries. Moreover, we have a pool of experts that are spearheading the creation of more biotechnology opportunities in the country," he stresses.

However, the biotech coalition believes that the full potential of modern biotechnology can only be realized if the products of these technologies will be accessible and available to the adoptors of the technology, particularly the farmers sector.

"ISAAA should continue to facilitate farmers exchange programs to sustain information sharing and transfer of technologies among adopters of crop biotechnology, especially in the developing countries," says Abe. Likewise, he emphasizes the need to intensify more biotechnology information campaigns in regional levels where the local government is skeptical about the technology as well as in areas where emerging biotech crops will soon be planted.

Abe believes that continuing dynamic exchange of ideas from and within the science community and the general public must be sustained through continuing partnership – a condition for a big leap for crop biotechnology in the Philippines. ❑

REFERENCES

Biotechnology Coalition of the Philippines. About BCP. http://www.bcp.org.ph/aboutbcp/boutbcp.html (Accessed April 21, 2009).

Cavanagh, H., Hood J. and Wilkinson J. 2005. Riverina High School Students Views of Biotechnology. Electronic Journal of Biotechnology Vol 8 No 2: http://dx.doi.org/10.2225./vol8-issue2-fulltext-1 (Accessed January 28, 2009).

Fritz, S., Husmann, D., Wingenbach, G., Rutherford, T., Egger, V., & Wadhwa, P. 2003. Awareness and Acceptance of Biotechnology Issues Among Youth, Undergraduates, and Adults. AgBioForum, *6*(4), 178-184 http://www.agbioforum.missouri.edu/v6n4/v6n4a05-fritz.htm (Accessed on February 3, 2009).

Gaskell, George, Edna Einsiedel, William Hallman, Susuna Hornig Priest, Jonathan Jackson, and Johannus Olsthoorn. Social Values and the Governance of Science. 2005. Science. Vol. 310, No. 5756. http://www.sciencemag.org/cgi/content/full/310/5756/1908 (Accessed December 16, 2008).

Kitto, S., Griffiths L. and Pesek J. D. 2003. A Long-Term Study of Knowledge, Risk, and Ethics for Students Enrolled in an Introductory Biotechnology Course. J. Anim. Sci. 81:1348-1353.

SEARCA Diary. 2006. SEARCA BIC Teams up with UP Student Org in Biology Meet. March 2006 Issue. Los Baños, Laguna, Philippines.

Global Community

Virtual Sharing of Information

By Mariechel J. Navarro and Noel Amano Jr.

The mass media through the tri-media (print, radio, and television) as well as the Internet have made it easier to mainstream a lot of information for various audiences. People have a choice about accessing information in a preferred communication mode. While the tri-media help promote awareness, knowledge, and understanding of concepts and issues for a heterogeneous audience, the Internet also allows a more focused content for specialized stakeholders. Hence, together, these communication channels allow a broad base by which science-based information on crop biotechnology can be shared across geographical, political, cultural, and social barriers.

The use of the Internet has revolutionalized the spread of information. As of June 2008, an estimated 1.5 billion or 22 percent of the total world population of 6.7 billion people use the Internet. This is a 305.5 percent growth since 2000 when only slightly more than 360 million people were using the Internet. Asia accounts for almost 40 percent in terms of usage percentage of total world users, followed by Europe (26.3 percent), and North America (17 percent). North America remains to have the highest world Internet penetration rates among the geographical regions at 74 percent. However, the Middle East, Africa, and Latin America have had a usage growth rate of 1,176.8 percent, 1,031 per cent, and 669.3 percent, respectively, since 2000 (Internet World Stats, 2008). This means that the global community, particularly those from the developing world, is fast getting into the Internet bandwagon. Worth noting is that developing countries have the highest growth rates among Internet users, thus making information accessible to more people.

Hines (2007) notes that scientific controversies spread more widely now because the media is more developed and the "border-free, self-published attributes of the Internet only serve to speed up the tempo and breath of the debate."

As early as 1999 during the United Nation's Economic Commission for Africa, it was

stated that, "The future success factor for nations, organizations and individuals is not high-level technology, but rather innovative and well-managed content." Riggs (2003) adds that there should be more focus on "determining what content users truly need, and then adapting that content using the best technology to make it available in a given environment."

Salazar et al. (2003) argue that competitiveness of businesses depend on their ability to create and commercialize new knowledge as much as on their ability to produce new products. The strategic impact of Internet technology in the biotechnology and pharmaceutical industry, they aver, is based on three key dimensions: converting information into knowledge, redesigning the innovation process, and structuring knowledge-oriented organization. A competitive edge among organizations is the ability to manage information and make it available for decision-making by various stakeholders.

The International Service for the Acquisition of Agri-biotech Applications (ISAAA) uses the tri media and the Internet to reach its global stakeholders. ISAAA is closely identified with the annual report on the global status of commercialized biotech/GM crops. The availability of information about the report in various formats (full report, executive summary, press release, highlights, slides) and translations, makes it the most sought reference. It is thus considered an information niche of ISAAA. In addition, are other publications and videos developed/co-published by ISAAA that highlight technical as well as social dimensions of crop biotechnology. All these materials, except for a few, are made freely available to stakeholders, either in hard or electronic copies, to encourage the global sharing of information.

The Annual Global Status Report on Commercialized Biotech/GM Crops

The annual ISAAA Brief on the Global Status of Commercialized Biotech/GM Crops, authored by Dr. Clive James, ISAAA's founder and chair, is regarded as the most authoritative single source of information and the most cited reference on the subject. It provides an in-depth analysis of global developments pertaining to biotech crops, distribution of biotech crops by country and crop, global adoption of the major crops, and status of regulatory approvals. The report is free of charge to eligible nationals of developing countries. The executive summary, highlights, Pocket K (knowledge) version, press release, PowerPoint slides of important figures, and report summary in video format are available also for downloading on ISAAA's website. The executive summary is translated into 17 languages: Arabic, Bahasa Indonesia, Bangla, Chinese, French, Hindi, Italian, Japanese, Korean, Portuguese, Spanish (Latin America), Spanish (Spain), Swahili, Thai, Turkish, Urdu, and Vietnamese. The highlights, on the other hand, is translated in 52 languages.

The report is presented in a global launch that includes a webcast and media teleconference originating from a specific country. India and the Philippines, countries in Asia which are already commercializing a biotech crop, were the venue for the launch in 2007 and 2008, respectively. The report's author along with a panel that includes key government and farmer representatives, discuss highlights and its implications for local stakeholders. The international media from North America, Latin America and Europe representing key print, news services, and electronic media such as the New York Times, Washington Post, Bloomberg, Reuters, Associated Press, and Wall Street Journal are invited to participate in the webcast and ask questions regarding the report. Other countries also hold their own media briefing and or seminar on the report that is facilitated by scientists or experts. BICs translate the executive summary and press release for distribution to stakeholders, organize the seminar briefings, and answer inquiries either through newspaper, radio or

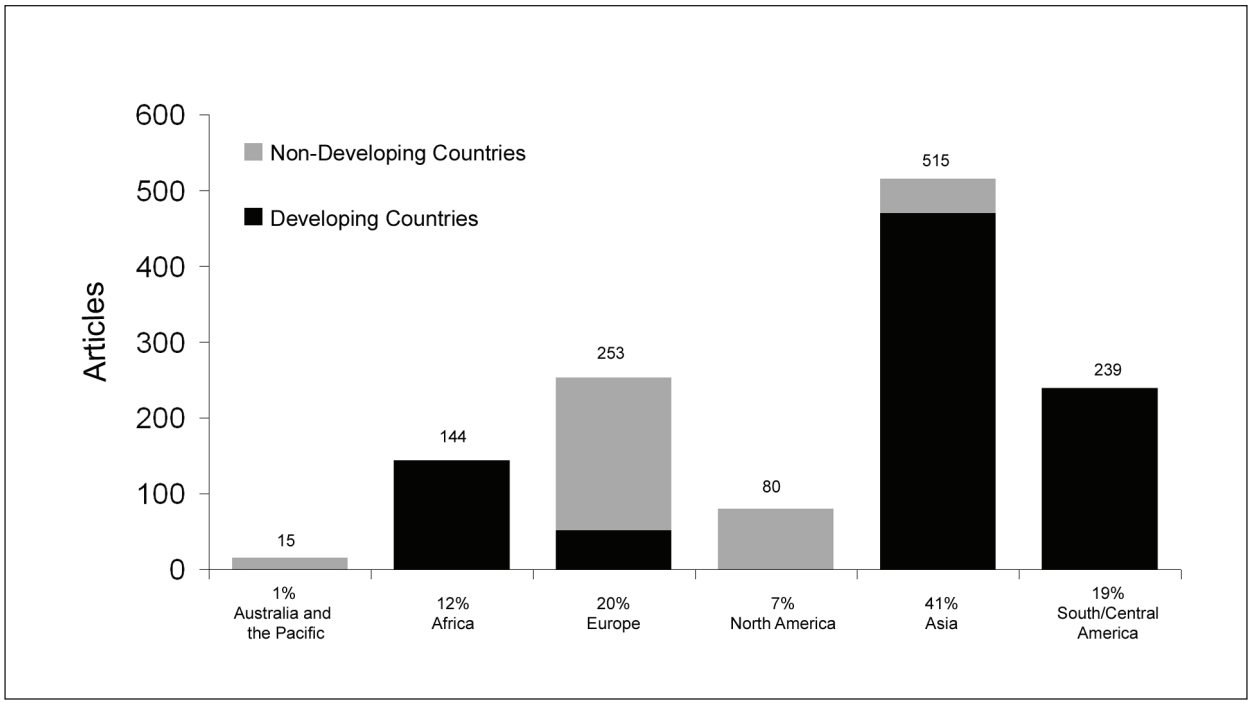


Figure 1. Distribution by region of articles on the 2008 global status report.

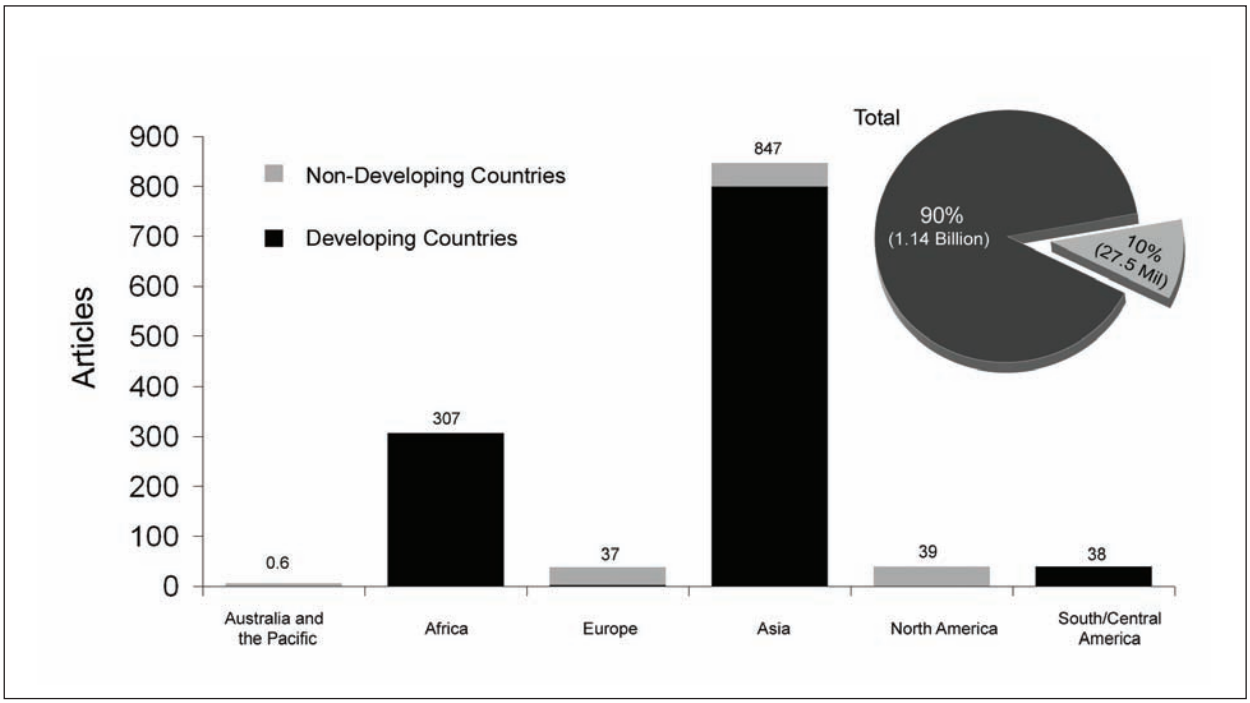


Figure 2. Impressions generated by the 2008 global status report by region.

television interviews. The international as well as key country launches generate a significant number of articles in newspapers, as well as radio and television spots.

To capture the global reach of the report, an independent body documents the number of articles written, as well as total impressions – an impression stands for each individual person who is likely to have come in contact with the media story about the report (Colleen Parr, personal communication, 2006). In 2008, a total of 1,596 media articles in 41 languages and reaching 72 countries, were published. These accounted for an estimated 1.108 billion impressions. A total of 1246 articles in 42 languages, reaching 71 countries were generated by the 2008 report as of April 2009. Total impressions were estimated to be an all time high of 1,273,420,000. Figures 1 and 2 show the distribution of articles and impressions by region. Developing countries contributed 73 percent of all media articles. Top countries with the most number of media articles generated were China (275), Brazil (153), India (102), USA (59), Egypt (36), Mexico (33), Poland (32), and United Kingdom (30). Developing countries also accounted for 90 percent of the total impressions suggesting that a substantial number of people from such regions as Africa (Burkina Faso, Ethiopia, Ghana, Kenya, Mali, Namibia, South Africa, Sudan, and Uganda), Asia (Bangladesh, China, India, Indonesia, Japan, Korea, Malaysia, Pakistan, Philippines, Singapore, Thailand, and Vietnam), and Latin America (Argentina, Brazil, Chile, Colombia, Guatemala, Honduras, Mexico, Panama, Paraguay, Peru, and Venezuela) were reached regarding the latest information about the global status of commercialized biotech/GM crops. In particular, Asian countries such as China and India topped the countries with the most number of impressions at 344 million and 340 million, respectively.

ISAAA Website

A major communication strategy for reaching a global community is through the Internet. ISAAA's website was developed in 2001 to address stakeholders need for information and updates about the objectives, programs, and activities of the organization. The site has gone through several revisions through the years in response to viewer feedback that information materials on crop biotechnology be readily available for downloading for instruction and briefing purposes. Hence, the home page presents two major programs of ISAAA (technology transfer and knowledge sharing initiatives), special projects, and then liberally displays information resources such as publications and presentations on the global status of commercialized biotech/GM crops report, ISAAA videos, the e-newsletter Crop Biotech Update, ISAAA in the News, and recommended reading fare. Many of the ISAAA publications, including archived materials, are available for downloading in various formats, video series can be viewed by streaming directly on screen; and flash papers (PowerPoint presentations) can be seen and used directly from the site. An online purchasing system is also available for those who wish to order hard copies of documents or videos. Using the Google translator, the website can be translated into 23 other languages of viewers, among them Chinese, Dutch, French, Italian, Korean, Portuguese, and Spanish.

The Global Knowledge Center on Crop Biotechnology (KC) site is integrated seamlessly within the ISAAA homepage. It includes various information resources on crop biotechnology and the network of Biotechnology Information Centers (BICs). The homepage highlights the different publications available for downloading, the most current issue of the e-newsletter Crop Biotech Update and the Biofuels Supplement, listing of upcoming biotech events, and a directory of links to various relevant institutions. Different

Figure 3. Homepage of the ISAAA website.

Figure 4. Website of the Global Knowledge Center on Crop Biotechnology.

translations of the newsletters are available in several languages as well as Google translations of the website itself. Details of the BICs such as contact persons and addresses are also available for viewing.

Major changes and improvements were done to streamline and improve the content and design of the ISAAA website to allow ease of navigation across sections, enable users to search the site, and benefit from an RSS page for its newsletters, which allows immediate notification of new items. Content of many materials such as ISAAA publications, features, acronyms, and glossary of biotechnology information, and biotech repository is strategically located.

Publications developed by the KC include the Pocket Ks (knowledge), a series of packaged information on crop biotechnology products and related issues. Topics include questions and answers on crop biotechnology, plant products of biotechnology, documented benefits of GM crops, contribution of GM technology to livestock sector, biofuels, biotech plants for bioremediation, biopharming, biotechnology for the development of drought tolerant crops, biotechnology and biofortification. Other topics deal with ethics, and communicating crop biotechnology. On the website, the series are arranged so that a viewer can use the index or search function to find a specific Pocket K of interest. A viewer also has the option of downloading either a document or foldable version. Other publications are monographs on public perception studies on biotechnology, communicating crop biotechnology, and biotechnology in agriculture, a book on reporting agri-biotech for journalists, brochure on myths and facts about biotechnology, and institutional write-ups.

Videos available for viewing on the website are documentaries on developing country stories on developing and or using biotech crops – Bt corn in the Philippines, Bt cotton in India and China, tissue culture banana in East Africa, clonal forestry in East Africa, and biotech papaya in Southeast Asia. Story patterns on crop biotechnology experiences are discussed from the perspectives of different stakeholders such as farmers, regulators, policy makers, and scientists. For example, the China Bt cotton video documents cotton cultivation in China and how Bt cotton eventually became the first biotech crop to be cultivated widely in the country. Various stakeholders who made this a reality - scientists, government officials, farmers and the private sector - share their experiences and thoughts about this technology.

The collaborative efforts of various stakeholders and partners to develop papaya ringspot virus (PRSV) resistant papaya are captured in the papaya video. It highlights public-private partnerships and how countries in Southeast Asia have benefited through the network's capacity building efforts and technology and information sharing initiatives. Another video documents the efforts of various stakeholders to introduce tissue culture banana in small farmers' farms in Kenya and Tanzania while the Bt corn video captures in 18 minutes the seven year process that it took for a genetically modified crop to be approved for commercialization in the Philippines. Other topics include a corporate video on ISAAA, and the Bt cotton trials in Burkina Faso.

ISAAA uses AWstats, a web statistics analyzer to determine the user profile of visitors to the website. Between June 2006 to December 2008, top visitors to the site were the U.S., Philippines, India, France, Germany, China, Australia, Canada, Japan, Great Britain, Italy, South Korea, Brazil and Taiwan. Interestingly, seven of the countries are from the Asia Pacific region which validates the Internet statistics about Asia increasingly contributing to total Internet usage in the world. Figure 5 shows the average monthly website visitors per country.

Figure 5. Average monthly website visitors (January-December, 2008)

From visitors mostly from the developed countries in the early 2000s, there has been a significant shift in those coming from the developing countries. The U.S., however, continues to generally account for 18-20 percent of total visitors.

AWstats reports the "number of visits", which is the total number of visits by all visitors within a 1 hour cut-off time. There has been a steady increase in number of visits since June 2006 when AWstats was used (Webtrends, the web analyzer used previously, reported visits within a 30-minute cut-off time). The average monthly visits in mid-2008 is more than 30,000. The number of visits is higher in particular months, due primarily to the release of the global status report of commercialized biotech/GM crops which is the most sought out document published by ISAAA.

The most accessed pages on the website are the ISAAA home page, the Crop Biotech Update (CBU) RSS, the weekly newsletter CBU online, Biofuels Supplement RSS, and the KC home page. Recipients using the RSS feature are provided automatic feeds or alerts through a web feed format that makes it possible for people to keep up with updates regarding the CBU/Biofuels Supplement in an automated manner. A significant number of RSS viewers attest to the increasing number of readers who subscribe to this alert feed feature or are keen on automatic updates of the CBU. Also worth noting is that a new feature, CBU Send to a Friend, which was started only in November 2007 has registered a significant number of visits proving that the CBU is interesting enough for readers to send articles to colleagues who in turn are potential subscribers of the newsletter.

Usability of the website can be gauged by the number of document downloads that visitors request from the site. Based on the most downloaded files, combined materials related

to the Annual Review (Briefs, slides, executive summaries) validated viewers interest in these materials. Brief-related materials were downloaded over 80,000 times of which the Chinese translation of the Executive Summary was the most sought material at 20,424. Individually, Brief 36 on *GM Crops: The First Ten Years – Global Socio-Economic and Environmental Impacts* totaled 21,499 downloads. Other popular downloads were the ISAAA brochure, the book *Genes are Gems: Reporting Agri-biotechnology*, the monograph *Crop Biotechnology and Biosafety*, and ISAAA strategic plan.

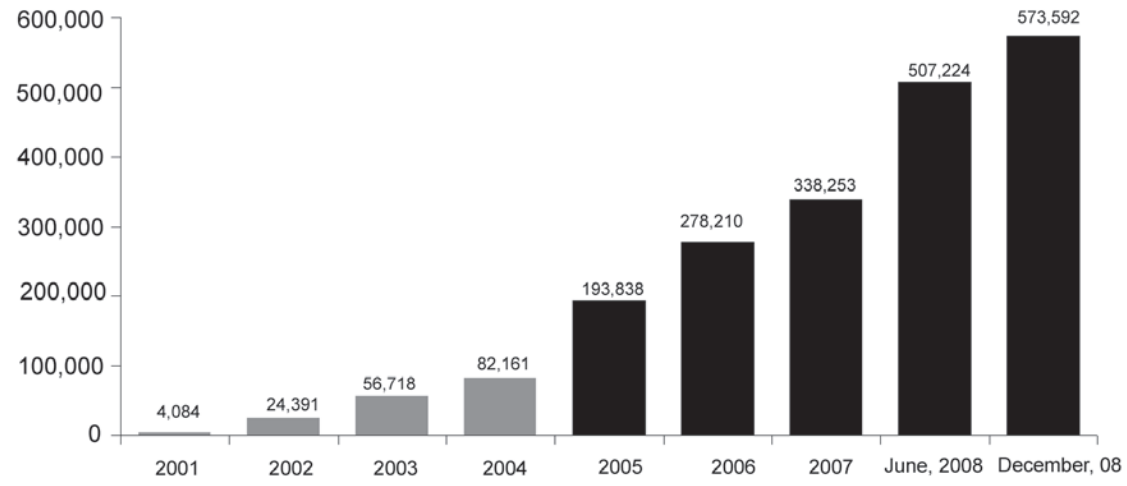
Crop Biotech Update

To offset the predominantly developed world clientele of the website, the KC has taken an active effort in reaching more stakeholders in the developing world through the Crop Biotech Update, a weekly e-newsletter. The Update summarizes global news with implications for developing countries, research highlights, documents, and announcements of events, and related topics. Stories are categorized as news (Global, Africa, Americas, Asia and the Pacific, Europe). Articles are sourced from primary journals, contacts, institutional websites, documents, published articles, and from the BICs. Articles are two to three paragraph summaries with a hyperlink to the original publication, or an email contact to the main author or correspondent. A supplementary e-newsletter on biofuels is published every two weeks highlighting major developments in the field, as well as announcements on events and other related issues. It basically follows the CBU format but articles are classified as news and trends; energy crops and feedstocks for biofuels program; biofuels processing; and biofuels policy and economics.

The articles published in the CBU are constantly being cited and used by other listservs or news sources like Agbios, Meridian, Seedquest, Checkbiotech, and Biovalley News as well as those of the Biotech Knowledge Center by Monsanto, Kenya's Ministry of Science and Technology, Consortium for Improving Agriculture Based Livelihoods in Central Africa (CIALCA), Alltop Biotech News and the Agricultural Biotechnology Network in Africa (ABNETA). ABNETA, publishes only the Africa section of the CBU and allows the reader to rate the articles (on a scale of 1-5). Alltop Biotech News and CIALCA, on the other hand, syndicate the CBU RSS feed. CIALCA allows the readers not only to rate the articles but also post their comments. In contrast, Monsanto's Biotech Knowledge Center and Kenya's Ministry of Science and Technology provide the whole article in their sites. Kenya's Ministry of Science and Technology posts CBU articles under its Biosafety News section while the National Institute of Higher Education, Research, Science and Technology (NIHERST) of the Republic of Trinidad and Tobago posts the CBU under its on-line S&T News.

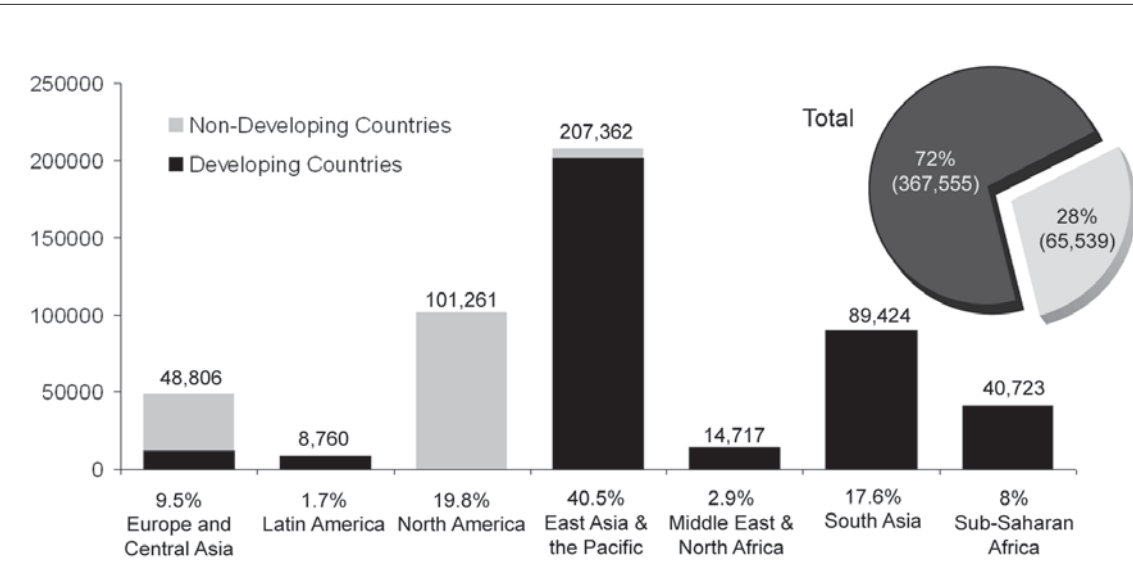
Both newsletters reach over 570,000 subscribers/recipients (Figure 6) in 200 countries, with the Update translated into 11 other languages (Arabic, Bahasa Indonesia, Bangla, Chinese, French, Japanese, Italian, Portuguese, Spanish, Thai, and Vietnamese). The subscriber list is constantly updated through an active search by the Global Knowledge Center on Crop Biotechnology and the assistance of ISAAA's BICs. The list excludes subscribers of other listservs that pick up news from the Update. This network of subscribers is probably the largest of its kind, reaching 10 times more subscribers than that of similar services. Seventy-two percent of the recipients come from developing countries with almost half of the total recipients from East Asia and the Pacific (Figure 7). This recipient list offsets the predominantly developed country visitors to the website.

The KC conducts an annual e-survey of its subscribers to gather feedback on the newsletters.



Note: Includes recipients of Crop Biotech translations in Arabic, Bahasa Indonesia, Bangla, Chinese, French, Italian, Japanese, Portuguese, Spanish, Thai and Vietnamese
Does not include subscribers to other listservs that pick up articles from the Crop Biotech Update, estimated at 30,000

Figure 6. Crop Biotech Update recipients, 2001-2008



Note: Includes recipients of Crop Biotech translations in Arabic, Bahasa Indonesia, Bangla, Chinese, French, Italian, Japanese, Portuguese, Spanish, Thai and Vietnamese
Does not include subscribers to other listservs that pick up articles from the Crop Biotech Update, estimated at 30,000

Figure 7. Distribution of CBU recipients by region (as of December 2008)

A short questionnaire is sent by email and respondents are asked to comment on why they read the CBU, what they find most useful, what they like about it, and suggestions for improvement. The questionnaire also provides a 'face' to subscribers as they give information about themselves, i.e. name, designation, and company. A total of 1,998 respondents answered the e-survey between 2006 to 2008. While the figure is small compared to total subscribers, it nevertheless provides a profile of actual users of the CBU and gives insights on what they think about the e-newsletter. This profile and feedback has helped the KC in redesigning the e-newsletter to better address the needs of the subscribers.

The subscriber-respondents come from 118 countries in Africa, Asia and the Pacific, Latin America, North America, and Europe. Thirty-five percent of the respondents were either scientists or researchers while 31 percent were from the academic sector as either faculty or academic staff. About 18 percent were administrators or managers, while 5 percent were represented by media or communication persons. Decision makers exemplified by designations such as consultant, advisor, and policy maker made up 6 percent while the rest were either regulator, student, from industry, or a development/extension worker (Figure 8).

In terms of organizational affiliation, 36 percent were affiliated with universities, 18 percent from national research organizations, 15 percent from private companies, and 11 percent from government exemplified by Ministries or Departments of Agriculture, and Environment. Others are from international organizations such as the United Nations, and Food and Agriculture Organization (7 percent), nongovernmental organizations (5 percent), and media companies (5 percent) (Table 1 and Figure 9).

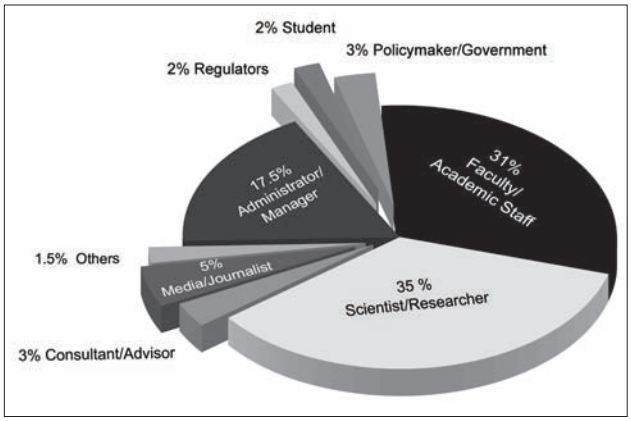


Figure 8. Designation of the CBU survey respondents

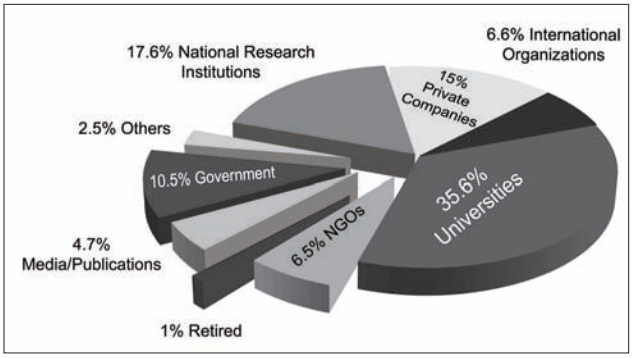


Figure 9. Organizational affiliation of the CBU survey respondents

Subscribers read the CBU to get the latest information on crop biotechnology. "It is the most up to date on-line information source in the field of agricultural biotechnology. It covers a wide spectrum of issues from technical/scientific, to legal, economic, and social," says George Sakellaris, scientist at the National Hellenic Research Foundation in Greece. Clifford Keil of the Pontifical Catholic University of Ecuador notes that he "finds the news articles essential to stay updated in a rapidly changing field." This view was also reiterated by Suwanna Kijparkom of Chulalongkorn University, MTK Gunasekane of the Sri Lankan Tea Research Institute and Ambonesigwe Mbwaga from Tanzania's Uyole Agricultural Research

Institute. John Komen from the Program for Biosafety Systems of the International Food Policy Research Institute comments that CBU's coverage is balanced and from trusted sources. "I also like the mixture of news items, research and development highlights and alerts to documents and upcoming meetings." Darmono Taniwiryono, administrator of the Indonesian Biotechnology Research Institute of Estate Crops, notes that the CBU is his main source of global information on biotechnology. Jozef Simuth of the Slovak Academy of Sciences appreciates the e-newsletter for an "express overview on GMO." For Abisai Mafa, the head of the National Biotechnology Authority in Zimbabwe, the CBU gives "the latest global and regional updates on biotechnology research, development, commercialization, and regulation." Angela Sessitsch, administrator of the Austrian Research Centers GmbH finds "valuable information which is difficult to get by other means."

Academicians make up a substantial bulk of subscribers. They are mostly faculty and academic staff of public and private universities and colleges exemplified by the University of Dschang in Cameroon, University of Tasmania in Australia, Shandong University in China, University of Talca in Chile, University of British Columbia in Canada, University of Minnesota in the U.S., and Ghent University in Belgium. Subscribers say they use the CBU as materials for instruction and as a source of current information on crop biotechnology. Faculty members add that they made the CBU required reading for their students. Colin Birch of the University of Tasmania says that the newsletter "is used in support of teaching in agricultural systems, agronomy and in gaining understanding that is broadly relevant to research activities in agriculture." She also states that she uses the CBU as a reference in teaching and in her research. Esteban Hopp of the Instituto de Biotecnologia INTA Castelar in Argentina adds that he subscribes to the CBU because he "works with GMO and receives frequent consultations from the press." David Gidoni of the Israel Ministry of Agriculture is also a professor and organizes group discussion on these items to keep up with new developments in the field and to learn reactions of the world press to new technologies. Zoran Zgaga of the University of Zagreb in Croatia teaches molecular genetics and genetic engineering, hence the CBU provides up to date information about GMOs in food production. Eufemio Rasco, Jr. of the University of the Philippines Mindanao finds the CBU useful for teaching a course on biotechnology and society.

The scientific community uses the CBU for research update and to give them idea on the emerging biotech subfields. Scientists and researchers hail from various research and development institutions such as the Empresa Brasileira de Pesquisa Agropecuaria in Brazil, Institute of Crop Science of the China Academy of Agricultural Sciences, International Center for Tropical Agriculture in Colombia, and Central Tuber Crops Research Institute in India. "My research work involves biotechnology approaches," says Jose Casaretto of the Instituto de Biologia Vegetal y Biotecnologia in Chile. "I am interested in being informed of current developments in agri-biotech (research, policies, and trends)." Ebenezer Laing of the University of Ghana comments that the "overview of progress in biotechnology leads to interesting details of theory that I can follow up." S.M. Balachandr of the Directorate of Rice Research in Rajendranagar, India notes that the information saves him a lot of time in looking for the latest information, as he is actively involved in GM research. Jayanta Bhattacharya of the Indian National Science Academy says that "it takes into account many well researched facts to which researchers usually don't have any access." Faculty-researcher Rafiqul Islam Sarker of the Bangladesh Agricultural

Table 1. Profile of subscribers' country and organization that provided feedback about the CBU.

	Organization/Company
AFRICA	
Universities	***Benin:*** University of Benin; ***Cameroon:*** University of Dschang; ***Ghana:*** University of Ghana; ***Kenya***: Kenyatta University, Mavoko Secondary School, University of Nairobi; ***Malawi:*** University of Malawi; ***Nigeria:*** University of Agriculture, Federal University of Technology, University of Nigeria, University of Ibadan, University of Agriculture Abeokuta; ***South Africa:*** Stellenbosch University, University of the Witwatersrand, Mangosuthu Technikon, University of Johannesburg, University of Technology; ***Sudan:*** Gezira University; ***Syria:*** Aleppo University; ***Tanzania:*** Sokoine University of Agriculture; ***Uganda:*** Makerere University; ***Zambia:*** University of Zambia
Research Institutions	***Benin:*** Insititut National des Recherches Agricoles du Benin; ***Burkina Faso:*** EIER-ETSHER, Institut de l'Environnement et de Recherches Agricoles; ***Congo:*** Centre de Recherches Agronomiques de Loudima, Directorate General des Recherches Scientifiques et Techniques; ***Egypt:*** Agricultural Research Center; ***Ethiopia:*** Ethiopian Agricultural Research Institute, Institute of Biodiversity Conservation; ***Ghana:*** Council for Scientific and Industrial Research Crops Research Institute, Science and Technology Policy Research Institute; ***Kenya:*** Kenya Agricultural Research Institute, Kenya Forestry Research Institute, Kenya Medical Research Institute; ***Libya:*** National Gene Bank; ***Niger:*** Institut National de l'Recherche Agronomique; ***Nigeria:*** National Root Crops Research Institute, Department of Horticulture Technology, National Horticulture Research Institute; ***South Africa:*** Forestry and Agricultural Biotechnology Institute, Makana Biodiversity Centre, National Innovation Centre for Plant Biotechnology, South African Sugarcane Research Institute; ***Tanzania:*** Ukiriguru Agricultural Research Institute, Selian Agricultural Research Institute, Uyole Agricultural Research Institute, Livestock Training Institute; ***Zimbabwe:*** Scientific and Industrial Research and Development Center (SIRDC)-Biotechnology Research Institute, Scientific and Industrial Research and Development Center, Forest Research Center
Private Companies	***Ethiopia:*** Makobu Enterprises, Pioneer Hi-bred Seeds, Ethiopian Seed Enterprise; ***Kenya:*** Agro-Irrigation and Pump Services Ltd, Amaranth International Ltd., Monsanto Kenya, Freshco Seeds Ltd., Homegrown Kenya Ltd.; ***South Africa:*** Pioneer Hi-Bred, Hans Lombard Public Relations, Microbial Solutions Pty. Ltd., Woolworths, Pannar Seed Pty. Ltd., Starke Ayres Ltd., Dr. Bernard Cole Technical Services; ***Swaziland:*** New Dawn Engineering; ***Tanzania:*** Mount Elgon Seed Company Ltd.; ***Zimbabwe:*** Seed Co., Ltd.
Government	***Kenya:*** Kenya National Assembly, Horticultural Crops Development Authority, National School of Feeding Council; ***Nigeria:*** Department of Horticulture Technology; ***South Africa:*** Department of Agriculture; ***Tanzania:*** Ministry of Agriculture, Food Security and Cooperatives; ***Uganda:*** Uganda National Council for Science and Technology, National Agricultural Research Organization; ***Tonga:*** Ministry of Agriculture, Forestry and Food; ***Zambia:*** National Agricultural

	Information Services; ***Zimbabwe:*** National Biotechnology Authority, Seed Co., Ltd., Biosafety Board of Zimbabwe
International Private and Non-for-Profit Organizations	***Benin:*** International Center for Soil Fertility and Agricultural Development; ***Botswana:*** United States Agency for International Development (USAID); ***Ethiopia:*** International Livestock Research Institute, ***Ghana:*** USAID; ***Kenya:*** United Nations Environment Programme, UN Food and Agriculture Organization, Consultative Group on International Agricultural Research (CGIAR) Gender and Diversity Program, International Livestock Research Institute (ILRI), The African Centre for Technology Centre Studies, Center Internacional de Mejoramiento de Maiz y Trigo (CIMMYT), African Technology Policy Studies Network, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Maendeleo Agricultural Technology Transfer Fund, Eastern Africa Farmers Federation, USAID; ***Malawi:*** Biotechnology- Ecology Research and Outreach Consortium, International Institute of Tropical Agriculture (IITA); ***Mali:*** International Center for Soil and Agricultural Development, USAID, ICRISAT; ***Morocco:*** International Center for Agricultural Research in the Dry Areas (ICARDA); ***Mozambique:*** Sasakawa Global 2000; ***Niger:*** ICRISAT; ***Nigeria:*** IITA, International Rice Research Institute (IRRI), ***Senegal:*** United Nations Development Program (UNDP); ***South Africa:*** Food Agriculture and Natural Resources Policy Analysis Network, AfricaBio, Pharmaceutical Manufacturers Association of South Africa, IITA; ***Swaziland:*** International Centre for Agricultural Research in the Dry Areas; ***Tanzania:*** IITA, Tanzania Home Economics Association; ***Uganda:*** Eastern Africa Farmers Federation, USAID; International Potato Center; ***Togo:*** IFDC Africa Division; ***Zimbabwe:*** Center for International Forestry Research (CIFOR), Biotechnology Trust of Zimbabwe
Media/Publications	***Ethiopia:*** Ethiopian Environmental Journalists Association; ***Kenya:*** National Media Group, Janak Communications, Kenya News Agency, The Standard Group, Radio Lake Victoria, Royal Media Services Ltd., Kenya Broadcasting Corp.; ***Nigeria:*** Guardian Newspapers Ltd.; ***South Africa:*** AgriPress Communications for Agriculture, Landbou Weekblad, Green Ink Publishing Services Ltd.; ***Uganda:*** The New Vision Publishing and Printing Co., Ltd., The Farmers Voice Newspaper
ASIA AND THE PACIFIC	
Universities	***Australia:*** University of Tasmania, University of New England, University of Sydney, University of Wollongong, University of Queensland, Australian National University, Curtin University of Technology; ***Bangladesh:*** Bangladesh Agricultural University, Khulna University; ***China:*** South China Agricultural University, Shandong University, Zhejiang University, Huazhong University of Science and Technology, Fudan University, Northeast Normal University, ***Hong Kong:*** The Chinese University of Hongkong; ***India:*** University of Pune, Tamil Nadu Agricultural University, Panjab University, Geetanjali Institute of Technical Studies, Jawaharlal Nehru College of Agriculture and Research Institute, Apollo College of Veterinary Medicine, University, Kerala Agricultural University, Indira Gandhi Agricultural University, Rajendra Agricultural University, University of Delhi, Maharashtra Animal and Fishery Sciences University, Anna University, Biotech Park Lucknow, Cochin University of Science and Technology, Doon University, University of Agricultural

	Sciences Bangalore, Bose Institute, CCS Haryana Agricultural University, Madurai Kamaraj University, University of Hyderabad, Acharya N.G. Ranga Agricultural University, Banaras Hindu University, Mahatma Phule Agricultural University, Banaras Hindu University, University of Agricultural Sciences and Technology Banaras Hindu University, University of Agricultural Sciences and Technology of Kashmir; ***Indonesia:*** Sebelas Maret University Surakarta, Universitas Bangka Belitung,University of Indonesia; ***Iran:*** Razi University, University of Tehran, College of Agriculture Kemanshah; ***Iraq:*** Basrah University; ***Israel:*** Hebrew University of Jerusalem, Tel Aviv University, Hebrew University of Israel, The Tel Aviv Yaffo Academic College, Gedera Ben Gurion University; ***Japan:*** Osaka University, Kinki University, Tottori University, Tokyo University, Univesity of Tsukuba, The University of Shiga Prefecture, Meiji University, Kobe University; ***Jordan:*** University of Jordan; ***South Korea:*** Chung-Ang University, Soonchunhyang University, Chonbuk National University, Daegu University, Chungbuk National University; ***Kuwait:*** Kuwait University; ***Malaysia:*** International Medical University, University Putra Malaysia, Universiti Tunku Adbdul Rahman, Universiti Malaysia Sabah, National University of Malaysia; ***Mauritius:*** University of Mauritius; ***New Zealand:*** Lincoln University, University of Otago, ***Palestine:*** An-Najah National University; ***Philippines:*** University of the Philippines, Mindanao Polytechnic State College, Bicol University; ***Singapore:*** National University of Singapore, Nanyang Technological University; ***Sri Lanka:*** University of Colombo; ***Taiwan:*** Taiwan National University, Mingdao University; ***Thailand:*** Bangkok School of Management, Kasetsart University, Rajamangala University of Technology, Chulalongkorn University, Chiang Mai University, Silpakorn University, Ubon Ratchathani University; ***Uzbekistan:*** University of Agriculture; ***Vietnam:*** Nong Lam University
Research Institutions	***Australia:*** CSIRO, Australian Center for Plant Functional Genomics, ARC Centre of Integrative Legume Research; ***Bangladesh:*** Bangladesh Rice Research Institute; ***China:*** China Academy of Agricultural Sciences, China National Rice Research Institute, Biotechnology Research Institute, China National Center for Biotechnology Development, Institute of Crop Sciences, Shanghai Academy of Agricultural Sciences; ***India:*** Directorate of Rice Research, Institute of Genomics and Integrative Biology, Indian Council for Agricultural Research, National Dairy Research Institute, National Research Centre for Groundnut, Central Tuber Crops Research Institute, Central Tuber Crops Research Institute, National Bureau of Plant Genetic Resources, National Research Center on Plant Biotechnology, Central Rainfed Upland Rice Research Station, Central Institute of Medicinal and Aromatic Plants, India Institute of Hygiene and Public Health, Centre for Cellular and Molecular Biology, National Bureau of Plant Genetic Resources, Birla Institute of Scientific Research, Nimbkar Agricultural Research Institute, National Dairy Research Institute, National Botanical Research Institute; ***Indonesia:*** Indonesian Biotechnology Research Institute for Estate Crops, Indonesian Center for Agriculture Biotech and Genetic Resources Research and Development; ***Iran:*** Iranian Plant Protection Research Institute, Institute for Green Rural Advancement, Rice Research Institute of Iran, National Institute for Genetic Engineering and Biotechnology, Cotton Research Institute; ***Israel:*** The Volcani Center, Weisman Institute of Science, J. Blaustein Institute for Desert Research; ***Japan:*** National Institute of Health Sciences, National Institute of

	Agrobiological Science, Forestry and Forest Products Research Institute, National Institute for AgroEnvironmental Sciences, Kihara Insitute for Biological Research; ***South Korea:*** National Horticultural Research Institute, National Institute of Crop Science, LCC Life Environment Institute, National Institute of Agricultural Biotechnology; ***Malaysia:*** Malaysian Agricultural Research and Development Institute, Agriculture Research Centre (Sarawak), Forest Research Institute Malaysia, Guthrie Biotech Laboratory; ***Mauritius:*** Mauritius Sugar Industry Research Institute; ***Pakistan:*** Institute of Agri Biotechnology and Genetic Resources, Pakistan Agricultural Research Council; ***Philippines:*** Ecosystems Research and Development Bureau, Philippine Council for Agriculture, Forestry and Natural Resources Research and Development, Philippine Rice Research Institute, Fiber Industry Development Authority; ***Sri Lanka:*** Plant Genetic Resources Center, Tea Research Institute of Sri Lanka, CIMMYT, Coconut Research Institute; ***Taiwan:*** Taiwan Institute of Economic Research, National Science and Technology Program on Agricultural Biotechnology, Taiwan Agricultural Chemicals and Toxic Substances Research Institute, The World Vegetable Center, Institute of Molecular Biology, Academia Sinica; ***Thailand:*** Thailand Development Research Institute, Chum-Phae Rice Research Institute, Field Crops Research Institute; ***Vietnam:*** Institute of Agricultural Science for Southern Vietnam, Institute of Biotechnology, Institute of Agricultural Genetics
Private Companies	***Australia:*** Florigene, Innovation Dynamics Pty, Ltd, SGA Solutions Pty., Ltd., Farmacule Bioindustries Pty., Ltd., Kraft Foods, BSES Ltd., Monsanto Australia, Innovation Dynamics, HortResearch Pty Ltd.; ***China:*** Novozymes China, Dupont China Holding Co. Ltd., China National Seed Group Corp.; ***India:*** Syngenta, Bayer Crop Science, Ayurvet Limited, Bioseed Research India Pvt., Pandit NRI Agritech Private Ltd., Maple Biosys Ltd., Nunhems India Pvt. Ltd., Maharashtra Hybrid Seeds Co., Krishidhan Research Foundation, Pvt. Ltd., Atash Seeds Pvt Ltd., Reliance Life Sciences, Dow Agrosciences, Pioneer Overseas Corporation, Krishidhan Seed Ltd, Mahyco, Bioseed Research India Pvt., Ltd., Global AgriSystem Private Ltd., Sudarhan Chemical Industries Ltd., Namdhari Seeds Pvt. Ltd., Nestlé India, Cargill India, Vibha Agrotech, Clause Tezier India Pvt. Ltd., Metahelix Life Sciences, Proagro Seed, Seminis Vegetable Seeds (India) Ltd., Jain Irrigation Systems, Reliance Life Sciences; ***Indonesia:*** Barcon PT, PT Nestle Indonesia, Syngenta, Monsanto; ***Israel:*** Zeraim Gedera; ***Japan:*** Suntory Ltd., Plant Genome Center Co., Cosmo Public Relations Corp., Kirin Brewery; ***Malaysia:*** Ainaacom System Sdn (Agro Bio), Publicis Malaysia, Celadon Capital Sdn BHd, Chemtron Biotechnology Sdn Bhd., Cryocord Sdn., Bhd; ***New Zealand:*** PGG Wrightson Seeds, Crop and Food Research Institute, Horizon2, New Zealand Agriseed Ltd., Genetic Technologies, Ensis, Dunbier and Associates Ltd.; ***Pakistan:*** Pioneer Pakistan Seed Ltd., Auriga Seed Corp.; ***Philippines:*** Pioneer Hi-Bred, Development Alternatives, Inc., Lapanday Group, Syngenta Philippines, Coca-Cola Export Corporation, Dole Philippines, Petbowe Chemtrade Corp., Cargill Philippines, Christman and Cua Associates, San Miguel Corp., Monsanto; Singapore: Asia BioBusiness Pte. Ltd., Monsanto, Bayer; ***Thailand:*** Monsanto, Syngenta; ***Vietnam:*** Vietnam Cotton Co.

Government	***Australia:*** Department of Water, Land and Biodiversity Conservation, Plant Biosecurity Australia, Department of Primary Industries and Fisheries, Department of Environment, Australian Government; ***Cambodia:*** Ministry of Environment; ***China:*** State Tobacco Monopoly Administration; ***India:*** Indian Council for Agricultural Research, Defense Research and Development Organization, National Academy of Customs Excise and Narcotics; ***Indonesia:*** Ministry of Agriculture; ***Israel:*** Ministry of Agriculture; ***Philippines:*** Bureau of Internal Revenue, City Government of Davao, Department of Agriculture, Bureau of Animal Industry, Department of Agriculture, Philippine Coconut Authority; ***Taiwan:*** Department of Health; ***Thailand:*** Department of Agriculture, Office of the National Economic and Social Development Board; ***Vietnam:*** Ministry of Agriculture and Rural Development
International Private and Non-for-Profit Organizations	***Afghanistan:*** USAID; ***Australia:*** Melbourne Biotechnology, Plant Health Australia; ***Bangladesh:*** The Swallows, Grameen Shakti, International Rice Research Institute; ***Fiji:*** Secretariat of the Pacific Community; ***India:*** ICRISAT, Center for Science and Technology of the Non-aligned and Other Developing Countries, International Center for Genetic Engineering and Biotechnology, Confederation of Kisan Organizations, CropLife Asia, M.S. Swaminathan Research Foundation, US Grains Council, Swiss Agency for Development and Cooperation, International Life Sciences Institute; ***Indonesia:*** Asian Farmers Regional Network (ASFARNET), Agency for the Assessment and Application of Technology; ***Japan:*** Japan Bioindustry Association; ***Myanmar:*** United Nations Office on Drugs and Crime; ***Nepal:*** International Centre for Integrated Mountain Development; ***New Zealand:*** NZBio; ***Philippines:*** International Rice Research Institute, Biotechnology Coalition of the Philippines, UN Food and Agriculture Organization; ***Thailand:*** UN Food and Agriculture Organization, CropLife Asia
Media/Publications	***Bangladesh:*** The Daily Jugantor; ***India:*** The Financial Express; ***Philippines:*** Business Mirror
LATIN AMERICA	
Universities	***Argentina:*** Universidad Nacional de Rosario, University of Buenos Aires; ***Brazil:*** Universidad Federal do Rio de Janeiro, University of Brasilia, Sao Paulo University; ***Chile:*** University of Talca, Catholic University of Valparaiso, Universidad de Concepción; ***Colombia:*** Pontificia Universidad Javeriana; ***Cuba:*** University of Havana; ***Ecuador:*** Pontifical Catholic University of Ecuador; ***Mexico:*** Universidad Americana de Acapulco, Faculdade de Estudios Profesionales Iztacala Unam, Universidad Nacional Autonoma de Mexico, Universidad Autonoma Chapingo, University of Guadalajara; ***Nicaragua:*** National Agrarian University; ***Peru:*** Universidad Nacional Agraria La Molina, University of Trujillo; ***Venezuela:*** Universidad de Oriente
Research Institutions	***Argentina:*** Instituto de Biotechnologia, Centro de Estudios Fotosinteticos y Bioquimicos; ***Brazil:*** EMBRAPA Environment, Brazilian Agricultural Research Corporation, Instituto Agronomico do Parana (IAPAR), Escola Superior de Agricultura Luiz de Quieroz (ESALQ/USP); ***Chile:*** Center for Advanced Studies in Arid Zones; ***Costa Rica:*** Centro Agronomico Tropical de Investigación Ensenanza, Tropical Agriculture Research and Development; ***Cuba:*** Instituto de Biotechnologia de las Plantas; ***Dominican Republic:*** Instituto Dominicano de Investigaciones

	Agropecuarias y Forestales; ***Guatemala:*** Guatemalan Sugarcane Research and Training Centre ***Mexico:*** Instituto Nacional de Investigaciones Forestales Agricolas y Pecuarias (INIFAP), Centro de Investigacion y de Estudios Avanzados (CINVESTAV), ***Uruguay:*** Instituto Nacional de Investigacion Agropecuaria
Private Companies	***Argentina:*** McCain Argentina, Relmo S.A., Bayer CropScience, Nidera SA; ***Brazil:*** Paraiso Farming Ltd., DuPont, Syngenta, BASF; ***Chile:*** Semillas Seminis Sudamerica S.A.; ***Dominican Republic:*** Bayer CropScience; ***Mexico:*** Monsanto; ***Panama:*** Phytoclones; ***Peru:*** Agro Consult Internacional ***Uruguay:*** Calagua
Government	***Brazil:*** National Institute for Industrial Property, Civil House of the Republic Presidency; ***Costa Rica:*** Ministry of Agriculture and Livestock; ***Dominican Republic:*** Dominica Export Import Agency; ***Panama:*** Consejo Nacional de Ciencia y Technologia, Ministry of Agricultura
International Private and Non-for-Profit Organizations	***Barbados:*** Inter-American Institute for Cooperation on Agriculture, ***Bolivia:*** Foundation for Andean Crops, Bolivian Association on the Political Economy of Globalization, Promocion e Investigacion de Productos Andiros (PROINPA) Foundation; ***Colombia:*** HarvestPlus, Bill and Melinda Gates Foundation, International Center for Tropical Agriculture; ***Guatemala:*** The Nature Conservancy; ***Honduras:*** Inter-American Institute for Cooperation on Agriculture (IICA), USAID; ***Mexico:*** CGIAR Generation Challenge Program, Agro Bio Mexico, CIMMYT; ***Paraguay:*** Iniciativa para la Investigacion y Transferencia de Technologia Agraria Sostenible, INTTAS ***Peru:*** International Potato Center; ***Trinidad and Tobago:*** Caribbean Agricultural Research and Development Institute
Media/Publications	***Trinidad and Tobago:*** CAB International
NORTH AMERICA	
Universities	***Canada:*** University of British Columbia, University of Victoria, University of Guelph, University of Ottawa, University of Saskatchewan, Nova Scotia Agricultural College, McMaster University; ***United States:*** University of California, West Virginia University, Rockefeller University, Tufts University, University of Kentucky, Cornell University, University of Delaware, Montana State University, University of Minnesota, Southern Connecticut State University, University of New Hampshire, California State University, University of Idaho, University of Nevada, South Dakota State University, Case Western Reserve University, Kansas State University, University of Georgia, University of Illinois, Miami University, Michigan State University, Auburn University, Colorado State University, University of Illinois, Louisiana State University, North Carolina State University, University of South Carolina, University of Wisconsin, North Dakota State University, City College of New York, University of Nebraska, Purdue University, Dartmouth College, Brigham Young University, University of Georgia, Whitman College, Oregon State University, The City University of New York, Stanford University, University of Wisconsin, Mississippi State University, Indiana University, University of Connecticut, University of New Hampshire, Ohio State University, Iowa State University, Auburn University,

	Salisbury University, Pittsburg State University, West Texas A&M University, University of Oklahoma, University of Hawaii, University of Wyoming, University of Nebraska, Texas A&M University, Rutgers University, Michigan State University, Colorado State University, University of Florida, University of Tennessee, University of Arkansas, University of Houston, Oklahoma State University, State University of New York College of Environmental Science and Forestry, University of Maryland, University of Kentucky, Louisiana State University, Pittsburg State University, University of Wyoming, New York State University, Virginia Tech
Research Institutions	***Canada:*** National Research Council Industrial Research Assistance Program, Institute for Aerospace Research, Plant Biotechnology Institute, National Research Council Canada; ***USA:*** Donald Danforth Plant Science Center, the Boyce Thompson Institute for Plant Research, National Renewable Energy Laboratory
Private Companies	***Canada:*** Bayer CropScience, Conscience Biotechnologique Inc., Solanum Genomics Int. Inc., BioAtlantech, Ray Mowling and Associates; ***USA:*** Hubbard Feeds, Inc., Nitrate Elimination Co., Pioneer/DuPont, Pennington Seed Inc., Syngenta Seeds, Delfino Nutrition and Management, Inc., Novus International, Novozymes Biologicals, Inc., Kitchen Culture Kits, Inc., Monsanto, Seminis Vegetable Seeds, Garrett Ag. Farms, Grove Scientific and Engineering Company, Vita Plus, Syngenta Associates, BioCognito, Tyson Foods, FibroGen, Investigen, Crop Technology Consulting, Eversole Associates, Oxford Farms, Americot, Inc., Stonebridge International, BioAbility, H.E. Butt Grocery Company, Acala Partners, Inc., Battelle, ADM Alliance Nutrition, Inc., Bayer Corp., Eurofins-GeneScan, Veserat Consulting, Smithfield Foods, Seminis, Crop Technology Consulting
Government	***Canada:*** Ministry of Forest and Range, New Brunswick Government, Department of Agriculture and Aquaculture, National Research Council of Canada, Environment Canada, Government of Canada, Canadian Grain Commission, Agriculture and Agrifood Canada, Canadian Forest Service, New Brunswick Agriculture, Fisheries and Aquaculture, Justice Department, Canadian Food Inspection Agency, Alberta Agriculture, ***USA:*** Department of Agriculture, National Institute of General Medicine Sciences, Environmental Protection Agency, US Patents and Trademark Office, Indiana Department of Natural Resources, National Academies Board on Agriculture and Natural Resources, Department of State, US National Academy of Sciences, National Science Foundation, Maine Forest Service
International Private and Non-for-Profit Organizations	***Canada:*** Secretariat of the Convention on Biological Diversity; ***USA:*** International Food Policy Research Institute, World Bank, CropLife Africa, Bill and Melinda Gates Foundation, Samuel Roberts Noble Foundation, Rockefeller Foundation, USAID, International Foundation for the Conservation of Natural Resources, USAID Africa, The Nature Conservatory
Media/Publications	***Canada:*** AgBios; ***USA:*** Kiplinger Agriculture, Seed Today, Nutrition Edge Communications

EUROPE	
Universities	***Austria:*** University of Natural Resources and Applied Life Sciences, ***Belgium:*** Ghent University, Virje Universiteit Brussel, Katholieke Universiteit Leuven, Gembloux Agricultural University, Universiteit Antwerpen, University of Liege; ***Czech Republic:*** Charles University; ***Denmark:*** University of Aarhus, University of Copenhagen, University of Southern Denmark, Royal Veterinary and Agricultural University; ***Finland:*** University of Joensuu, University of Helsinki; ***France:*** Universite Louis Pasteur, University of Dijon, Universite Pierre Mendes, Blaise Pascal University; ***Germany:*** University of Applied Sciences at Eberswalde, Justus Liebig University, University of Hannover, University of Jena, University of Rostock; ***Greece:*** Aristotle University; ***Hungary:*** Szent Istvan University; ***Ireland:*** UCD University, Dublin University; ***Italy:*** University of Milan, Marche Polytechnic University, University of Tuscia, University of Pisa, Universita Degli Studi di Milano, University of Parma, University of Rome, University of Perugia, Universita Cattolica del Sacro Cuore, University of Bari, University of Naples, University of Florence, University of Bologna, University of Torino; ***Latvia:*** Latvia University of Agriculture; ***Netherlands:*** University of Amsterdam, Leiden University, Wageningen University, Ultrecht University, University of Technology (Delft); ***Norway:*** University of Stavanger; ***Portugal:*** University of Lisbon; ***Slovakia:*** Slovak Agricultural University, ***Spain:*** Technological University of Catalonia, University of Barcelona, University of Cordoba, University of Valencia, University of Lleida, Universidad Politecnica de Madrid; ***Switzerland:*** Swedish University of Agricultural Sciences, University of Basel, University of Zurich; ***United Kingdom:*** University of Greenwich, University of Oxford, University of Reading, University of Sheffield, University of Warwick, Newscastle University, University of York, University of Glamorgan, University of Wolverhampton, King's College, University of Southampton, University of Leeds, University of Wales, University of London, University of Nottingham, Lancaster University, Queen's University, University of Exeter, University of Dundee
Research Institutions	***Austria:*** Federal Research Centre for Forests, Austrian Research Centers GmbH; ***Belgium:*** Central Laboratory of General Ecology, ***Bulgaria:*** Agricultural Experiment Station, Central Laboratory of General Ecology; ***Denmark:*** Danish Plant Directorate, Danish Institute for Food Research, ***Finland:*** VTT Technical Research of Finland; ***France:*** CIRAD, National Institute for Agronomic Research; ***Germany:*** Max Planck Institute for Plant Breeding Research, GSF, Julius Kuhn-Institut, AlPlanta Institute for Plant Research, Federal Biological Research Centre for Agriculture and Forestry, Leibniz Institute of Plant Biochemistry; ***Greece:*** National Hellenic Research Foundation, ***Hungary:*** National Institute for Food Safety and Nutrition, Biomi Ltd., Agricultural Biotechnology Center, ***Ireland:*** Marine Institute, ***Italy:*** Institute of Biology and Agricultural Biotechnology, Adriano Buzzati Traverso Consiglio Nazionale delle Ricerche, Institute of Biology and Agricultural Biotechnology, Research Institute for Vegetables Crops, Ordine Nazionale dei Biologi, Istituto di Virologia Vegetale, ***Poland:*** Plant Breeding Institute, ***Portugal:*** Instituto de

	Educacion Basica el Tenam (IBET/ITQB); ***Romania:*** Agricultural Research and Development Station Turda; ***Russia:*** Centre Bioengineering of Russian Academy of Sciences, Institute of Nutrition; ***Serbia:*** Institute of Molecular Genetics and Genetic Engineering, Institute of Field and Vegetable Crops; ***Slovakia:*** Institute of Molecular Biology of the Slovak Academy of Sciences, Institute of Botany; ***Spain:*** International Reciprocal Trade Association (IRTA), Insituto Nacional de Investigaciones Agrarias y Alimentarias; ***Sweden:*** Swedish Institute for Food and Agricultural Economics; ***Switzerland:*** Agroscope Reckenholdz Tanikon Research Station; ***Ukraine:*** Institute of Food Biotechnology and Genomics; ***UK:*** Scottish Crop Research Institute, Agri-Food and Biosciences Institute, Rothamsted Research, Broom's Barn Research Station
Private Companies	***Belgium:*** Pioneer Hi-Bred International, Inc.; ***Czech Republic:*** Selgen, Monsanto; ***Denmark:*** Aresa AS; ***France:*** Geves, Limagrain, Bayer CropScience, Biogemma, Syngenta, Monsanto, Biologos, Phylum, Florimond Desprez, Sepant, ***Germany:*** RLP AgroScience, Planta GmbH, BASF, Pioneer Hi-Bred International, TransGen, McDonald's QA Europe, Saaten Union Resistenzlabor, Munich Re, ***Greece:*** Biomi Ltd.; ***Italy:*** Tempestini Group, Oxon Italia; ***Netherlands:*** Keygene N.V., Plant Research International, Europoint B.V., SVS Holland B.V., Plantum NL, Schenkelaars Biotechnology Consultancy, Barenbrug Holding; ***Norway:*** Graminor AS; Romania: Syngenta; ***Russia:*** Monsanto Europe; ***Spain:*** Global Bionanomics; ***Sweden:*** AK Consulting BioAgri AB; ***Switzerland:*** Syngenta, InterNutrition, CPW-Nestle; ***UK:*** Oxitec, Ltd., Advanced Technologies Cambridge, Research Information Limited, Toxicological Consulting Ltd., Withers and Rogers LLP, Research Information Ltd., McCain Foods Ltd., Milmo Associates, Monsanto
Government	***Austria:*** Federal Research Centre for Forests, BFW Department of Genetic; ***Belarus:*** National Coordination Biosafety Centre of the Republic of Belarus; ***Belgium:*** Department of Agriculture and Fisheries; ***Denmark:*** Danish Veterinary and Food Administration, Danish Plant Directorate; ***Finland:*** Ministry of Social Affairs and Health, Ministry of Agriculture; ***France:*** French Department of Agriculture, Museum d'histoire Naturelle, CNRS; ***Germany:*** Federal Office for Consumer Protection and Food Safety, Federal Ministry of Food, Landesumweltamt Nordnhein-Westfalen, Bavarian State Ministry for Agriculture and Forestry; ***Italy:*** Italian National Research Council, Consiglio Nazionale delle Ricerche; ***Lithuania:*** Ministry of Agriculture; ***Netherlands:*** Dutch Ministry of Agriculture; ***Slovakia:*** Ministry of Environment; ***Slovenia:*** Ministry of the Environment and Spatial Planning, MESP; ***Sweden:*** Swedish Gene Technology Advisory Board; ***UK:*** Natural England
International Private and Non-for-Profit Organizations	***Albania:*** USAID; ***Austria:*** Dialog Gentechnik; ***Belgium:*** International Center for Soil Fertility and Agriculture Development (IFDC); ***France:*** Bioversity International, Euro Information Centre, Organization for Economic Cooperation and Development, International Fertilizer Industry Association; ***Italy:*** International Center for Genetic Engineering and Biotechnology (ICGEB), Food and Agriculture Organization, Societa Produttori Sementi, CGIAR; ***Netherlands:*** International Food Policy Research Institute, Niaba, Secretariat Product Boards Working Group Biotechnology, Royal

	NL Academy; ***Poland:*** Polish Academy of Sciences; ***Spain:*** Consejo Superior de Investigaciones Cientificas (CSIC); ***Sweden:*** International Union for Conservation of Nature (IUCN), United Nations Environment Program; ***Switzerland:*** Syngenta Foundation for Sustainable Agriculture; ***UK:*** FARM-Africa
Media/Publications	***Denmark:*** Engineering Weekly; ***Germany:*** Springer Verlag; ***Italy:*** National Italian Television and Radio, Agrimpresa Magazine, Orsa Maggiore, Edizioni Elsevier Masson, L'Informatore Agrario; ***UK:*** Green Ink Publishing Services Ltd, SciDev Net, Commodities Now Magazine, New Scientist

University says that the CBU helps him identify people involved in crop biotechnology.

The CBU is also used as an information source for analysis and decision making by administrators and policy makers. "I need to know the trends in the field," explains Patrick Ayiecho Olweny of the Kenya National Assembly. "As a policy maker I have a major say in decisions for adoption of modern technology in our country." Alan Brown, scientist of the National Research Council for Industrial Research Assistance Program in Canada says "that the newsletter provides up to date advisory on technical issues for firms in Canada." Mary Taylor of Fiji's Secretariat of the Pacific Community has the responsibility of circulating agbiotech information to the Secretariat's biotechnology working group. And for this task, she uses the CBU. "I was amazed at the amount of information I had on biotech compared with other participants," recalls John Ugolo of the United Nations Environment Program in Kenya when he attended an international workshop. "This is because of the consistency in which I received the newsletter and the usefulness of the information."

Marie Nyman, manager of the Swedish Gene Technology Advisory Board notes that the CBU helps her write a yearly report as she has to follow research and development trends regarding gene technology. Audia Barnet from Jamaica's Scientific Research Council says that as a scientist with a strong interest in biotechnology and as an administrator of a research and development institution she needs information on current developments on biotechnology. The CBU enables her to satisfy this need. Takeshi Uchudia, administrator of the National Institute of Agrobiological Science in Japan says he is able to collect worldwide information that enables him to negotiate and communicate with the public and opposition groups. As an administrator at the Ministry of Agriculture, Ivan Branzovsky of the Czech Republic's Ministry of Agriculture explains that the "news from around the world is very important for making objective reports, statements, advices for government and parliament." Farmer leader Chebet Maikut of the Eastern Africa Farmers Federation and Anil Kumar Epur of the Confederation of Kisan Organizations in India use information from the CBU for dissemination to stakeholders.

Media practitioners from the tri media are also subscribers to the CBU. Lyn Resurrecion, science writer of the Business Mirror, a national daily in the Philippines, says that she "uses its relevant stories" for articles. Maja Tumpej, a communication person from Dialog Gentechnik in Austria, explains that she needs to be up to date about biotechnology because she writes articles, manages projects, organizes events/discussions/lectures, and produces information materials about different biotechnology topics. Argaw Ashne Sahle of the Ethiopia Environmental Journalists Association requires latest information in his career and the

CBU provides access to institutions engaged in biotechnology.

A media practitioner from the Kenya News Agency, Nancy Juddy Njambi Mathu comments that "crop biotechnology is a relatively new concept to her and that CBU gives a journalistic angle where I can get well researched articles and materials for publication in the print media" while colleague Ann Mikia uses the articles in her radio program to complement information obtained from the field. Wisdom Changadeya of the Biotechnology Ecology Research and Outreach Consortium in Malawi adds that CBU articles are used in their own newsletter *Biotechnology Update* while Nazimi Acikgoz of Ege University Turkey cites the CBU in their monthly bilingual online agricultural biotechnology newsletter. Girolamo Mangano of the National Italian Television and Radio writes and broadcasts news picked up from the CBU. Nigerian journalist Olukayode Oyeleye says that by being abreast of new developments, he can have "better insights on various aspects of biotech so as to put the issues in clearer and better perspectives for the audience."

IBERCIB-Spain's Center for Biotechnology Information

Aside from the ISAAA website, several BICs have their own websites. To illustrate the reach of these country-based websites, the case of Ibercib is discussed. Ibercib (El Centro de Información en Innovación Biotecnológica, www.ibercib.es) was born from the collaboration between ISAAA and the social and cultural division of the Spanish savings bank Ibercaja. Ibercib aims to disseminate the latest information on agricultural biotechnology and biofuels and encourage informed discussion among public interest groups, the biotechnology industry, policy makers and other stakeholders. Ibercib publishes Spanish translations of educational materials provided by the Global Knowledge Center on Crop Biotechnology. These

Figure 10. Homepage of the Ibercib website.

include the annual global status update of GM crops, the Crop Biotech Update and its Biofuels Supplement.

The website attracts some 27,000 annual unique visitors viewing 65,219 pages. The average visitors Ibercib receives has more than tripled since it officially started in October 2007. From its average annual visitors of 35,000, around 65 percent are from Spain (Figure 11). The site also attracts visitors from other parts of Europe, the U.S. and most importantly from countries in Latin America particularly Mexico (4,700 unique visitors per month), Colombia (2,630), Peru (2,200), Argentina (2,000) and Chile (1,200). This large number of website visitors makes up for the relatively low hits the ISAAA website receives from Spanish-speaking South American countries. In Spain, most website visitors are from Madrid, followed by Zaragoza, Barcelona, Sevilla, Valencia and Pamplona (Figure 12).

The Spanish translation of the Crop Biotech Update and the Biofuels Supplement is being distributed to a list of some 2,500 subscriptions. This does not include subscribers of other listservs that pick up news from the Update. Most subscribers are from universities, research institutions and private companies. There has also been an increase in the number of Crop Biotech and Biofuels RSS subscribers.

In addition to boasting a new look, the Ibercib website has undergone recent changes to improve its functionality and usability, making the site even more user friendly and easier to navigate. Ibercib now allows its users to search for articles using keywords. These changes, in addition to publicity campaigns both via the internet and in print, are expected to significantly increase Ibercib's website traffic and newsletter subscribers.

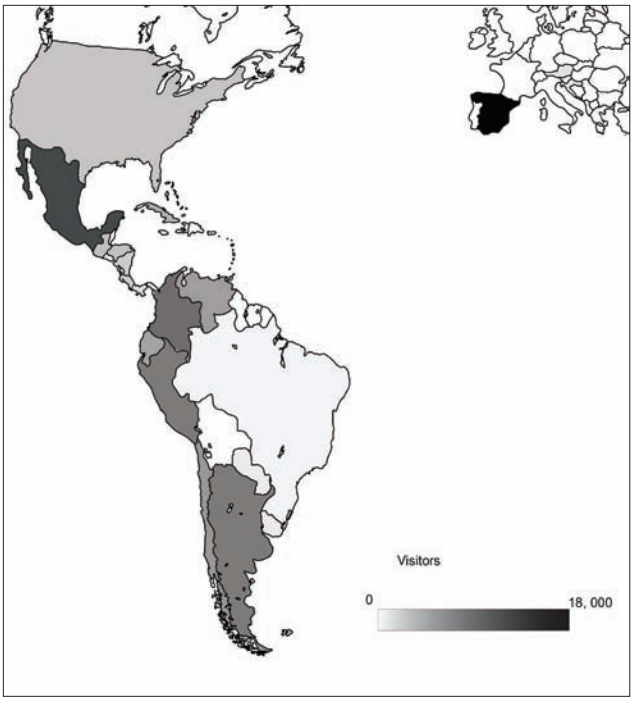


Figure 11. Average annual Ibercib website visitors.

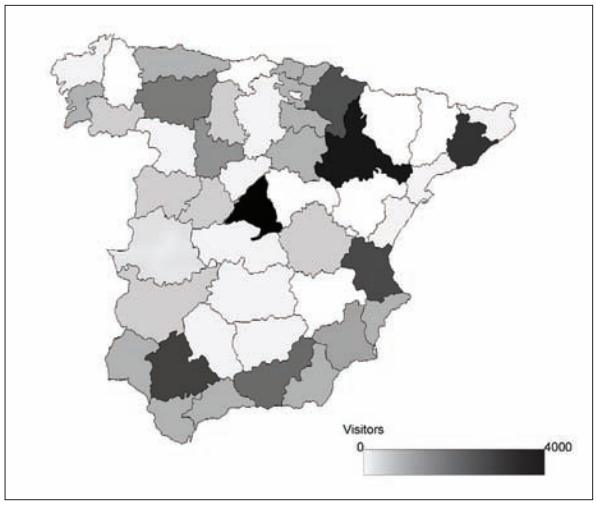


Figure 12. Average annual website visitors from Spain.

In September 2008, Ibercib conducted an e-survey to gather feedback on its e-newsletters. The survey was designed to gauge the newsletters' effectiveness, the relevance of its content as well as to determine the informational need of the subscribers. A questionnaire was sent by email and the subscribers were asked to rate the content, layout, timing and usefulness of the newsletter. Subscribers who responded to the survey were mainly from Spain, Mexico, Argentina, Peru, Colombia and Venezuela. The respondents' designation is shown in Figure 13. Thirty percent were administrators, particularly from private companies, 24 percent were from the government, and 19 percent were scientists.

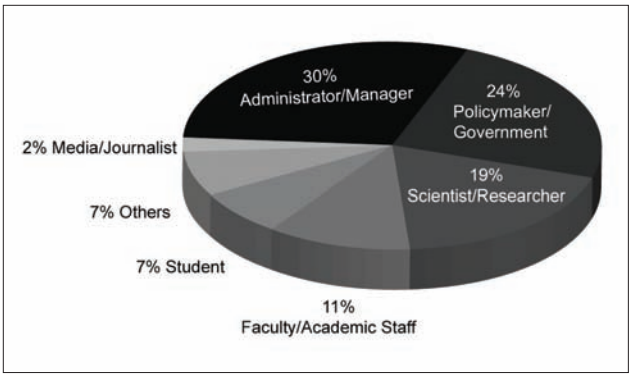


Figure 13. Designation of the Ibercib survey respondents.

The responses were generally favorable, with more than 84 percent of the subscribers rating the e-newsletters good or excellent. When asked for suggestions for improvement, responses included: wider coverage of agbiotech topics, more frequent updates, improvement in layout, more details on research news, and links to open-access research papers. Majority of the respondents found the research articles particularly useful. ❑

REFERENCES

Global Knowledge Center on Crop Biotechnology. 2006-2008. Unpublished summary tables of subscribers' profile and feedback. International Service for the Acquisition of Agri-biotech Applications (ISAAA) Southeast Asia Office, Los Baños, Laguna, Philippines.

Ibercib Quarterly Reports. March 2009. Zaragosa, Spain.

Hines, Pamela. 2003. The Dynamics of Scientific Controversies. AgbioForum. Vol. 4, No. 3 and 4. Retrieved from http://www.agbioforum.org/v4n34/v4n34106-hines.htm (Accessed September 10, 2008)

Internet World Stats. 2008. Internet Usage Statistics: the Internet Big Picture. http://www.internetworldstats.com/ (Accessed September 10, 2008).

Navarro, Mariechel with Contributions from the Biotechnology Information Centers. Bridging the Knowledge Divide: Experiences in Communicating Crop Biotechnology. International Service for the Acquisition of Agri-biotech Applications (ISAAA) Southeast Asia, Los Baños, Laguna, Philippines. 65 pp.

Riggs, Michael. 2003. Agricultural Information Management: Global and Community Development. Quarterly Bulletin. International Association of Agricultural Information Specialists. Vol. XLVIII, No. 1 and 2. Allen Press, Lawrence, Kansas. Pp. 32-35.

Salazar, Angel, Ray Hackney, and Jeremy Howells. 2003. The Strategic Impact of Internet Technology in Biotechnology and Pharmaceutical Firms: Insights from a Knowledge Management Perspective. Information Technology and Management, Vol. 4, Issue 2-3. Springer Netherlands. http://www.springerlink.com/content/q10536rh61g2j62k (Accessed September 10, 2008).

Acknowledgments

Communicating Crop Biotechnology: Stories from Stakeholders comes at the heels of *Bridging the Knowledge Divide: Experiences in Communicating Crop Biotechnology,* a science communication handbook published in 2008 by the International Service for the Acquisition of Agri-biotech Applications (ISAAA). It was a feat to put together 49 stories from 19 authors and 14 countries.

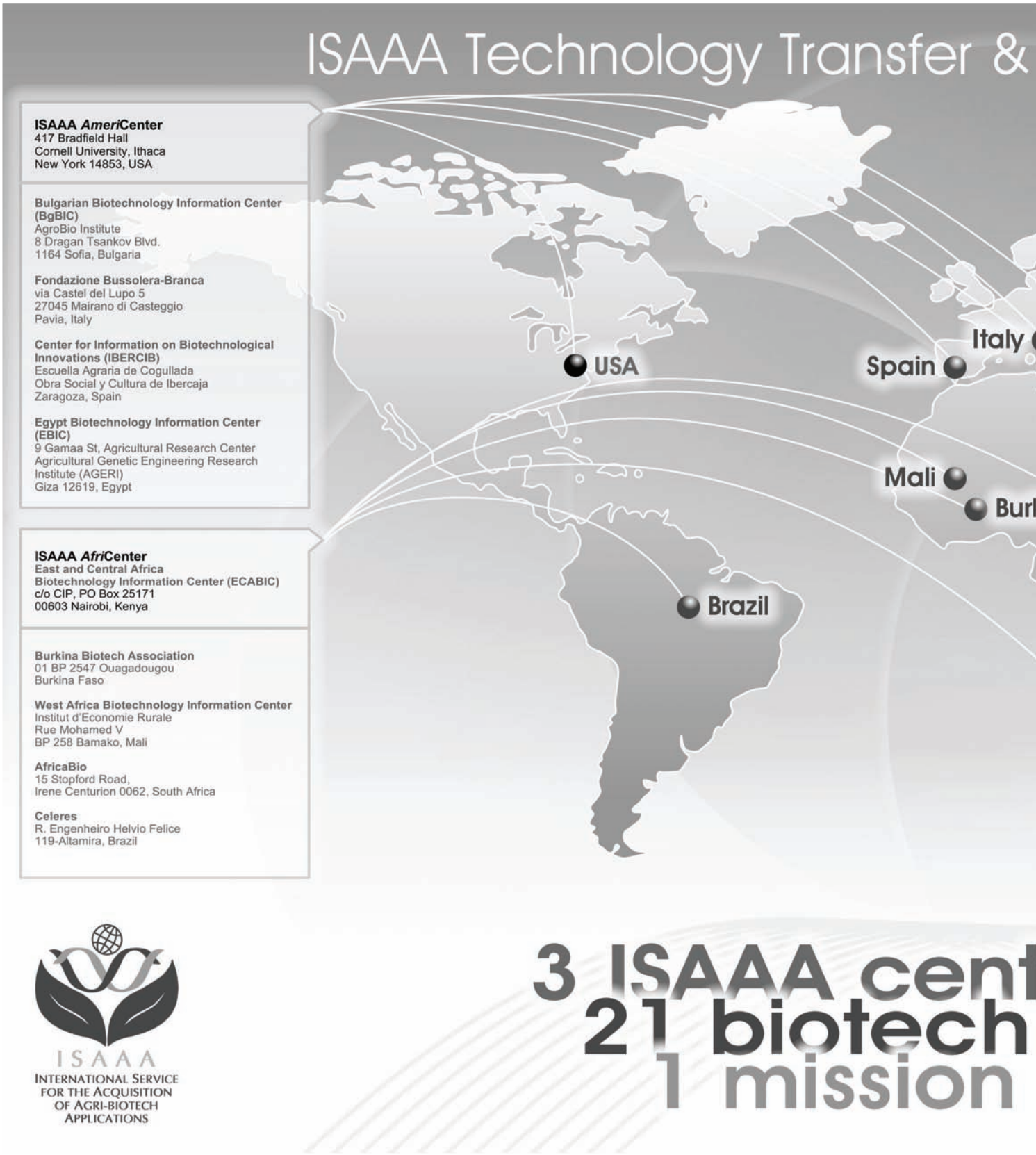
Many people helped make this publication possible. Foremost are the 19 authors from ISAAA and the Biotechnology Information Centers who spent time and effort in contacting and interviewing people, writing and rewriting the articles, and understanding the demands of the editor until the articles were just right. Writing stories was not an easy task (it is a story by itself) but the outcome defies expectations. In addition, BIC staff contributed pictures, followed-up respondent reviews, and searched for relevant information and materials. It was a perfect example of team effort.

External reviewer Dr. Felix Librero, former Chancellor of the University of the Philippines (UP) Open University, UP Faculty Regent, and Professor of Development Communication, gave incisive comments and inputs to improve the publication. ISAAA colleagues, Drs. Rhodora Aldemita and Von Mark Cruz, gave their time to review and suggest ways to communicate ideas better. Dr. Rex Navarro, development communication colleague, helped visualize the science communication framework and its theoretical perspective. Dr. Randy Hautea, ISAAA Global Coordinator, fully supported this project from conceptualization to the final product.

The triad at the Global Knowledge Center on Crop Biotechnology provided significant support – Clement Dionglay for the innovative layout and openness to the idea of frequent changes in design; Noel Amano, Jr. for various forms of assistance from proofreading, preparing figures, validating information, to contributing articles; and Eric John Azucena for designing the appendices and initial science communication framework. It is always a joy to work with an excellent team. On-the-job trainees from the UP Los Baños College of Development Communication – Resa Badrina, Jennifer Yee, and Liezl Guerrero – proofread the manuscript and saw through some editorial lapses. Jesus Recuenco helped visualize and finalize the cover design.

The collective contribution of all to this project is much appreciated.

Appendix 1. Global Map of ISAAA Network



Knowledge Sharing Network

Bangladesh Biotechnology Information Center (BdBIC)
Department of Biotechnology
Bangladesh Agricultural University
Mymensingh 2202, Bangladesh

China Biotechnology Information Center
Chinese Society of Biotechnology
33 Beisihuan Xi Lu, Zhong Guan Cun
Beijing 100190, P R China

ISAAA South Asia Center
c/o ICRISAT, NASC Complex, DPS Marg,
Opp. Todapur Village, New Delhi 110012, India

Nippon Biotechnology Information Center
NPO Hokkaido Bioindustry Association (HOBIA)
c/o Hokkaido Collaboration Center
Kita-21, Nishi-12, Kita-ku, Sapporo
Japan 001-0021

Pakistan Biotechnology Information Center (PaBIC)
H.E.J. Research Institute of Chemistry,
Dr. Panjwani Center for Molecular Medicine and Drug Research
University of Karachi, Karachi, Pakistan 75270

Russian Biotechnology Information Center (RuBIC)
IACGEA, 60-letiya Oktyabrya 7-1
117312 Moscow, Russia

ISAAA *SEAsia*Center
c/o IRRI, DAPO BOX 7777,
Metro Manila, Philippines

Indonesian Biotechnology Information Centre (IndoBIC)
c/o SEAMEO-BIOTROP
Jalan Raya Tajur Km. 6
PO Box 116, Bogor, Indonesia

Malaysia Biotechnology Information Centre (MaBIC)
Monash University
2-5-40 Jalan Lagoon Selatan, Bandar Sunway
46150 Petaling Jaya, Selangor, Malaysia

SEARCA Biotechnology Information Center
SEAMEO Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA)
College, Los Baños, Laguna 4031, Philippines

Biotechnology Education & Information Center (BEIC)
Department of Plant Sciences
University of Colombo
P.O.Box 1490, Colombo 03, Sri Lanka

Biotechnology and Biosafety Information Centre (BBIC)
Deparment of Plant Pathology
National Center for Genetic Engineering and Biotechnology (BIOTEC)
Kasetsart University
Kamphaengsaen, Nakhon Pathom
73140 Thailand

Agbiotech Vietnam
House No 12B, Block 13B
Trung Yen 11 Street, Trung Yen New City,
Trung Hoa Precinct, Cau Giay District,
Hanoi, Vietnam

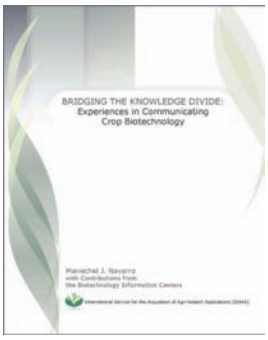
ters
info centers

ISAAA Briefs
Major papers reviewing current developments in international biotechnology, sustainable agriculture, and technology transfer.

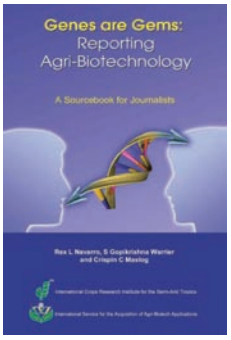
Crop Biotech Update
A weekly summary of world developments in agri-biotech for developing countries.

Also includes **Biofuels Supplement**, a bi-weekly summary on biofuels.

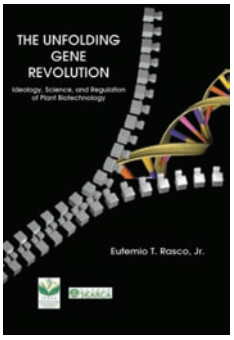
Pocket K
Pocket Ks are Pockets of Knowledge, packaged information on crop biotechnology products and related issues. (Available in 20 languages)



Bridging the Knowledge Divide: Experiences in Communicating Crop Biotechnology
This handbook is ISAAA's contribution to the field of science communication in general, and biotechnology communication in particular. It distills ISAAA's experiences in communicating crop biotechnology and theoretical perspectives of science communication experts. (Also available in French)



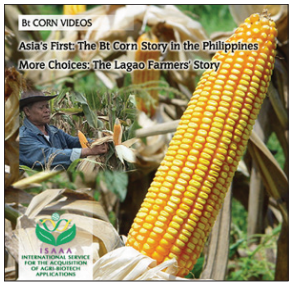
Genes are Gems: Reporting Agri-Biotechnology
"Genes are Gems" is a collection of knowledge and wisdom gained from media workshops organized by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and supported by ISAAA and the United Nations Educational, Scientific and Cultural Organization (UNESCO). (Also available in French)



The Unfolding Gene Revolution: Ideology, Science, and Regulation of Plant Biotechnology
The book unravels the development of plant biotechnology, specifically genetic engineering. It reviews the basic sciences relevant to biotechnology and the art and science of genetic engineering in a simple and non-technical way.

Trust in the Seed
This publication highlights the significance of the seed and new crop technologies. It captures the experiences of three key developments in India that sustained growth in agriculture, and contributed to increased food production and the alleviation of poverty and hunger.

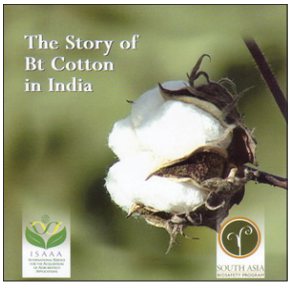
http://www.isaaa.org



Asia's First: The Bt Corn Story in the Philippines
A documentary that captures in 18 minutes the seven year process that it took for a genetically modified crop to be approved for commercialization in a developing country.

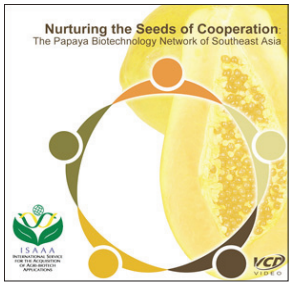
Also includes **More Choices: The Lagao Farmers' Story** (Also available in Filipino)

Fruits of Partnerships
A 20-minute video that documents the efforts of various stakeholders to introduce tissue culture banana in small farmers' farms in Kenya and Tanzania.



The Story of Bt Cotton in India
This video documents the process that it took for India's first genetically modified crop, Bt cotton to be approved for commercialization. (Available in 7 Indian languages and French)

Seeing is Believing - The Bt Cotton Trials in Burkina Faso (French)
A 19-minute video that documents the "Seeing is Believing" visit to the Burkina Faso Bt cotton field trials. The workshop was held in November 2006.



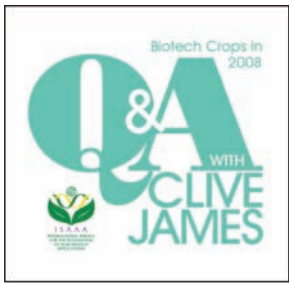
Nurturing the Seeds of Cooperation: The Papaya Network of Southeast Asia
A 17-minute video that documents the collaborative efforts of various stakeholders and partners to develop papaya ringspot virus (PRSV)-resistant papaya. The video highlights public-private partnerships and how countries in Southeast Asia have benefited through the network's capacity building efforts and information sharing initiatives.

Silver Fields of Gold: The Story of Bt Cotton in China
This video documents cotton cultivation in China and how Bt cotton eventually became the first biotech crop to be cultivated widely in the country. Various stakeholders who made this a reality - scientists, government officials, farmers and the private sector - share their experiences and thoughts about this technology. (Also available in Mandarin)

Restoring Lost Cover
The video documents efforts of the Tree Biotechnology Programme-Trust (TBP-Trust) to meet the growing demand for quality trees and tree products in the Eastern & Central Africa region through a South-to-South, public-private technology transfer of the proven clonal eucalyptus from South Africa.

ISAAA Corporate Video
The visions, strategies, programs, and projects of ISAAA, a not-for-profit organization, that delivers the benefits of new agricultural biotechnologies to the poor in developing countries, succinctly presented in an 18-minute video format.

Knowledge, Technology and Alleviation of Poverty
This video presents the major findings of the Global Status of Commercialized Biotech/GM Crops in 2008 and addresses the growing interest biotech crops have experienced in the past years, including substantial advances in Africa. (The abridged version is also available in Arabic, Bahasa Indonesia, Bangla, Chinese, French, Hindi, Japanese, Malay, Portuguese, Spanish, Russian, Swahili, Tagalog, Thai, Urdu, and Vietnamese).



Q & A with Clive James
This video provides an opportunity for the viewers to know more about ISAAA, its mission and who funds ISAAA and its global report on biotech crops.

Dr. Clive James also answers some of the most frequently asked questions on the role of biotech crops.

978-1-892456-47-8