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ABSP II

Agricultural Biotechnology Support Project II, South Asia

Supporting agricultural development through biotechnology

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About ABSPII

The developing world can benefit from advances in biotechnology, but much needs to be done to make bio-engineered products available in forms that formers can use. The Agricultural Biotechnology Support Project II (ABSPII) believes that farmers and consumers worldwide should have the opportunity to make informed choices about using bio-engineered products. ABSPII focuses on the safe and effective development and commercialization of bio-engineering crops as a complement to traditional and organic agricultural approaches in developing countries. The project helps boost food security, economic growth, nutrition and environmental quality in East and West Africa, Indonesia, India, Bangladesh and Philippines. Funded by the United States Agency for International Development (USAID) and led by Cornell University, ABSPII is a consortium of public and private sector institutions.

The consortium develops innovative, pragmatic solutions, building on the successes of the Agricultural Biotechnology Support Project (ABSP) that was led for a decade by Michigan State University.

In South Asia (India and Bangladesh), ABSPII supports development of expertise in the areas of research, policy development, licensing and outreach to help reduce poverty and hunger through agricultural biotechnology. Current initiatives relate to development of Tobacco Streak Virus Resistant (TSVR) groundnut, Late Blight Resistant (LBR) potato, Fruit and Shoot Borer Resistant (FSBR) eggplant, drought tolerant rice and salinity tolerant rice.

Message from K. Vijayaraghavan

Regional Co-ordinator, ABSPII, South Asia

Over the last three decades, the private sector made unprecedented investments in the development of transgenic crops resulting in several successful events in grains that are now globally adopted. The Public sector in the United States has focused on upstream and downstream research for transgenic crop development, creating innovative products within the public system. Public institutions, such as the PIPRA (Public Intellectual Property Resource for Agriculture), have also come into existence to pool technologies and otherwise facilitate technology transfer.

In Asia, the public sector lags behind in investing in research for biotechnology applications in crop yield improvement. Though Europe is still debating the extent of adoption of biotechnology solutions for crop yield improvement, there is significant investment by EU countries in new discoveries and innovations for biotechnology derived solutions. There are some ground breaking technologies currently available in European academic institutions.

ABSPII focuses on creating South-South partnerships with significant institutional linkages with researchers based in the USA and Europe for adopting technologies that could mitigate biotic and abiotic stress factors in tropical crops. Eggplant, potato, rice, groundnut, papaya, and banana are among the crops targeted for development with academic research institutions in India, Bangladesh, Philippines and Africa. Participating institutions have partnered among themselves and with the private sector to harness traits in publicly bred cultivars and in commercially developed hybrids. Now six years into the project, the consortium nears its ultimate goal, namely the public partners' capability to deliver transgenic seeds to resource-constrained farmers. Fruit and shoot borer resistant eggplant is in the advanced stage of field validation in India, Bangladesh and Philippines and the results have been reflecting exemplary quality and trait characteristics for the products. Late blight resistant potato is another important effort. ABSPII partners will soon field test the products in India and Bangladesh.

The public partners' efforts provide spin off opportunities such as the deployment of research students in product development efforts and building the public sector's capacity to deliver high quality seeds to farmers. ABSPII in South Asia will continue to work closely with the public and private partners to maximize these gains. breakthrough development effort. ABSPII partners will soon field test the products in India and Bangladesh.

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Feature

Access to Plant Genetic Resources: Issues and Concerns

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Plant Genetic Resource (PGR), the genetic material of plants which are of value for present and future generations of humankind, is often used as a synonym for germplasm. It can be defined as seed, plant or plant part that, because of its genetic attributes, is useful in crop breeding, research or conservation. The term "genetic resources" was first used in 1967 at the Second Tech meeting on Plant Exploration and Conservation co-hosted by FAO and the International Biological Program to assess the danger of genetic loss in diversity of crop plants and to define a global strategy for conservation of PGR.

PGR forms the backbone of agriculture, playing a positive and unique role in the development of new cultivars. They offer enormous opportunity for better economic growth, potential stability, improved human health and a sustainable environment. For developing varieties resistant to various pests and diseases and to improve quality and quantity of the produce, there is a continuous need for genetic resources. Genetic resources constitute undeniable interdependence between countries and continents. Even biodiversity rich regions depend on crops originating from other countries for more than 30% of their food requirements. This interdependence and expected increase in demand for food products emphasize the need for international collection and exchange strategies. Acquisition of diverse and superior germplasm and their conservation have become major concerns for many nations and international institutions.

In the past unrestricted exchange, utilization and marketing of germplasm has tremendously benefited agriculture. PGR was regarded as the common heritage of mankind. Farmers were the breeders and conservers, who obtained seeds by buying, collecting or by being provided with them. They could do anything with the seeds once procured with no restrictions whatsoever. Thus countries gained more than what they contributed. It promised self sufficiency in food, food security and improved economy. The Green Revolution was made possible only through such international germplasm exchange.

During the 1970s, Plant Breeding Rights (PBR) were implemented in many developed economies and this encouraged an expansion of private sector breeding. Rapid development of biotechnology research methods and the recognition of these methods as important tools that enabled the development of new plants and plant components, lead to the expansion of patent rights. The landmark decision on expansion of patent rights to cover living plants and animals changed the perception. With inclusion of IP rights in the Trade–Related Aspects of Intellectual Property Rights (TRIPS) section of General Agreement on Tariffs and Trade (GATT) by the World Trade Organization (WTO), IP issues are widely discussed in the context of international trade, agriculture and development. The WTO TRIPS agreement required all signatories to implement IP protection on a range of biologically based material that they had not previously been obliged to protect. Many developing countries were required to address Intellectual Property issues for the first time. With stronger patent rights incorporated into TRIPS and biodiversity being regarded as a treasure under national sovereignty, apprehensions on free exchange of germplasm were raised. The paradigm shift from free flow of genetic resources to a restricted exchange was officially introduced when the Convention on Biological Diversity came into force in 1993.

Issues were raised on the ownership of PGR and benefit sharing, as the vast stores of germplasm conserved in various gene banks in CG system were collected from gene rich/economically developing nations and stored away from the place of collection. Continued free exchange of germplasm was the main concern but more importantly the most critical issue was how the farmers can benefit from these resources who are the true discoverers, conservers, producers and breeders of these invaluable resources. Several international agreements and conventions, which directly or indirectly had implications on the conservation and use of genetic resources, came into force. Of these international and national agreements and conventions, three important agreements which address the issues of access to biological resources are discussed here in brief.

International Undertaking on Plant Genetic Resources (IUPGR)

Based on the universal principle that PGR(s) are a heritage of mankind and consequently should be available without restriction, FAO in 1983 adopted a non binding International Undertaking on Plant Genetic Resources (IUPGR) to ensure that PGRs of economic and/or social interest particularly for agriculture, will be explored, preserved, evaluated and made available for plant breeding and research purposes. The FAO Commission on Genetic Resources for Food & Agriculture (CGRFA) monitored the implementation of IUPGR. However the principle gradually narrowed and 1989 amendment made it consistent with the plant breeder's right favoring technology rich countries. The rights of the breeders and farmers were being negotiated in harmony with CBD.

Convention on Biological Diversity (CBD)

Adopted in the background of increased threat to genetic resources by the developments in biotechnology, the legally binding Convention on Biological Diversity (CBD) came into force in 1993. The most widely adopted UN agreement ever, aimed at conservation and sustainable use of the components of biodiversity with fair and equitable sharing of benefits arising from the utilization of genetic resources. Access was determined by national governments subject to Prior Informed Consent (PIC) and Mutually Agreed Terms (MAT). Accordingly, patents on genetic material can only be consistent with the CBD if the resources are acquired with national approval. Thus country of origin and proof of PIC, together known as disclosure issues, must be indicated in patent applications. Though it encouraged exchange of germplasm, it also raised the required level of negotiations.

International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)

Despite the position taken by CBD that IP issues must not conflict with the conservation and sustainable use of biodiversity, conflicts do arise. Legally binding ITPGRFA, negotiated as a direct response to CBD in 2001, came into force in 2004 to facilitate access to PGRFA in harmony with CBD, through an efficient, mutually agreed multilateral system (MS) of access and benefit sharing. Access is only for research, breeding and training and not for chemical, pharmaceutical or non food/feed industrial use. No Intellectual Property rights can be claimed on the form received from MS that limit the facilitated access to PGRFA/genetic parts or components. To ensure that the germplasm is used only legally, the Material Transfer Agreement (MTA) binds users to certain terms and conditions and is signed for both inflow and outflow of germplasm. The treaty works through inter-governmental agreement as required by CBD. Two key components of the treaty being that

1. Each party should facilitate germplasm exchange for a list of crops (includes 35 food crops and 29 forages) which are important for food security and for which countries are interdependent.
2. It must provide a system to enforce equitable share of benefits, through a central fund for obligatory payments to the country of origin.

Biological Diversity Act (BDA)

Under the provisions of the Convention on Biological Diversity (CBD), the Government of India enacted legislation called Biological Diversity Act (BDA), 2002 and also formalized the Biological Diversity Rules, 2004. The objective is to provide for access to biological resources of the country and equitable share in benefits arising from the use of biological resource together with sustainable use and conservation of biological diversity. As per the Act (Section 3), no person from outside India or a corporate body, association, organization incorporated or registered in India having non-Indian participation in its share capital or management, can access any biological resources or knowledge associated, for research, commercial utilization, bio-prospecting or bio-utilization, without proper approval of National Biodiversity Authority (NBA). No person can apply for any IPR in or outside India for any invention based on any research or information on a biological resource obtained from India without obtaining approval from NBA.

Collaborative research projects involving transfer or exchange of resources or biological information between government sponsored institutions in India, and such in other countries, if they conform to the policy guidelines or approved by the Central Government are exempted.

Persons required to seek approval of the National Biodiversity Authority are the following:

1. A person who is not a citizen of India
2. A citizen of India, who is a nonresident as defined in clause (30) of section 2 of the Income tax Act, 1961
3. A body corporate, association or organization
   (a) not incorporated or registered in India; or
   (b) incorporated or registered in India under any law for the time being in force which has any non-Indian participation in its share capital or management

Access to germplasm is now viewed as politicized and legally controlled, subject to international agreements as well as national legislations. In addition, the agriculture scenario is confronted by numerous other problems which call for modalities for benefit sharing to ensure continuity of germplasm exchange. Critical analysis of laws and policies that impact access and use of germplasm must be done. The future demands mutual agreements to undertake research and access the germplasm and technologies without infringing IP rights. If new technologies are developed, it must spell out the terms on which it may be made available, as one can foresee considerable dangers to food security if the technologies are inaccessible to those who really need them. Whether the current scenario is encouraging or restricting research and development is unclear.

Trehalose: Sweet Rescue for Salinity and Drought Stresses in Plants

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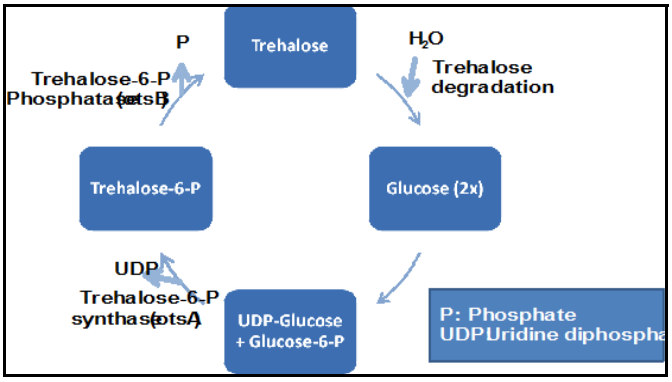
The sole phenomenon of productivity of plants depends on various factors. The major factors are the efficiency of photosynthesis, availability of nutrients and tolerance capacity to withstand biotic and abiotic stresses. India is the world's second most populated country and it is predicted that, at the rate at which its population is growing, it will face a severe scarcity of food grains after ten years. The projected value for demand of food grains of India by 2010 will be 246 million tons and by 2020 will be 294 million tons (Grover *et al.*, 2003). Most of the Indian population depends on rice as a major source of food grains. It is fortunate that rice is the most amenable crop plant for genetic manipulation amongst monocots due to its small genome size (430 Mb), enriched genetic map, availability of entire genome sequence and relative ease of transformation. So to feed the continuously increasing population, there is a need to re-engineer rice at the biochemical level (Surridge, 2002). The sequencing of rice genome has also opened an array of possibilities for improving other cereals such as maize and wheat as there is significant conservation of genes amongst cereals (Devos and Gale, 2000, Tyagi *et al.*, 2004). To withstand stress conditions like salinity stress, transgenic plants in model systems and cereals have been developed targeting genes involved in diverse processes such as signaling, transcription, ion homeostasis, accumulating compatible solutes, antioxidant defense etc.

Several rice varieties with improved agronomic characteristics have been developed through conventional breeding approaches. But breeding efforts for the development of salinity tolerant rice varieties have yielded only limited success (Singh *et al.*, 2008). However, in India, the Central Soil Salinity Research Institute (CSSRI, Karnal, India) has made significant progress. The first salt tolerant, early maturing rice variety of India, CSR10, can withstand highly alkaline (pH 9.8-10.2) and saline conditions (ECe 6-10 dsm-1) under transplanted irrigated management system. Subsequently, several other salt tolerant varieties such as CSR13, CSR27 and CSR30 have also been developed by CSSRI, Karnal (http://www.cssri.org). But, development of a salt tolerant rice variety without any yield penalty is still a challenge. Salinity stress response is a multigenic trait. A number of processes, such as compatible solutes/osmolytes, polyamines, reactive oxygen species, antioxidant defense mechanism, ion transport and compartmentalization of injurious ions involved in tolerance mechanism are affected. (Sairam and Tyagi, 2004). Accumulation of osmolytes is one of the most prominent defense mechanisms in plants to tolerate both salt and drought stresses (Bajaj *et al.*, 1999). Osmolytes are low molecular weight organic molecules collectively known as compatible solutes as they do not interfere with other cellular functions. These solutes differ among plant species and include polyhydroxylated sugar alcohols, amino acids and their derivatives, tertiary sulphonium compounds and quaternary ammonium compounds (Bohnert and Jensen, 1996).

Trehalose is a non-reducing disaccharide (a-D-glucopyranosyl-1,1-a-D-glucopyranoside) that accumulates in a wide variety of organisms that withstand drought, salt, heat or freeze stress. Trehalose is present at almost undetectable levels in plants. However, it is present in some "resurrection plants" such as *Selaginella lepidophylla*, where it works as osmoprotectant during desiccation stress (Adams et al., 1990). There are three different pathways for trehalose biosynthesis. The most widely distributed and present in many bacteria, yeast, and plants is a two step process in which trehalose-6-phosphate (T6P) synthase (TPS) synthesizes T6P from UDP-glucose and glucose-6-phosphate followed by dephosphorylation to trehalose by T6P phosphatase (TPP) (Goddijn and Van Dun, 1999; Figure 1). The best known and most widely distributed physical features of trehalose is its ability to protect the integrity of cells against a variety of environmental stresses such as desiccation, dehydration, heat, cold and oxidation (Elbein et al., 2003).



Biosynthesis and degradation pathway of trehalose

The commonly studied trehalose biosynthetic pathway is in Saccharomyces cerevisiae, in which trehalose accumulation has been associated with improved tolerance to a number of stresses such as extreme temperature (Eleutherio et al., 1993) and water deficiency (Mackenzie et al., 1988). The capacity to synthesize trehalose by higher plants was first revealed by using the Validamycin A, which is the inhibitor of trehalose degrading enzyme, trehalase. Validamycin A treated tobacco and potato plants accumulated trehalose, albeit at low levels (Goddijn et al., 1997). *Arabidopsis* and *Selaginella lepidophylla* plants also contain genes homologous with the trehalose-6-phosphate synthase (TPS) gene of bacteria and fungi. Overexpression of the plant TPS gene in a yeast tps1? mutant led to very low TPS activity and trehalose accumulation. However, truncation of the plant-specific N-terminal extension in the *Arabidopsis* AtTPS1 and *Selaginella* SlTPS1 homologues results in 10-40 fold higher TPS activity and 20-40 fold higher trehalose accumulation on expression in yeast, which showed that the plant TPS enzyme have high potential catalytic activity (Van Dijck et al., 2002). Over-expression of the yeast TPS1 gene in tobacco led to moderate trehalose accumulation and dehydration tolerance (Holmstrom et al., 1996). Introduction of yeast TPS1 gene under the control of CaMV35S promoter in transgenic potato plants showed significant drought resistance along with growth retardation and root aberration (Yeo et al., 2000). Overexpression of a bifunctional gene fusion of otsA and otsB of E. coli encoding TPS and TPP, respectively driven by stress-regulated promoter confers resistance to abiotic stress without causing morphological changes in rice (Garg et al., 2002). Similarly, a bifunctional fusion of the TPS and TPP genes of E. coli was over-expressed under the control of maize ubiquitin promoter (Ubi1). It was found that transgenic plants exhibited no growth inhibition or visible phenotypic alterations despite the high level production of trehalose (Jang et al., 2003). Recently, yeast TPS and TPP genes were expressed in *Arabidopsis* plants either under the control of *Arabidopsis* RuBisCO promoter (AtRbcS1A) giving constitutive production or under the control of drought-inducible *Arabidopsis* AtRAB18 promoter or under the control of AtRbcS1A promoter together with a chloroplastic transit peptide in front of the coding ScTPS1 and showed that all three strategies resulted in transgenic plants with increased drought tolerance without growth aberrations, suggesting that growth aberrations and improved drought tolerance can be uncoupled (Karim et al., 2007).

At ICGEB, work has been undertaken to develop salt and drought tolerant marker-free transgenic rice (IR64) by overproduction of trehalose through insertion of bifunctional TPSP fusion gene of *E. coli* under ABA-inducible promotor (Figure 2). Trehalose can be expected to work as a universal stabilizer of protein conformation due to its exceptional effect on the structure and properties of solvent water compared with other sugars and polyols (Kaushik and Bhat, 2003) and an increase in the stability of proteins in the presence of trehalose depends upon the length of the polypeptide chain. Thus, transgenic rice plants over-expressing genes of trehalose biosynthetic pathway under the control of ABA inducible promoter might be tolerant to salt and drought stresses without any adverse effect on plant growth and yield.

Transgenic rice plants harboring bifunctional fusion gene of TPS and TPP growing in green house at ICGEB, Delhi

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Report

Seed Industry Program 2008

The seed industry executive development program organized by Sathguru Management Consultants in collaboration with Cornell University, NY, USA, was held from 8 to 11 April, 2008 at the Taj Savoy in Ooty, India. Its primary focus was to enhance the participants' ability to develop strategic solutions to augment business through a deeper understanding of research management, technology access through licensing, regulatory compliance, market access factors and business restructuring.

The program was attended by participants representing government bodies, academic and research institutions, and seed companies from India and abroad. They were addressed by a distinguished faculty from both academia and industry -- Cornell University, Sathguru Management Consultants, Tamil Nadu Agricultural University, Monsanto and Mahyco.

After a short introduction and welcome address by Vijayaraghavan of Sathguru, Ronnie Coffman of Cornell University gave his presentation entitled "The Big Picture: Emerging Trends in the Global Seed Sector" in which he illustrated the global importance of plant breeding and explained the progress of global competitiveness through the improvement of Total Factor Productivity (TFP). He substantiated the need for a vigorous public plant breeding sector to improve TFP and ensure the competitiveness of agriculture and enumerated the advantages of improving international competitiveness through plant breeding and discussed the implications of globalization on the future of plant breeding. In conclusion, he emphasized the importance and advantages of international partnerships in the future of plant breeding.

Yossi Shapiro of Monsanto, India, in his presentation on the "Trends and Innovations in a Corporate Breeding Initiative," explained the management fundamentals, technological advances and product stewardship strategies using Monsanto's business model as an example. Dr. Shapiro concluded by enumerating current trends in the industry and provided a few pointers on how these trends can be tackled through sound human and resource managements, staying up to date with new technology and maintaining a vision for the future while also being flexible enough to quickly adapt to change.

In "The Role of Global Public Universities in Supporting Seed Sector Research," K. V. Raman of Cornell, described the global trends in agriculture with special emphasis on the growing role of genetically enhanced seeds in these trends. He spoke of the major role played by seed genomics in new trait development which translates into new products. After describing the global acreage of genetically engineered crops and the challenges facing the commercialization of horticultural crops, he explained how India could play a major role in bringing horticultural GE crops to market. He emphasized the importance of integrating the seed and crop protection industry and concluded with some observations and predictions for India.

Richard Cahoon of Cornell, in his presentation on "Licensing Principles and Practices for Plant Genetic Resources," began by enumerating the importance of licensing as a strategy for both seed companies and research institutions working on seed genomics. After providing an overview of licensing basics he delved into the principles behind, and specifics of plant variety and germplasm licensing and proceeded to explain various types of licensing agreements such as material transfer agreements and other bailment contracts. He then enumerated the various elements that comprise a licensing agreement and the strategies involved in developing license terms and also special considerations for licensing traits, lines and varieties.

On the second day, Ragunathan of Sathguru spoke on "Valuation Principles and Valuation Metrics for the Seed Industry" in which he explained the fundamental principles of the valuation process and how it forms the keystone for licensing agreements. Ragunathan explained the valuation methods that must be adopted for intellectual assets.

Patricia McClarie of Cornell expanded on the topic of intellectual asset protection through her presentation on "Trade Marks and Other Non-Patent Related Protection of Intellectual Assets and Their Relevance for the Seed Industry." She spoke of the three major non-patent means for protecting intellectual assets.

Richard Cahoon introduced the topic for the break-out group discussion for "A Case Study in University AgBiotech Licensing: PRV-Resistant Papaya." Attending participants were split up into groups and were required to formulate a global commercialization strategy with special emphasis on India; develop a technology development strategy (virus resistance, ripening control, nutritional enhancement); describe the partnership structures necessary for the plan; define a coordinated IP and bio property strategy to accomplish the commercialization strategy; develop a value capture strategy for the technology creator and define a PR and regulatory acceptance strategy. The individual presentation by the groups were made at the end of the program

Ragunathan in his presentation on "Information Systems Management for Seed Production and Delivery" provided the audience with an overview of the basic principles for IT systems available for seed companies. He provide participants with an overview of the proprietary system developed by Sathguru for the ABSPII project.

Raju Barwale of Mahyco in his presentation, "Strategies for Seed Delivery of Transgenic Seeds and Enhancing Market Access," used Mahyco's experiences with marketing seeds for Bt Cotton in India as a base to discuss effective distribution strategies for transgenic. Starting with a description of the regulatory approval process, Mr. Barwale proceeded to explain the strategies adopted for market access, which include legal access, extension activities and sub-licensing. He then described the results achieved by Mahyco and shared with those present the lessons that were learned.

Paramathma of TNAU in his presentation on "Bio-Energy Crops—Opportunities and Challenges for Seed Industry" quickly introduced TNAU's Jatropha and Sugar beet projects. He then described the advantages of adopting a practical policy on bio-energy crops to provide a sustainable environmentally friendly alternative to the country's energy and economic requirements. He enumerated the various opportunities for seed industry, entrepreneurs, researchers and farmers that can be derived from this.

Richard Cahoon, in his second presentation on "Intricacies in Licensing Biological Materials and Technologies for Transgenic Crops." complicate the licensing technology, he explained how the multiplicity of technologies that come into play in the development of a transgenic variety results in a complex "ownership mosaic" that the end licensor must tackle. He enumerated effective strategies and checklists to help licensors stay aware of the licensing status of the various technologies that have contributed to the development of their product.

Vijayaraghavan of Sathguru, who spoke on "Gaining Strategic Leadership in Technology: The Private Sector Perspective." stressed the importance of understanding the principle behind and the process by which priorities are set for research and technology acquisition in the seed industry. Vijayaraghavan then described the strategic factors for achieving and retaining leadership in the seed industry.

ABSPII Director Visits

On 27 May 2008, Dr. Frank Shotkoski, Director ABSPII, visited the Bangladesh Agricultural Research Institute (BARI) and discussed the progress made on various projects with its Director General Dr. Harun-ur-Rashid. He then visited the biotech lab, net house, and the confined field trial site at Gazipur. He also evaluted BARI's preparedness to conduct its first multi locational field trials for Bt Eggplant.

The following morning, he met with Dr. Md. Abdur Razzaque, Executive Chairman and Member Director (Crops) at the Bangaldesh Agricultural Research Council. In the afternoon, he met with the Chairman of the Bangladesh Agricultural Development Corporation. The focus was to explore new cooperative endeavors with the project partners.

On 29 May, he visited the Dhaka office of East West Seeds to discuss the issues involved in gaining approval for contained (net house) trial of Bt Eggplant hybrids, with its Chairman. The Chairman assured him that the approval process was being expedited. In the afternoon, he visited the USAID mission officials discussed the progress made for various research projects.

Dr. Al Amin and Dr. Harun with Dr. Shotkoski at the BARI net house

Bt Eggplant Counted Among 100 Great Innovations

The Association of University Technology Managers (AUTM), has included the Transgenic Eggplant Project in its report entitled *Technology Transfer Works: 100 Innovations from Academic Research to Real-World Application*. The project is supported by USAID and managed by Sathguru Management Consultants in partnership with Cornell University, private sector seed company MAHYCO and a consortium of public sector research institutions.

The report, the third in a series that make up AUTM's Better World Project, documents the stories of various collaborative efforts between partners that have ensured that results of academic research are translated to products that benefit the general public. According to AUTM, the successful transfer of the fruits of academic research into usable technology involves "continuous interactions and partnering at a number of levels in the public and private sectors."

The eggplant project has been listed by the report as one among a hundred projects undertaken across the globe with a potential to benefit humanity. The fruit and shoot borer (FSB) resistant variety of eggplant will allow farmers to reduce their dependence on pesticides, maximize farm yields and create a more stable income for farming families. It is the only project from the Indian region and one of few from the Asian region that has been identified by AUTM for this recognition.

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