

## VII CONCLUSIONS AND RECOMMENDATIONS

### A. Conclusions

During the next 25 years, Asia will face a serious challenge on how to reduce poverty and achieve food security due to (i) an absolute increase in population; (ii) the doubling of its urban population; (iii) continued deterioration of water, forest, and soil resources; and (iv) the need to produce the food where it is consumed, because the share of total grain production traded has remained stable at about 10 percent.

The most attractive strategy to meet this challenge is to increase smallholder agricultural productivity. This strategy will not only increase food supplies, but it will also increase smallholders' incomes, reduce malnutrition, and improve the livelihoods of the poor. Increasing smallholder productivity on a sustainable basis is complex. The challenge has to be addressed by modern science since the Green Revolution has already run its course in much of Asia. And it has also bypassed the rainfed and marginal area where most of the poor are concentrated.

Modern biotechnology brings new possibilities for achieving the sustainable increases in agricultural productivity that will be necessary to meet the projected demands for food by Asia's growing population. It has the potential to increase agricultural production and improve processing. Past large-scale investments in biotechnology have resulted in modest increases in crop yields, reduced dependence on pesticides, and better quality food. That could be followed by larger, dramatic increases in crop and livestock productivity; control of major diseases in livestock and fisheries; increased resistance of crops to drought, salinity, and acidity; and new types of processed foods. Using modern biotechnology, new HYVs can now be developed much more quickly with greater precision compared with conventional breeding methods.

During the past decade there has been rapid progress in the application of modern biotechnology in developed countries, thanks to massive investment of the private sector. During 1996-2000, the total area planted to genetically modified crops expanded rapidly from 1.7 million ha to 44.2 million ha. Seventy-five percent were in the United States, with the remainder in other countries in Europe, Latin America, and Asia (mainly the PRC).

Some Asian countries, notably PRC, India, Indonesia, Malaysia, Pakistan, Philippines, Thailand, and Viet Nam, have already made modest investments in agricultural biotechnology. Their capacity to carry out biotechnology R&D has been strengthened with financial support from ADB, AusAID, USAID, the Rockefeller Foundation, the World Bank, and other funding agencies. The PRC has developed and released to farmers a number of transgenic crops, which now cover at least 500,000 ha. Some IARCs have also made modest investments in biotechnology to develop HYVs of orphan crops (e.g., tropical rice, tropical maize, sorghum, groundnut, and chickpea) in collaboration with NARSs. The development of safe and efficient biotechnology in Asia has been constrained by a shortage of trained personnel, lack of capital, poor management of IPR, ineffective biosafety regulations and enforcement, and the widespread perception of some NGOs that biotechnology poses serious risks to human health and the environment.

The risks of biotechnology to human health and the environment are confined to transgenic crops and livestock or GMOs. Other components of biotechnology such as microbial fermentation, tissue culture, marker-selected breeding, and disease control are relatively safe and have no adverse impact on human health and the environment. Biotechnology consists of a gradient of technologies ranging from simple, low risk technologies to complex, expensive, and highly risky technologies. Asian governments therefore have a choice of technologies to invest in depending on the availability of human and financial resources, and their capacity to monitor and evaluate potential risks.

Agricultural biotechnology is not the sole means for achieving food security. But in conjunction with complementary activities, it may be a powerful tool in the fight against poverty. These complementary activities would include a favorable policy environment; good governance; investments in rural infrastructure, agricultural research, extension, and agricultural credit; and marketing.

## **B. Recommendations**

### **1. General Strategy**

To ensure that agricultural biotechnology will contribute to reducing poverty and improving food security in Asia, biotechnology R&D should do the following:

- (i) Address the problems of small farmers in the rainfed and marginal areas where most of the poor live, yet not neglect the problems of small farmers in the irrigated areas.
- (ii) Focus on economically important orphan crops, high value crops, and livestock to increase their productivity.
- (iii) Develop low cost, appropriate technologies for small farmers, particularly the development of HYVs adapted to the rainfed and marginal areas.
- (iv) Develop, test, and release technologies that will pose minimal or no risks to human health and the environment.
- (v) Strengthen the extension, delivery, and regulatory systems to ensure that improved varieties and technologies will be disseminated widely to small farmers with little or no risk to consumers or the farmers themselves.

## **2. Role of Government**

To use agricultural biotechnology safely and effectively for the benefit of small farmers in Asia, governments in the region should:

- (i) Demonstrate a strong commitment to agriculture and rural development by providing adequate budget and staffing to the sector in general and agricultural biotechnology in particular.
- (ii) Establish clear policies and priorities in biotechnology R&D to ensure that it can contribute effectively and safely toward poverty reduction and food security.
- (iii) Enhance cooperation with the private sector in the development of biotechnology that will benefit small farmers.
- (iv) Set up effective biosafety regulatory and enforcement systems to ensure that the risks of biotechnology (particularly those of genetically modified crops and livestock) will be minimized.
- (v) Enact IPR laws that will protect and stimulate private sector investments in biotechnology in the region.
- (vi) Organize dialogue with NGOs, consumers, and farmers on the benefits, risks, and opportunities in the use of new biotechnology.

- (vii) Seek assistance from international organizations and funding agencies on specific problems in biotechnology that cannot be addressed using their own resources.

### **3. Suggested Policy for ADB on Agricultural Biotechnology**

The major conclusion of this study is that funding agencies, including ADB, would be wise to continue and increase their investments in the safe applications of biotechnology, as one means to achieving poverty reduction and food security in Asia over the next 25 years. Achieving these goals with presently available technologies will be difficult given present trends and future challenges facing the rural sector in Asian environments. ADB can support biotechnology R&D in Asia through loans and technical assistance to both public and private sector entities. Accordingly, it is recommended that ADB consider the following measures:

**Recommendation 1.** ADB should assist DMCs in policy and priority setting to enhance investments in the safe application of biotechnology.

- (i) Provide information to enable governments to make informed decisions in relation to the use of new biotechnology applications in agriculture. Particular care needs to be taken to select those interventions that impact poor people, either directly by increasing incomes or crop yields and quality, or indirectly by improving their environment and prospects for sustainable productivity.
- (ii) Assist DMCs in identifying R&D areas where the use of new scientific developments may help achieve breakthroughs in dealing with previously intractable problems. These may include ways to increase sustainable productivity in rainfed areas, for example by the use of molecular methods to select new crop varieties with higher water use efficiency.

**Recommendation 2.** ADB should increase dialogue with its DMCs in identifying potential benefits and opportunities in the use of different biotechnologies to address specific targets.

- (i) Increase policy dialogue with governments on the importance of the rural sector in underpinning social, economic,

and environmentally sustainable development. The important role scientific developments can play in making the rural sector more productive and more sustainable through better management of natural resources is an important issue. Good governance and beneficiary participation will ensure the poor, including women, have access to the new technology.

- (ii) Support risk/benefit analyses as a basis for choices on the merits of new technologies to address particular problems relative to existing technologies and other options. An example of where risk/benefit analyses could be undertaken in the short term is on the potential use of transgenic cotton varieties in Asian cotton-growing countries, based on the experience of the use of transgenic cotton varieties in the PRC. The analyses could compare various technology options, including the use of pesticides and integrated pest management systems.

**Recommendation 3.** ADB should strengthen risk assessment and management capabilities in its DMCs through systematic capacity building.

- (i) Assist smaller Asian countries to set up national regulatory systems appropriate to their size and resources, while being consistent with international best practice.
- (ii) Support regional harmonization efforts and activities being undertaken through ASEAN and APEC for the development of agreed upon biotechnology standards, guidelines, and regulations.
- (iii) Support the development and implementation of protocols to monitor the long-term ecological impact of GMOs in the environment. Initial priorities could be for monitoring the performance of transgenic cotton and rice, since cotton is already under widespread commercial cultivation in the PRC and rice is the major food crop in Asia.
- (iv) Facilitate the evaluation of potential new products in the regulatory pipeline in several countries through small-scale trials conducted under international best practice guidelines. These experiments would give data that could guide risk/benefit analyses and future decisions on the safety of specific applications of new biotechnologies in Asian environments.

- (v) Strengthen law enforcement in most DMCs to ensure that the introduction and release of GMOs follow government environmental requirements and procedures.
- (vi) Support ex-ante and ex-post studies on the socioeconomic impact of transgenic crops in the region and their impact on the poor, including women.

**Recommendation 4.** ADB should facilitate access to proprietary technologies and encourage greater private and public sector cooperation in the development and delivery of new products at affordable prices for the poor.

- (i) Facilitate negotiations with private companies on behalf of developing countries and the international agricultural research community to access key enabling technologies potentially useful on orphan commodities in Asia (i.e. staple food crops, livestock, and fish consumed locally).
- (ii) Act as an honest broker or as a convenor in facilitating more public-private sector partnership in research, development, and dissemination of technologies relevant to the needs of small farmers.
- (iii) Examine the feasibility of providing incentives for local private sector development in areas that would develop biotechnology-based businesses in rural areas, with high potential for stimulating income and employment opportunities.
- (iv) Examine the feasibility of providing incentives for multinational companies to develop products to benefit poor people. Such incentives may be provided through tax breaks, contract R&D, guaranteeing a base market for a successful product, strategic alliances, or underwriting joint ventures with national companies. There are some experiences with these types of incentives in the health sector that merit closer examination for their applicability to the rural sector.
- (v) Support national capacity building in IP management and technology transfer.

**Recommendation 5.** ADB should support a strategic R&D agenda and associated human resources development in Asia to generate new knowledge and disseminate the results for the public good. It should

support and fund national governments and IARCs to undertake important initiatives that will have significant impact on poverty reduction and food security in the long term in areas of market failure where the private sector is unlikely to invest.

- (i) **Applications of Biotechnology to Orphan Commodities.** Support public R&D on orphan commodities by national and international agencies. This may best be done by developing more efficient methods of crop improvement through the use of marker-assisted selection for complex traits such as drought tolerance. In other cases, the most appropriate approach may be the development of transgenic varieties with specific characteristics such as disease resistance or improved nutritional quality.
- (ii) **Ecological Research.** Support national governments and international agencies in developing methods for undertaking participatory field studies on the ecological impact of the first generation of genetically modified crops. For example, insect-resistant cotton and rice are being released for field testing and commercial production in Asia, particularly in the PRC. These assessments should involve local communities in the evaluation of the new technologies, similar to the approaches developed in Asia for integrated pest management.
- (iii) **Strategic Research on Functional Genomics.** Support regional efforts on functional genomics to understand the genetic basis of the agriculturally important crops and livestock in Asia. For example, genomic studies on rice, maize, and sorghum may identify potentially useful genes for drought and salinity tolerance that may have wide applicability across all cereals.
- (iv) **Exchange of Information.** Support the sharing of knowledge and experience among Asian countries on the applications of biotechnology to specific targets, the risk/benefit analyses that underlie particular choices, and the data on food safety and environmental risks that will be acquired as experience accumulates and strategic R&D is conducted.