

The Current and Future Outlook of Agricultural Biotechnology in Malaysia

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Introduction

During the past few years, biotechnology has emerged as a powerful technology that has a big potential for a number of economic sectors, including agriculture. A number of basic human needs such as food, cloth, medicines and a cleaner environment have been fulfilled through biotechnological means. New developments in genomics (namely the human genome project and other genome projects in a number of organisms including important crops such as rice), bioinformatics and proteomics have opened new frontiers in biotechnology R&D. The convergence of these new technology platforms with the powerful information technology now provides a greater understanding of the biology of plants, animals, humans, and micro-organisms at the molecular level, enabling us to develop better strategies and approaches to deal with current and future challenges.

The last millennium witnessed the shift of the Malaysian economy from its reliance on the raw and unprocessed products to manufactured goods. However, agriculture continues to play an important role in the overall

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economic growth of the country. During that period, the Malaysian agricultural sector was left with two major challenges. The first major challenge is in the realm of addressing national food security, i.e. to produce sufficient amount of food to meet the national needs. The country is not producing sufficient amount of food for the populace. A drastic change in the exchange rate of the ringgit during the economic crisis of the late 1990s reinforced the above need as imported food items tend to be more costly. Of the total RM32 billion in the year 2000 budget, about RM10.52 billion was allocated for the imported food bill. The second major challenge relates to creating wealth for the nation through production of value-added food and food products, which are more competitive in the open market, and to supporting the manufacturing sector through production of sufficient amount of raw material. The far-sighted vision on the role of the agricultural sector in supporting economic growth of the country requires crucial injection of new high technology to transform this sector to be more productive especially in meeting the two challenges stated above. The agricultural sector must prepare itself from now not only to produce sufficient amount of food, but it should also produce high quality products that can compete with the imported produce during the current era of globalization. The National Agricultural Policy outlined a transformation route for the agricultural sector to be more productive, efficient, competitive and more commercialized.

The last millennium also left us with the technology that will enable us to address the above challenges. The discovery of DNA and rapid development in the science and technology of molecular biology during the last millennium has ushered us into a new era – the biotechnology era. During that period, biotechnology has proved its ability to transform a sector – such as the agriculture sector – while generating new industries to support economic growth in the developed world. Genes, the basic biological unit of life, that programme a character of plants, animal and micro-organisms, are amenable to modification, manipulation and transfer across species to bring about desired outcomes. Biotechnology has been recognized as one of the new high technologies that will bring about desired changes in the agricultural sector.

Institutional Development

Historically agricultural biotechnology development in Malaysia can be divided into three phases: the period of establishment (prior to 1995), development phase (1995-2000) and advancement phase (beyond 2001). Prior to 1995, initial establishment of agricultural biotechnology R&D took place in a number of research institutions such as MARDI, PORIM (now MPOB), and RRIM (now MRB) as well as at various universities such as UPM, UKM, UM and USM. The development at the institutions includes establishment of basic infrastructures such as molecular and cellular biology labs with necessary equipment and set-up, and establishment of basic expertise to undertake biotechnology R&D. The National Working Group on Biotechnology was set up under the Ministry of Science, Technology and Environment (MOSTE) to oversee and coordinate biotechnology activities in the country.

Subsequent to the successful establishment of basic infrastructures and technical competencies, many developments have taken place during the period of the 7th Malaysia Plan (1996-2000). Implementation of the national initiative and agenda on biotechnology was further enhanced with the establishment of the National Biotechnology Directorate (BIOTEK) under MOSTE. The mission of BIOTEK is to spearhead the development of biotechnology in Malaysia through research and related activities directed at commercializing biotechnology, and to establish Malaysia as a leading centre for biotechnology industry. Under BIOTEK, a mechanism called Biotechnology Cooperative Centers (BCC) was established to assist the Directorate in coordinating the National Programme in Biotechnology; developing a network among participating institutions (universities, research institutions and industries); and pursuing leading edge research and accelerating diffusion of knowledge to the industry. Seven BCCs have been established to cover primary biotechnology research areas, viz. plant-, animal-, food-, environmental/industrial, medical-biotechnology, molecular biology and bio-pharmacy. Besides the BCC system, another mechanism called the Contact Group Programme was also established by BIOTEK to facilitate direct communication and linkage with participating institutions of the public and the private sectors.

Recently, the Malaysian Government has endorsed a mega plan to develop biotechnology in the country under the BioValley Malaysia. The plan is based on the cluster concept where groups of specialized companies that support each other to create a “center of excellence”. Companies within the cluster can take advantage of the presence of physical infrastructures, facilities, human resource, entrepreneurship and sharing of ideas to enable them to compete at a global level.

R&D

During the 7th Malaysia Plan (1996-2000), four R&D programmes were implemented under BIOTEK under the coordinatorship of the BCCs. They were:

- I) Top-down research projects: National research projects directed by the National Scientific Research and Development Council for implementation by multi-institutions involved in biotechnology. A top-down project on rice genetic engineering for tungro virus resistance, for example, has led to the development of a transgenic rice that is resistant to one of the virus (RTSV) that is causing the disease. The project has also paved the way for other improvement of rice.
- II) Experimental developmental projects: Up-scaling projects that need to be developed after laboratory-scale R&D before they are commercialized. Public research institutions and universities are encouraged to forge partnerships with one or more companies in the private sector for undertaking these projects.
- III) Partnership programme: The programme involves partnership of a group of institutions in Malaysia with a prominent international center of excellence in relevant field of biotechnology. The Malaysia-MIT Biotechnology Partnership Programme is an example of a partnership programme that has entered its third year of implementation.

- IV) Bilateral programme: A supportive programme linking existing research interest/projects in Malaysia with a similar counterpart in another country. The support is mainly for exchange of information, training and transfer of technology.

Another programme that supports biotechnology R&D in Malaysia is the Intensified Research Priority Area (IRPA) under MOSTE. Although this programme is not under BIOTEK, advice and guidance of the Directorate are always required in implementing the programme on biotechnology. Issues that have been given priority in developing biotechnology projects are: Food security of the country; reducing the import bill on food and feed; and for wealth creation. Among the projects that have been implemented are: genetic engineering of papaya for virus resistance and improved shelf life of fruits; gene transfer system for oil palm; genetic engineering of rubber; and genetic engineering of orchids for improved shelf life of flowers.

Consumer Acceptance, Transfer of Technology and Globalization

As biotechnology is becoming more and more a commercial reality, its impact on consumers as well as producers is well recognized. The subject of GMOs is relatively new to Malaysian consumers. In general, the public is not well informed in the subject matter. As past surveys have shown, there is significantly more support among those who said they had heard a lot about GMOs than those who heard little about them. The National Biotechnology Directorate is stepping up its effort to implement public awareness programmes on biotechnology during the 8th Malaysia Plan (2001-2005). The programmes include arranging lectures at both a nationwide public forums as well as in schools; preparing and distributing pamphlets about biotechnology; and promoting understanding on biotechnology through mass media.

With globalization coming our way, two new issues have to be addressed: transfer of technology and the threat of globalization. Bulk of biotechnological research is done in the private sector, the relevant information and data are not publicly available, and most of the relevant

technologies and materials are not in the public domain. With such a situation, a developing nation like Malaysia viewed technology transfer as a critical agenda since the nation is still far behind in expertise, infrastructures, and financial support. Developed nations must facilitate technology transfer to developing counterparts in order to face challenges thrown up by globalization. It is also the challenge to a country like Malaysia to acquire expertise and capability in biotechnology as it moves forward in the era of globalization.

Future Strategies

Two strategies have been adopted for future development of biotechnology in Malaysia. First relates to strengthening the existing programmes/projects by focusing on key research fields and key platform technologies. BIOTEK will continue to support capacity building such as infrastructure, human resource development (HRD) and management. The role of BCC programme will be enhanced through grouping for common technological needs under three main R&D areas, viz. agro-forestry, healthcare and energy/environmental management. Technical competencies will be developed under a separate programme for technological development on in three identified areas, viz. genomics, bioprocessing and DNA diagnostics. The second strategy relates to developing new innovative projects which can ensure that research is translated into commercial products for global market place, thus making Malaysia more competitive in key biotechnology opportunity area. This will contribute to the national economy programme. This strategy is implemented through the establishment of the National Institute of Biotechnology Development Programme.

Conclusion

As the world moves into the era of globalization, where economy becomes borderless, enhanced efficiency, competitiveness, productivity and quality will take precedence in determining our success in the global arena. Malaysia is positioning herself to face the in-coming challenges being brought by globalization. Technology, such as biotechnology, will be a

strong driving force energizing the shift into a knowledge-based economy. Intensive application of high technology and competency building will enhance this transformation process to position the country where it can look forward to emerge as a stronger economy.

The country has no doubt about the benefits emanating from biotechnology, which was claimed by many as the technology of the 21st century for national development. It has been recognized as a major growth industry worldwide. Advances in biotechnology have spearheaded novel growth and development opportunities in a diverse range of industries such as pharmaceuticals, food processing, plant and animal production, and environmental management. The strategic plan for biotechnology developed by BIOTEK for the future should lead to a more dynamic and competitive biotechnology industry in Malaysia, capable of facing challenges of the next millennium and helping to contribute towards development of nation and move forward to realize the goal envisaged in achieving our Vision 2020.