Plant Biotechnology in Malaysia

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Introduction

Biotechnology has been referred to as the technology of the 21st century. It has been claimed by Bill Gates to be the most important technology after information technology (IT). Strong support has been given by the Malaysian government for the development of biotechnology in this country. The establishment of the National Biotechnology and Biodiversity Policy, the Malaysian Biosafety Guidelines and the attractive biotechnology incentives given to new biotechnology companies are many of the efforts put in by the government to encourage biotechnology development in the country. The government launched the Malaysian Biotechnology Policy in 2004, where biotechnology is envisioned as the engine of growth for knowledge-based economy in the country. The policy provides a conducive environment for R&D and industry growth through leveraging on country’s existing strength and capabilities. The government’s emphasis on the agriculture sector is seen in the Biotechnology Policy where it is placed as the first thrust of the policy. The Malaysian National Agriculture Policy 3 (NAP3) and action plans have outlined important elements for agriculture transformation by the utilization of high technologies including biotechnology. The main goal is to enhance food security and wealth creation through increased food production. Modern biotechnology is currently being applied for its potential to produce crops with higher yield, resistant to pests, disease and adverse conditions as well as improved quality.

The establishment of the National Biotechnology Directorate in 1995 and now called BIOTEK has enabled coordination of various areas of biotechnology research and development, capacity building in cutting edge biotechnology and establishment of effective linkages with biotechnology institutes from advanced countries.

Development of Biotech Crops

The activities in plant biotechnology started in Malaysia 20 years ago in the area of plant tissue culture. The main research focus at that time was in its vast application in plant breeding and in production of elite planting materials. Tissue culture of crops like banana, pineapple, papaya, orchids and another culture of rice were actively pursued then. Tissue culture of banana and orchids have been commercialized and adopted by growers.

Plant biotechnology has proven to create new opportunities for the advancement of the agriculture industry worldwide. With the advent of modern biotechnology, including molecular techniques and recombinant
DNA, local research organizations began to incorporate the new approaches as early as the mideighties. The potential of overcoming constraints faced by the conventional breeding techniques has made modern biotechnology an attractive alternative to produce the new crop varieties constantly needed by growers.

Realizing this, the Malaysian government gave due prominence to this technology to enhance food security and wealth through the development of crop varieties and livestock with higher yielding capacity, the production of goods with higher value and quality by the innovation in processing of natural resources and the generation of value added agriculture products.

Under the Ninth Malaysian Plan (2006–2010), to increase value of the agriculture sector, greater efforts will be undertaken to enhance national capability in agro-biotechnology. New technologies such as bioinformatics, genetic engineering, functional genomics and proteomics will find new applications in the agriculture sector. Applications of biotechnology platform technologies, such as genetic engineering, functional genomics and proteomics will be encouraged to produce agro-biotechnology products that increase plant and livestock productivity as well as improve their agronomic traits. Other agro-biotechnology activities that will be promoted include biopharming, which is the use of transgenic plants and livestock to produce high value proteins.

Various research institutions carry out research on agricultural commodities, namely oil palm by Malaysian Palm Oil Board (MPOB), rubber by Malaysia Rubber Board (MRB), cocoa by Malaysian Cocoa Board (MCB), rice, fruits, vegetables and other crops by Malaysian Agricultural Research and Development Institute (MARDI). The universities complement the research carried out in these research institutes. To enhance the productivity of these important crops, research on biotechnology, particularly plant biotechnology was emphasized and became an integral program that encompassed areas such as genetic engineering for plant improvement, molecular marker technology, plant cell culture/bioreactor system, and in vitro technology.

Plant biotechnology R&D is conducted mainly at MARDI where emphasis is placed on benefiting agriculture by addressing problems that cannot be achieved through conventional breeding. Besides this, the advancement in biotechnology today has also geared the institute up to harness these potentials in producing novel traits in food crops. The research is to complement the existing active breeding program on local crops in MARDI. The crops that are being addressed and the targeted traits are as follows:

1. Papaya for resistance to papaya ring spot virus (PRSV)
2. Papaya for delayed fruit ripening
3. Papaya for delayed fruit softening
4. Pineapple for resistance to fruit black heart
5. Pomelo for improved fruit colour
6. Orchid for increased flower shelf life and resistance to viruses
7. Passion fruit for resistance to viruses
8. Chili for resistance to viruses
9. Tomato for improved fruit colour
10. Rice for enhanced yield
11. Rice for resistance to sheath blight disease

The various priority areas of plant biotechnology research by various universities and research institutes are focused on the following crops/plants:

- Oil palm: Clonal propagation of planting material, oil quality
- Rubber: Disease resistance, yield, production of high value products
- Rice: Disease resistance, yield
- Ornamentals: Flower shelf-life, flower colour, disease resistance
- Fruits: Shelf life, disease resistance, fruit quality
- Cocoa: Insect and disease resistance, butter content and cocoa flavour
- Forest trees for disease resistance and delay in flowering

The research is still ongoing and to date no local biotech derived food crops have been commercialized.

Table 1 GM Crop R&D players in Malaysia

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<td>Malaysian Agricultural Research and Development Institute (MARDI)</td>
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<td>Forest Research Institute Malaysia (FRIM)</td>
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<td>Malaysian Cocoa Board (LKM)</td>
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<td>Malaysian Institute for Nuclear Technology Research (MINT)</td>
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<td>Malaysian Palm Oil Board (MPOB)</td>
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<td>Asean Institute of Medicine, Science and Technology (AIMST)</td>
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Source: Nair and Abu Bakar, 2001
Commercialization of Biotech Derived Crops

The emergence of biotech crops and their subsequent release into the environment have raised concerns among the general public and highlighted issues regarding the safety of these to the environment and human health. A regulatory system has to be set up to oversee, assess and manage the safety concerns of these biotech derived crops. In Malaysia, commercialization of any biotech-derived crops from the lab will involve steps requiring biosafety and food safety approvals. Biosafety approvals are required for all the various stages of the different field trials necessary before commercialization, whereas food safety approval is required before placing the biotech-derived products in the market.

Biosafety

Biosafety is shorthand for the regulatory systems designed to ensure that applications of biotechnology are safe for human health, agriculture and the environment. The Genetic Modification Advisory Committee (GMAC) of Malaysia was set up to formulate the National Guidelines on the release of these crops into the environment and also help draft the Biosafety Law of Malaysia. According to the guidelines and proposed Biosafety Law, all biotech research activities must be notified and development and marketing of biotech products must obtain approval form the National Biosafety Board (to be set up).

Public Awareness and Acceptance

Public acceptance of the biotech product is another important factor towards successful commercialization. Recent survey of key stakeholders in Malaysia conducted by the University of Illinois at Urbana Champagne (UIUC) and ISAAA had showed that attitude of various groups of stakeholders. They are positive towards biotechnology and they believe the technology will benefit small holders. In a survey of 1,400 Malaysian Muslims respondent around Kuala Lumpur conducted by the Institute of Islamic Understanding Malaysia (IKIM), showed that 66.7 % have heard of biotechnology but only 52.2% declared they know what it is about (6). The survey also showed that while about 67% could explain genetically modified organism (GMO), genetic engineering and bio-pharmaceuticals, only 40% know what is cloning. This indicates the acceptance level of Malaysians is quite promising. However, to ensure full public acceptance, public awareness efforts have to be emphasized. Organizations like IKIM and Malaysian Biotechnology Information Center (MABIC) have been active in organizing seminars, workshops and conferences on relevant areas of biotechnology to the public. Biotechnology awareness to students is being coordinated by the National Biotechnology Directorate, Malaysia. Government agencies conducting biotechnology R&D, like MARDI, are very supportive of any public awareness activities on biotechnology. Biotechnology scientists often participated in seminars and media interviews, held exhibitions as well as organized lab visits for the public.
Challenges and Future Prospects
To improve consumer acceptance, biotech crop development should focus on characteristics which benefit the consumers. With the know-how well established in the development and commercialization of the existing biotech crops, we plan to focus research efforts on developing nutritionally enhanced food crops which provides direct benefits to the consumers. Efforts are already underway to look into the relevant pathways leading to enhancement of important metabolites through the genomic approaches. Efforts are also being taken by the government to better coordinate biotechnology development in the country by strengthening biotech R&Ds as well as improving the regulatory framework and encouraging public acceptance. With these, Malaysia hopes to be competitive in food production through biotechnology.

References


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