CHAPTER 7
Innovation and Challenges in Malaysian Agriculture

7.1 Research and innovation technology

In recent years much of the technological innovations in agriculture have been introduced from local research findings from government agencies (MARDI, MPOB, MCB, MRB, FRIM, etc.) and the private sector (Golden Hope, Sime Darby, Guthrie, IOI, United Plantation Bhd., Kuala Lumpur Kepong Bhd., Boustead Plantations Bhd., FELDA, etc.).

Oil Palm

The oil palm industry had a humble beginning. From a mere four original palms introduced from West Africa to the Bogor Botanical Gardens, Indonesia in 1848, their seeds soon arrived on Malaysian shores in 1871. The first commercial planting was done in 1911 at Tenammaran Estate, Kuala Selangor. Such was the success of the crop that the area (ha) expanded quickly (1870-1910, <350; 1920, 400) the most rapid increases occurred during the 30s (20600), 40s (31400), 50s (38800), 60s (54638), 70s (261199), 80s (1023406), 90s (2029464) and 2000 (3376664). In 1997 Malaysia’s export accounted for 52% of world production and 64% of world oil export. It is Malaysia’s golden crop contributing about RM30 billion to its gross national product (GNP) annually, and now cultivated in an area in excess of 3.8 million hectares. Malaysia is currently the major world producer of palm oil (mesocarp oil). Many Malaysian based companies are beginning to expand through reverse investment (divestment) into neighbouring tropical regions such as Indonesia, New Guinea, the South Pacific Islands, West Africa, and Latin America which are most suitable for oil palm cultivation.

Research has succeeded in improving the yield of oil palm to 35 tonnes fresh fruit bunches per hectare per year, using the Tenera hybrid bred from the crossing of Dura and Pisifera varieties in early years. In the near future, the yield is expected to reach 40 t ffb ha⁻¹ yr⁻¹ with the use of new hybrids from research in biotechnology. The research group from Applied Agricultural Resources Sdn. Bhd. (KL Kepong Group) has developed: a) the Dumpy.Yamgambi.AVROS semi-dwarf oil palm hybrid varieties which facilitate harvesting with improved high yield potential and extends the economic life of the crop, and b) potential high yield clones from tissue culture.
In the near future new hybrids will be bred (including transgenic) that will be able to produce more than 50% oleo-fatty acids. Through the years, mechanization and the development of high yielding dwarf oil palm has increased profit margin with reduction in labour and improved yields. Oil palm is a multipurpose agricultural resource whereby its oil can act as a food constituent, oleochemicals, or biofuel (hitherto, the government has given permits for 20 biodiesel projects with investments reaching RM1.9 billion). The trunk is suitable for biocomposite material, pulp and paper, the leaves can be used for cattle feed, while the palm oil mill effluent (POME), the waste from the extraction of palm oil, can be used as an organic fertilizer. This is in line with the vision of making the industry a sustainable zero-waste industry. Integrated farming with livestock in oil palm plantations are continued to maximize returns from the land.

**Rubber**

A lot of technological innovations have been developed in the rubber industry. Being the third largest rubber producer, Malaysia has 1.7 million ha planted with rubber trees. The Malaysian Rubber Board (MRB) has developed high yield and disease resistant clones producing >3500 kg rubber ha⁻¹ yr⁻¹. In the 70s it introduced a high grade rubber named Standard Malaysian Rubber (SMR) in the form of hevea crumb which is internationally recognized as high quality raw material. Rubber can be turned into many manufactured goods and used for many purposes. Malaysia has the best system of plantation management in the tropics, all with the support of years of research, especially pertaining to terracing and cover crops.

The MRB has introduced a new innovation in rubber tapping called puncture tapping or microtapping which can result in an increased production of latex. It produces yields, with hormonal stimulation (etheral), comparable to that of conventional excision tapping. New latex-timber clones (LTC) of the RRIM200 series have been introduced of which the trunk can be harvested for the timber industry (labelled as the Malaysian oak) once it is no longer economical to tap for latex. Vitamine E has also been extracted from the latex.

The development of the industry is based upon the numerous products based on rubber such as latex, heveawood and rubber-based products. Current production is sustained at 750,000 million tonnes yr⁻¹ from 1.2 million ha of planted rubber. Consolidation of uneconomic-sized smallholdings into estate-type production units are undertaken to achieve economies of scale, and replanting are undertaken as part of reforestation programmes.

**Cocoa**

The production of cocoa has declined from 131,000 tonnes in 1995 to 70,000 tons in 2000 due to reduction in planted areas, low market price, adverse weather conditions, labour shortage and high production cost due to pests and diseases. Planted area felled from 400,000 ha in 1989 to 33,313 ha in 2005. Malaysia is forced to import cocoa beans from the neighbouring Indonesia to fulfill the requirement of the many processing factories.

In 2002 a biotechnology division of the MCB was established. This division aims to implement research and development in cocoa biotechnology as well as to provide services
to the entire cocoa industry by developing new technology, capacity building and innovation. Cocoa biotechnology research includes: (1) agrobiotechnology to improve productivity and production efficiency, (2) biotechnology enhanced-quality of cocoa products with respect to safety and health, and (3) industrial and pharmaceutical biotechnology to obtain new products such as useful bioactive compounds from the cocoa tree, associated microbes in the cocoa environment and cocoa waste.

**Padi**

Malaysia currently achieves only 70% self-sufficiency in rice. Among the eight granary areas, the major production centres (rice bowls) are MADA (Kedah-Perlis), KADA (Kelantan) and Sawah Sempadan-Tanjung Karang (Selangor). In 1995, the average national production is 3.8 tons per hectare although some areas in MADA have produced more than 5 tons ha\(^{-1}\). The government aims to raise the yield to 10 tons ha\(^{-1}\) with the use of new technology. Some farmers in Tanjong Karang are now producing >10 tons ha\(^{-1}\). The Minister of Agriculture and Agro-based Industry has declared that Malaysia will strive to achieve 90% self-sufficiency level (SSL) in the near future.

Mechanisation of rice production and the Consolidation of small holdings to group farming and estatisation (mini-estates in Hilir Perak) were intensified to promote commercialization and greater private sector involvement.

The use of a specially formulated chemical fertilizer in trial plots in Kedah, Perlis and Selangor was successful in doubling padi yield and producing better quality rice. Vita-grow® is a foliar fertilizer developed by UPM that contains complete and balanced plant nutrients that enhances growth of padi, vegetables, fruits and ornamentals. Zappa® is another UPM product that enhances rapid germination and tillering. Environment-friendly good farm practices such as precision agriculture, integrated pest management, and soil and water conservation are also encouraged.

**Livestock**

The livestock industry grew at the rate of 3.1% per annum from RM953 million in 1995 to RM1.1 billion in 2000. The integration of livestock rearing in oil palm plantations (and previously in rubber as well) represented a milestone in the increase in production of beef and mutton. Integration is an effective way of reducing management cost by allowing the livestock to eat away the weeds and having the dung from the animals distributed all over the plantation as a fertilizer. Land development agencies, namely FELDA, RISDA, FELCRA and State governments have participated in this integration programme. There are entrepreneurs who raise cattle in feed-lots, a concept introduced from overseas in the early years. We have developed new breed of beef cattle named Brahmas, a cross-breed between imported Brahman and local Kedah-Kelantan breed. Buffaloes are also now selected for meat purposes. A sheep named Malin, a cross between Australian and Indonesian breeds was
also developed to increase local supply of mutton. The Boar goats, a South African breed, are also being raised in large numbers for the same purpose.

Poultry industry is very advanced; we are able to produce broilers and eggs to meet not just the nation’s demand but also for the export market. The fowl pox and the Newcastle disease vaccines designed at UPM are now marketed internationally, while the vaccine against the infectious bursal disease is expected to be available soon. Researches on deer and ostrich have been undertaken by UPM and MARDI to provide alternative meat resources.

**Fisheries**

The fisheries industry, particularly deep sea fishing and aquaculture have receives government incentives to further commercialise and to establish economy of scale by consolidating small ventures. Aquaculture is the cultivation of natural produce of water (fish, shellfish, algae and other aquatic organisms). Also known as aquafarming, the term is distinguished from fishing by the idea of active human effort as opposed to simply taking them from the wild. Subsets of aquaculture include fish farming (raising of fresh water and brackish water fishes, lobsters and prawns in ponds), mariculture (aquaculture in the ocean which includes raising of mollusks), algaculture (production of algae and seaweeds) and the growing of cultured pearls. Species of fresh water fishes include river carp, catfish, giant fresh water prawn, tilapia and carp, while brackish/marine fishes include sea bass, tiger prawn and crabs. The government has set the target for fish production of 1.7 million tons by 2010 from the current 980,000 tonnes annually, of which 7% comes from aquaculture. Fishes produces about 60% of the animal protein intake of the country.

The government is encouraging locals to adopt aquaculture by constructing ponds and raising fishes in net cages in rivers, lakes and sea shores. Research has been done on the use of probiotics in improving cultivation of fish and prawns. A rapid detection kit has been developed to detect white spot syndrome virus (WSSV) disease in prawns. Modern technology has been promoted to enhance production while looking into the implication of the environment. Biotechnology is low-key at the moment but will be promoted extensively in the future.

The government has undertaken efforts in unifying individual entrepreneurs by forming consortia to venture into mega-commercial fishing. Mega-fishing ports that manage integrated processing complexes have been constructed in Penang and Sarawak. This will secure economy of scale, modernize operations, enhance ventures into export markets and attract processing of foreign catches in Malaysia.

**Fruits, Flowers and Vegetables**

Research has been conducted to improve commercial production of banana, pineapple, papaya, starfruit, mango, durian, guava, watermelon, jackfruit, rambutan, citrus, duku langsat/dokong, cempedak, ciku and mangosteen. Flowers such as orchids is a growing
industry. Tissue culture is now used for mass-production of orchid seedlings which are even exported. The vegetable industry has recorded a growth of 7.2% annually. Research on all these commodities have focused on yield increase, optimise usage of fertilizers, water, and new strains together with pest and disease control. Mushrooms which are strictly fungi but considered as “vegetables” is a growing industry in Malaysia. Research has focused on production biotechnology, cultivation of new species and novel mushroom products.

**Bioagents**

Innovations using biological organisms can be found in the form of biofertilizers such as *Rhizobium* and biocontrol agents. UPM has formulated naturally occurring antagonistic fungi effective against fungal diseases of vegetables. Research on cocoa has recently come up with a bacterial formulation that can significantly suppress black pod disease, while species of predatory mites have been successfully mass-reared for the control of phytophagous mites.

**Precision Agriculture**

This is a new innovation in agriculture. It is also known as “site specific management”. This approach has initially attracted the interest of the plantation sector. It utilises ICT and electronic tools to determine localities (micro-niches) that require specific amounts of fertilizer, pesticide, etc. In the long run it can save management cost and increases yield. Precision agriculture is being practised partly in oil palm and padi growing areas.

A novel precision integrated system for real-time mapping tractor-implement field performance has been assembled which can also record the implement’s geo-position in the field with respect to the tractors measured performance.

### 7.2 Future challenges in agriculture

There are several challenges now facing the agriculture industry:

**Labour**

There is a dire shortage of labour in Malaysia. In agriculture there is great dependence of foreign labour with some estates employing 100% foreigners particularly those from Indonesia and the Philippines. Local youths are less interested in agriculture, preferring to work in factories and offices where they receive higher remunerations and access to city life. Cost of labour has been rising steadily. However, as a transitional measure, the government still adopt a liberal policy on the recruitment of foreign workers for the agricultural sector until such time when a comprehensive foreign labour policy is formulated.

**Price**

Increase in the price of fertilizers, seeds, tools and equipments has affected the cost of agricultural production. Market price is also elastic and problematic at times especially when there is a sudden drop in commodity price.
**Crop Choice**

Big Conglomerates are not interested in agriculture other than planting oil palm and rubber. Not many large companies are involved in food crops.

**Agricultural Technology**

The benefits from prospecting and developing the potentials and applications of new and frontier technologies are yet to be realized. Among these are: a) the use of plant cell and tissue culture techniques as well as genetic engineering to complement conventional plant breeding in developing new crop varieties, b) the use of plant cell cultures to enhance the development of new and innovative products including metabolites such as pharmaceuticals, nutriceuticals and food additives, c) the application of embryo manipulation technology and the use of genetically engineered vaccines to strengthen existing technologies for increasing animal productivity, d) the incorporation of robotics and artificial intelligence as well as computer modeling, including expert systems and computer simulated scenario analysis, and microprocessor control in machinery and automation equipment to reduce labour, and e) the application of advance processing and packaging systems to strengthen and enhance conventional and traditional techniques for better post-harvest handling and storage and longer shelf-life of agricultural products.

**Resources**

There is keen competition for resource use in the future between agriculture, forestry, industry, residential buildings, wildlife, recreational establishments, and water catchments. Resources have to be carefully managed in order that agriculture could be sustained. The main challenge in the future is to enable continuous crop production with high yield per unit area. Unfortunately, intensification of agriculture will result in excessive agrochemical inputs which contribute to soil degradation. Therefore, agricultural practices on arable soils must be productive, environmental friendly and sustainable. This calls for efficient water, fertilizer, soil conservation management and new technologies such as precision farming.

Land development will slowly encroach into fragile soils, especially peat and steep lands. This results in soil degradation, example soil shrinkage due to over drainage in peat soils, and soil erosion in steep lands after heavy rainfall. Remedial measures include cultivation of ecofriendly crops.

Water resource management is also an important issue as only 2.1% of the country's heavy rainfall is being used currently. This low rate of water harvested is partly due to seasonal distribution of rainfall, where water excess causes flooding and need to be drained off. More water storage dams, where possible, should be constructed to reduce water losses. Water resources should also be managed at the national level as presently it is under individual state jurisdiction.

Land development therefore has to be properly managed which involves multiple objectives decision making. An environmental impact assessment (EIA) has been made mandatory to anyone who intends to develop land commercially, including large scale agricultural development.