CHAPTER 1

Introduction and Scope of Modern Agriculture

1.1 Definition of agriculture

Agriculture can be defined as the utilisation of natural resource systems to produce commodities which maintain life, including food, fiber, forest products, horticultural crops, and their related services.

It involves farming; the art and science or practice of cultivating the soil, systematic production of crops for food and rearing of livestock including poultry for source of protein as food and also fiber (wool and hairs) and skin for human use. Modern agriculture is a business; it is not only the production, but also the processing of produce into food and non-food items. For example, in oil palm the primary produce is the palm oil. The oil can be processed into many other food items, pharmaceuticals and industrial products, and recently into biofuel; similarly with rubber, cocoa and herbal plants.

There have been continuous improvement in the approach to today's agricultural development worldwide in the aspects of the production methods, technology adopted to increase the efficiency of production and input of appropriate resources such as research and knowledgable human capital including scientists, inventors, engineers, chemists and economists although many have nothing to do with food production. Modern agriculture incorporates many disciplines of sciences such as agronomy, horticulture, breeding, genetics, entomology, pathology, soil science, environment science, livestock management, pasture management, meat science, dairy science, biotechnology, engineering and many more.

Current farming also adopts some non-traditional agricultural practices such as soilless culture or hydroponics in which high value plants are grown in chemical nutrient solutions. The food safety, processing, packing, marketing, traceability and logistics of agricultural produce are closely related activities which are also important aspect in modern agriculture.

1.2 Importance of agriculture

Malaysia is currently a major player in research of tropical agricultural products. It strives to continue to enhance excellence in research and development of new agricultural industries and products from its primary commodities and natural resources. Developing new industries from its rich natural resources will assist in the industrialization of the nation, whilst developing new high value products from the agricultural commodities as well as agricultural waste and by-products would further improve Malaysia's productivity and global competitiveness. Creating new markets for our products will assure the continued significant contribution of the agricultural sector to export earnings. Pursuing integrated agroforestry development and good sustainable agricultural and forestry practices will ensure an ecologically balanced development, whilst increasing the production of major food products which are cost competitive will enhance food security and enable Malaysians better access to quality food at affordable prices.

To achieve excellence in agriculture, human resource development especially in new and emerging areas of agricultural science as well as professional farm managers to run large-scale mixed farming enterprises are essential. Emphasis will therefore be put
towards developing those expertises. The Malaysian government has always provided the environment for the development of the agricultural sector to be private sector-driven. The public sector will facilitate and enhance the delivery of support services to the private sector enterprises, farmers and fishermen to achieve their business and income objectives. Likewise, state governments have to play a prominent role to support private sector needs as land is under their purview.

At least 40% (2002 estimate) of the world’s population is employed in agriculture, making it the most common occupation. Asia’s share of the agricultural labour force reached 80% (India & China = 60%), Africa has 14%, Europe less than 10%, Latin America at about 3.5%, while North America barely exceeds 1% (highly mechanised farming).

Traditional farming, sometimes referred to as subsistence agriculture, ensures the production of enough food to meet the needs of the family. This form of agriculture is practiced particularly in many under-developed countries (majority of which are in the African continent), where survival can be a day to day affair. In the developed and industrialized countries and increasingly so in the more advanced developing countries like Malaysia, farming is an industrial intensive agriculture producing raw materials such as rubber, palm oil, cocoa, fish and livestock for the industrialized nations.

Generally, a government is very much dependent on agriculture in difficult times such as drought and other natural calamities to maintain socio-political stability. Those are days when food can become very scarce and as such a country must undertake certain measures of food stock-pile as a form of food security.

More recently, income is further derived from the transformation of agricultural wastes into feeds and fertilizers (organic farms), and oil palm wood press, and high value wooden tiles (water-proof). Environmental pollution is one of the negative aspects of agriculture. Soil conservation and nutrient management have been important concerns since 1950s; however, increasing contamination of the soil and the environment has, for example, polluted the waterways and wetlands with (1) nitrogen and phosphorus from the inorganic fertilizers and (2) pesticides and other biocides have affected the biodiversity of plants and animals.

1.3 Agricultural systems and practices

Practices in agriculture can be broadly categorised into: (a) subsistence farming (b) commercialised farming.

1.3.1 Subsistence Farming

This is a farming system characterised by a low input with a resultant low yield, and intercropping. Practices may involve slash and burn (nomadic) and more progressive stationary cultivation. Subsistence farming involves working on a plot of land to produce only enough food to feed the household (family) working on it. Success of the farming is strongly dependent on fertility of soil, climate, tools and techniques, agricultural practices and available crop types. The system produces enough food to sustain the family in their normal daily activities, but no surplus to sell or store for later use.

Although it does not promote accumulation of capital, subsistence farming requires lesser working hours. As such, it provides the family with only the necessities to live a healthy and comfortable life without the stress as in modern day living.
Shifting cultivation

It is the most primitive form of Subsistence farming and still being practiced in the tropics. As the soil fertility wanes, farmers abandon the lot and a considerable fallow period ensues. An improvement over shifting cultivation is one in which a family works permanently on a plot of land. This type of land develops from one that has undergone a slash and burn type of cultivation. The soil nutrient utility is inherently poor thus offering scant yields. Under such conditions, repeated cycles of poor harvests result in food scarcity and possibly famine.

Socio-economic conditions may lead a reduction in a farm plot when inheritance tradition requires that a plot be split among the children. However, when a government policy dictates large-scale farming with external inputs, the social fabric of rural society is undermined forcing farm families to migrate to cities.

Raising domesticated livestock for food and small profit, mostly limited to free-range and small enclosures, is now practiced. Examples could be seen in the case of rearing fishes in small ponds and paddy fields, and the raising of pigs, ruminants (cows, goats, sheeps) and poultry in makeshift sheds.

Subsistence farming (as of 2006) is still practiced in many countries in Africa (Benin, Botswana, Congo, Guinea, Rwanda, Madagascar, Sierra Leone and Zambia), Central and South America (Mexico, Ecuador and Bolivia), Europe (Yugoslavia and Albania), Polynesia (Papua New Guinea and Vanuatu) and South East Asia (Sarawak, Indonesian Borneo, Laos, Cambodia).

1.3.2 Commercialised Farming

In plant agriculture, it is characterised by monoculture or a cultivation of a combination of a few crops (examples: oil palm and rubber). It requires the use of high yielding modern varieties, application of chemical in the forms of pesticides, weedicides and fertilizers), high technology and extensive mechanisation.

In animal production, similar characteristics are observed. There are continuous development of new or improved breeds of animals that are able to produce more meat, milk, egg, wool, and yield. Much of the successful development in the animal sector is seen in the poultry (broiler and layer chicken). Genetically improved animals are more efficient in using feed, meaning that they consume less, but yield more products. Similar trend is seen in fish farming where aquaculture (freshwater or marine cultures) becomes much more important in the near future because the wild catch from the sea, rivers or lakes tend to reduce due to overfishing and destruction of their natural habitat for breeding.

Examples of commercial farming are discussed below:

Tropical plantation agriculture

It is solely a monocropping system dominated by perennial crops which include rubber, oil palm, cocoa, coffee, coconut and tea. It is suitable for the humid tropical climate. Their products are typically utilised as raw material in industrialised nations. Malaysia utilises some of these raw materials for her own industries. In fact in the case of cocoa, shortage of raw beans necessitates import from Indonesia and New Guinea. For downstream
processing, such as palm oil extraction, large industrialised companies conduct their operations on site. Further processing of the extracted oil into value added products such as margarine and carotenes are conducted at factories elsewhere.

**Vegetable Farming**

It is labour intensive and involves specialised cultivation in rows and blocks (beds), open or enclosed. The use of machinery has increase efficiency and output. The diversity of vegetable crops requires the use of various techniques to optimise yield. Due to market demand for fresh vegetables, ripening technologies and refrigeration have been developed to reduce the problems with getting produce to market in good condition.

i. **Organic farming**

Organic farming works based on naturally occurring biological processes. This involves using techniques to achieve good crop yields without harming the natural environment or the people who live and work in it. It relies on techniques such as crop rotation, green manure, compost and biological pest control to maintain soil productivity and control pests on a farm. Organic farming excludes or strictly limits the use of manufactured fertilizers, pesticides (which include herbicides, insecticides and fungicides), plant growth regulators such as hormones.

ii. **Soilless culture system**

Soilless culture is an artificial means of providing plants with support and a reservoir for nutrients and water. It is the technique of growing plants without soil. The simplest and oldest method for soilless culture is a vessel of water in which inorganic chemicals are dissolved to supply all of the nutrients that plants require. Today, soilless culture methods can be classified as either solid- or liquid-medium systems.

The most common liquid system in use today is nutrient film technique (NFT). Other techniques available include such as aeroponics and deep or floating culture.
In the case of NFT, plants are grown in channels into which the nutrient solution is pumped constantly. Plants are kept moist by the thin film of nutrient solution as it passes by. This technique is susceptible to power outage and pump failures. The aeroponics is probably the most high-tech type. Plants are grown with their roots suspended in a mist of nutrient solution delivered by a mist sprayer controlled by a short cycle timer. In deep culture the plant roots are suspended and allowed to hang down on floats into aerated nutrient solution.

![Diagram](image)

Deep or Floating Technique  Aeroponic

Solid-medium soilless culture may employ any one of many types of suitable media in various types of containers. Basic requirements are a material of uniform texture that drains well yet retains some nutrients and water, a container in which the material is confined, and a means of supplying nutrient solution. The materials include sand, gravel, vermiculite, rice hulls, coconut husk, peat moss and sawdust are commonly used as growing or supporting medium. Nutrient and water are normally supplied through drip irrigation system.

In soilless culture system, plants are grown in a controlled environment and arranged at a higher density. Often higher quality is achievable in lesser time. There is little likelihood of soil-borne diseases, weeds to pull or soil to till. Since it is a water-efficient system, only a small fraction of water is used compared to traditional farming.

**Aquaculture**

It is a purposeful cultivation of aquatic organisms as opposed to simply catching them from the wild. Aquaculture includes mariculture (culture in the ocean), algaculture (production of kelp/seaweed and other algae), fish and prawn farming (raising of catfish, tilapia and prawns in fresh water tanks/net-pans/ponds or salmon in marine enclosures) and the growing of oysters and cultured pearls. In special cases, semi-aquatic animals such as crocodiles, frogs and snails can also be raised in tanks and ponds.

**Livestock farming**

It involves raising livestock (domesticated animals intentionally reared in agricultural setting) to make products such as food or fibre, or for its labour. Raising animals (animal husbandry) is an important component of modern agriculture. Domesticated animals include cows, goats, pigs, sheeps, horses and poultry. Livestock are generally kept in an enclosure or allowed to roam freely (free rangeland).
**New products and future industries**

As envisaged in the Third National Agricultural Policy (NAP3), the development of biotechnology products, extraction of specialty natural chemicals from biological resources and utilization of oil palm biomass are emphasized to create new higher value industries. Examples include recreational fishery, agroforestry, herbal farming, mushroom cultivation and agrotourism.

1.4 Products of agriculture

The primary products from the agricultural industries can be broadly categorized into two: (1) Food products (animal and plant origin) and (2) non-food products (animal and plant origin). Many of these raw agricultural products undergo further processing usually on industrial scale to produce varieties of products for human (food and non-food) and animal (as feed) use. Therefore, the finished products are primarily sourced from either plants or animals.

**Plant Origin**

Beside direct consumption, fruits are often processed into juices, cordials, jems and jelly, herbal and health products. Some are preserved such as pickle and dehydrated (low moisture) products. Other sources processed include rice, sugar, spices, cereals, tomatoes, chillies and cocoa. Foods could also be packed, canned or bottled as in the case of candies, ketchup, cookies, crisps and many others as could be seen on the supermarket shelves.

Timber can be processed into furniture and building materials. Rubber latex can be turned into numerous products such as automobile tyres, gloves, shoes and condoms; palm oil is used for making margerines, toiletries, cosmetics, carotenes and biofuel; cotton and linen are processed into apparels.

**Animal Origin**

Food of animal origin is an important source of protein. Meats (from all livestock and poultry) are processed into several products such as burgers, sausages and nuggets. Fish are dried, salted or canned such as sardines. Dairy produced can be processed as powders, canned milk, cheeses and fermented beverages. In fact there are numerous products that are processed and consumed in different forms in different countries and communities.

As non-food products, the skin is processed into leather that is an important industry in many countries. Leather has numerous uses such as cover of car seats, home furnitures, footwear, belts, jackets and handbags etc. Farm animals such as sheep and goats, besides producing meat also produce fiber (wool and hairs) that is used mainly in the cloth and carpet making industries. Silk from the sericulture industry is another important agricultural industry. Natural silk is produced from the rearing of silkworm that only feed on mulberry leaves. It is an important industry in many countries particularly China, India, Thailand, Japan and Korea.