Golden Rice!

- Millet rice does not contain beta-carotene.
- Vitamin A deficiency afflicts over 200 million children and women.
- About 500,000 children go blind (or every hour).
- 2 million children under 5 years die each year.

Image: Portrait of Assoc. Professor Dr. Tan Yee How and Farmer (Germans).
CHAPTER 1

INTRODUCTION

&

SCOPE OF MODERN AGRICULTURE
MALAYSIA

• Major player in tropical agricultural research

• Primary agro-production: oil palm and rubber

• Industrialization: downstream processing for high value-added products

• Important for food security

• Private sector participation apart from government
Definition of Agriculture:

Utilization of **natural resource systems** to produce commodities which **maintain life**, including: **food, fiber, forest products, horticultural crops**, and their related services.

It involves **farming**:
- art and science of cultivating soil
- systematic production of crops for food, feed, fiber
- raising livestock
- protecting land from deterioration and misuse.
Modern agriculture

• Modern agriculture is a business.

• Apart from primary production, it also involves secondary processing of agricultural produce into food and non-food products.

• For example, with oil palm, the primary produce is palm oil, then the oil can be processed into food, pharmaceuticals and industrial products including recently, biofuel.

• Similarly with rubber, cocoa, etc.

• Involves specialists such as scientists, inventors and engineers
Modern agriculture (cont’d)

• Depends heavily on engineering/technology, biological and physical sciences:

  Agronomy, horticulture, plant breeding and genetics, entomology, pathology, soil science, dairying, animal husbandry, agricultural chemists, engineers, agricultural economics, etc.

• Present-day farming also adopts soil-less gardening (hydroponics) using chemical nutrient solutions.

• Packing, processing and marketing of agricultural products are other closely related activities.

• Food preservation, quick-freezing and dehydration have helped increase the markets.
TOPIC 2: Importance of agriculture

- 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 reaches 80%:
  - India & China - 60%
  - Africa - 14%
  - Europe - 10%
  - Latin America - 3.5%
  - North America - 1.0% (highly mechanized)
• Traditional farming: subsistence agriculture, the production of enough food for family needs

• This is especially the case in many underdeveloped (African continent) countries where survival can be a day to day affair.

• However, in developed and industrialized countries farming is an industrial intensive activity, producing raw materials (primary) for industrialized nations and engaging in downstream (secondary) processing

• For socio-political stability, a country must maintain a food stock-pile as a form of food security, in difficult times such as drought and natural calamities
• More recently, income is derived from transformation of agricultural wastes into feeds and fertilizers (organic farms).

• Negative aspects: environmental pollution:
  - contamination of environment with (1) nitrogen and phosphorus from inorganic fertilizers, and (2) pesticides and other biocides. All these have affected the biodiversity of plants and animals.
TOPIC 3:
Agricultural Systems/Practices

Broadly categorized into:

• Subsistence farming

• Commercialized farming.
Subsistence farming

- Characterised by low input/low yield, usually inter-cropping and slash and burn (nomadic, shifting) or stationary.
- Involves working on a plot of land to produce only enough food to feed the family working on it. Little surplus.
- Success is highly dependent on the climate, soil conditions, the agricultural practices and the types of crop grown.
- No capital accumulation but fewer working hours, less stress.
Subsistence farming (cont’d)

• **Shifting cultivation** is the **most primitive**, still being practiced in the tropics; farmers typically **abandon** a plot when **soil fertility wanes** and a considerable **fallow period** follows.

• **Sedentary farming** involves working on lands that have been slashed and burned; the **soil nutrient quality is inherently poor** thus offers scant yields.

• Unfortunately, under such conditions, years with poor harvests result in food scarcity and famine.
Subsistence agriculture
Subsistence agriculture
Subsistence farming (cont’d)

• Socioeconomic conditions may prevent an expansion of farming plot: inheritance requires split of a plot

• However, social fabric of rural society is undermined when government policy favours large-scale farming, forcing migration to cities.

• Raising domesticated livestock is limited to small enclosures, eg. fish in small ponds and paddy fields, and free-range (roaming) for cattle
Subsistence farming (cont’d)

Examples of countries practizing subsistence farming (as of 2006):

• **Africa** - Benin, Botswana, Congo, Guinea, Kikuyu, Madagascar, Rwanda, Sierra Leone, Zambia

• **Central and South America** - Mexico, Ecuador, Bolivia

• **Europe** – Yugoslavia, Albania

• **Polyneisa** - Papua New Guinea, Vanuatu

• **SE Asia** – Sarawak, Kalimantan, Laos, Cambodia
Commercialized farming

Characterized by:

- **Monoculture** or a combination of a few crops:

- **High yielding modern** varieties

- **Large chemical inputs** (pesticides, fertilizers, feeds)

- **High technology**

- **Mechanization**

- Examples include:
1. **TROPICAL PLANTATIONS (ESTATES)**

- **Monocropping** - dominated by *perennial* plants, well known are rubber, oil palm, cocoa, coffee, coconut, tea, etc.;

- Raw material *mostly exported to industrialized nations* for value-added processing.

- However, **Malaysia** is utilizing these primary commodities for her own industry.

- **Palm oil** has been converted into *margarines* and extracted for its *carotenes*.

- **Rubber** has been used in the manufacture of *gloves, tyres, condoms, shoes*

- **Coffee** has been processed as *beverages and cocoa* for *chocolates*. In fact in the case of cocoa, **Malaysia** is importing raw beans from Indonesia and New Guinea for *local processing*. 
Commercial agriculture
Commercial agriculture
2. VEGETABLE/FRUIT/ORNAMENTALS FARMING

- Specialized production system in rows and blocks (beds), open or enclosed

- **Diversity** of vegetable crops requires use of various techniques to optimize yield.

- Development of **ripening technologies** and **refrigeration** has reduced the problem with getting fresh produce to market.

- Apart from vegetable farms, **fruit orchards** and **flower nurseries** operate along similar lines.
3. ORGANIC FARMING

- Production system that avoids synthetically compounded fertilizers, pesticides, growth regulators, and feed additives.
- Relies on crop rotations, animal and green manures, and biological control measures.
- Avoids excessive depletion of soil nutrients.
- Also known as alternative farming, biological farming, regenerative farming and sustainable farming.
Organic cultivation of mixed vegetables. Note the **hedgerow** in the background.
4. **HYDROPONICS**

- A technique of growing plants *without soil*, taking advantage of the fact that plants absorb nutrients as simple ions in water.

- Plants can be grown in a *more controlled environment*, and *more* can be produced since plants can be placed at a higher density.

- Produce are often of *higher quality* and harvested in a *shorter time*.

- There is *no soil-borne diseases*, weeds to pull or soil to till.

- It is a *water-efficient system* since only a small fraction of water is used compared to traditional farming.
4. HYDROPONICS - Techniques available include:

- **Passive hydroponics** (plants grown in containers of nutrient solution on medium such as perlite, vermiculite, clay granules, rockwool, gravel)

- **Deep water culture** in which the plant roots are suspended and allowed to hang down into aerated (with aquarium pump) nutrient solution

- **Nutrient film technique (NFT)** where the plants grow through light-proof plastic films placed over shallow, gently sloping channels along which a steady flow of a thin film of nutrient solution is maintained such that roots grow into dense mats,

- **Aeroponics** where the plant roots are suspended in a mist or fine fog of nutrient-rich solution.
5. **AQUACULTURE**

- **Purposeful** cultivation of **aquatic organisms**.

- Includes **mariculture** (ocean), **algaculture** (kelp, seaweed), **fish and prawn farming** (raising catfish, tilapia and prawns in fresh water ponds or tanks), **oysters and cultured pearls**, **semi-aquatic farming** (crocodiles, frogs, snails)

- Breeding of **ornamental fishes**.
6. **LIVESTOCK FARMING (ANIMAL HUSBANDRY)**

- Raising livestock for **food, fibre, labour**

- In **sheltered enclosures** such as chicken, cattle, pigs, goats.

- **Free range** (roam freely) such as chicken, cattle and deer.
Sheltered enclosure vs free-range
7. **NEW PRODUCTS AND FUTURE INDUSTRIES**

- **Mushrooms** cultivation
  - Lowland farms: *oyster, abalone, lingzhi* mushrooms;
  - Highland farms: *shiitake* mushroom

- **Herbal farms** and **health foods**

- **Speciality natural chemicals** eg carotenes

- **Recreational fishing**
Shiitake mushroom

Oyster mushroom

Button mushroom
Eurycoma longifolia – Tongkat Ali
TOPIC 4: Downstream Processing

1. Food processing – sourced from plants or animals

2. Industrial processing – sourced from plants and animals
Food processing – from plant sources

- **Fruits and spread** - canned juices, cordials, jams & jellies, pickled, dehydrated fruits, margarine
- **Cereals** - rice, wheat as foods
- **Crispies** - tapioca, banana, mushroom, potato
- **Beverages** – chocolate from cocoa, alcohol from barley
- **Bottled and canned food** - tomato, chilli, oil
Food processing – from animal sources

• **Frozen ready-to-eat meals** – burgers, sausages, nuggets

• **Processed fish** – dried, salted, canned (sardines)

• **Dairy** – powders, milk, cheeses, fermented beverage (yoghurt)
Industrial processing – from plant sources

• **Palm oil** – toiletries, cosmetics, carotenes, biofuel

• **Rubber latex** – tyres, gloves, shoes, condoms

• **Timber** – furniture, building materials

• **Cotton, linen** - clothings
Industrial processing – from animal sources

Leather and silk – clothings, footwear, belts, handbags, wallets