AGRICULTURE AND MAN (PRT 2008)
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Golden Rice!
- Milled rice does not contain betacarotene
- Vitamin A deficiency afflict over 250 million children and 250 million adults
- About 500,000 children go blind (60 every hour)
- 2 million children under 5 years die each year

Ingo Potrykus (Switzerland) and Peter Beyer (Germany)
CHAPTER 1

INTRODUCTION

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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 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.
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.
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**
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** - canned juices, cordials, jams & jellies, pickled, dehydrated fruits, margarine
- **Herbal & health products** – eg tongkat ali
- **Cereals** - rice, wheat as foods
- **Crispies** - tapioca, banana, mushroom, potato
- **Beverages** – chocolate from cocoa, alcohol from barley
- **Bottled sauces** - tomato, chilli
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