1. Introduction & Scope of Modern Agriculture

2. Transformation of Agriculture - Agricultural Evolution

3. Transformation of Agriculture - Agricultural Revolution

4. Agro-Ecological System - Basic Agricultural Resources and the Environment

5. Genetic Resources in Agriculture

• 30 Objective Questions
FINAL EXAMINATION
REMINDER !!!

MAKE SURE YOU SHADE CORRECTLY YOUR MATRIC NO! You will get ZERO mark if your matric number is not read by the OMR reader resulting in your number not appearing in the Result printout.

(Do not shade the ‘space’ between the ‘J’ and numerals in your matric no.)

Make sure you have your name and matric number written correctly on your OMR form.
• All Chapters with emphasis on Chapters 6-9, 40 questions)

• Format of the examination is the same as that of the Mid-Semester examination (English, objective choice questions)

• Use of a dictionary is NOT allowed
CHAPTER 6A
Sustainable Agriculture

CHAPTER 6B
Agricultural Practices in Malaysia

CHAPTER 7
Economics of Agricultural Development (Agriculture and the Malaysian Economy)

CHAPTER 8
Innovation & Challenges in Agriculture

CHAPTER 9
Approaches to Agricultural Development in Malaysia
CHAPTER 6A

SUSTAINABLE AGRICULTURE

- Economic development (E)
- Environmental conservation (E)
- Socio-political benefits (S)
Sustainable farming systems are capable of maintaining their productivity and usefulness to society indefinitely.

They must be:
1. Economically competitive (E)
2. Environmentally sound (E)
3. Socially supportive (S)
1. ECONOMICALLY COMPETITIVE
Selecting Profitable Enterprises to Ensure Economic Sustainability

Explore income opportunities other than traditional crops and practices such as:

Growing alternative crops like herbs and mushrooms
– Mixed plant and animal farming

– Contract growing of seeds for vegetable, rice and specialty crops

– Organic farming

However some of these involve niche markets
2: Environmentally Sound
Environmental conservation involves keeping in good condition the 4 ecosystem processes:

- Energy flow \((E)\)
- Water cycle \((W)\)
- Mineral cycle \((M)\)
- Ecosystem dynamics \((E)\)
Energy Flow

- Energy flow is the non-cyclical path of solar energy (sunlight) going into any biological system.

- The natural world runs on sunlight. Our management decisions affect how much of it is captured and put to good use on the farm.

- Sunlight is the ultimate energy source
Water Cycle

An effective water cycle is typified by:

1. little soil erosion
2. fast water entry into the soil
3. the soil's capacity to store large amounts of water.

Goal is to get as much water as possible into the soil during each rainfall.
Mineral Cycle

• In nature, minerals needed for plant and animal growth are continuously recycled within the ecosystem and there is no need for added fertilizer.

• Conditions and practices that inhibit the natural mineral cycle - erosion, nutrient leaching, organic matter depletion reduce the farm's sustainability.
Ecosystem Dynamics

An effective ecosystem dynamic is indicated by high diversity of plants and animals above and below ground.

Examples of increasing diversity: intercropping and crop rotation
Intercropping

- Increases crop species and therefore biodiversity eg strip cropping of wheat and soybeans, bananas and pineapples

- Some insects can recognize rows of green plants separated by brown soil but not one uniform green expanse of plants and intercrops; or carrots intercropped with onions mask smell of carrots from flies.
Crop rotation

- Increases biodiversity
- breaks weed and pest life cycles
3: SOCIO-POLITICAL BENEFITS
Social benefits are provided for the farm family and community in terms of:

- food security
- land tenure
- good health
- maintaining the fabric of rural communities.
- keeping money within the local economy
CHAPTER 6B

AGRICULTURAL PRACTICES IN MALAYSIA
• **Major development in pre-independent Malaya:** Introduction of rubber by H.N. Ridley and the development of plantation agriculture.

• **Malaysia became world’s top rubber producer**
• Apart from rubber, tea plantations such as Boh Tea, were also established on Cameron highlands.

• Later on, other crops such as cocoa and coffee were also grown.

• However most locals were still practising subsistence agriculture producing rice, fruit and other food crops
• Post independence (1957-1970): Government set up the Federal Land Development Authority (FELDA) and the Federal Land Consolidation and Rehabilitation Authority (FELCRA).

• Enabled huge tracts of land to be cultivated with plantation crops by settlers.
Smallholders were encouraged to switch from subsistence crops to cash crops such as rubber and oil palm.
• 1984 onwards: Agricultural development was driven by the National Agricultural Policies (NAPs).

• 1\textsuperscript{st} NAP (1984-1991)

• 2\textsuperscript{nd} NAP (1992-2010)

• 3\textsuperscript{rd} NAP (1998-2010)
• Malaysian agricultural land use dominated by perennial industrial crops, chiefly oil palm, rubber, coconuts, cocoa, coffee and tea.

• Oil palm and rubber alone occupies more than 80% of the agricultural land area.
1. OIL PALM

- Oil palm (*Elaeis guineensis*) occupies the largest area (≈ 60%) among crops in Malaysia and palm oil is the top foreign exchange earner among all agricultural commodities.

- Malaysia accounts for 39% of the world’s palm oil production.

- Oil palm can be harvested 25-30 months after planting. Economic life of the oil palm tree is about 20 years.
2. RUBBER

• Rubber (*Hevea brasiliensis*) was the 1\textsuperscript{st} major plantation crop introduced into Malaysia in 1877 from Brazil

• Rubber was then mainly planted by plantations including Harrison & Crossfield, Boustead, Sime Darby and Guthrie.

• Rubber was the dominant plantation crop for eight decades up to 1989, when oil palm (1.59 million ha) overtook rubber (1.55 million ha).
3. RICE

• Rice is the staple food of most Malaysians.

• Total area: Rice is the 3\textsuperscript{rd} largest agricultural crop in area planted after oil palm and rubber.

• Currently, rice growing is concentrated in eight granary areas in Peninsular Malaysia, the most productive in Tanjung Karang.
• Rice is a highly subsidized crop.

• Rice growers are given subsidies for purchase of seeds, fertilizers, herbicides and insecticides. Prices are guaranteed for growers and controlled for consumers.

• Currently, Malaysia produces around 72% of rice consumed but targets for full sufficiency by 2015.

• Average yield per ha of rice is 3.6 tonnes.
4. COCONUT

- Coconut ranks the 4\textsuperscript{th} fourth most important crop in terms of area planted after oil palm, rubber and rice.

- Rise of oil palm as the major cooking oil is one factor that caused a decline in coconut planting.
5. COCOA

• Most plantations are in Sabah but most of the processing in Peninsula Malaysia.

• Over the years, planting area has been reduced nearly 90% because of pests and poor cocoa price.

• However the processing sector has seen tremendous growth.

• Malaysian cocoa products (such as cocoa powder and chocolate) are exported to over 80 countries.
6. TEA

- Major tea growing area is Cameron Highlands
- Main type of tea produced in Peninsula Malaysia is black tea.
7. COFFEE

- Mainly grown in Johor and Selangor.
- Major type of coffee grown is Liberica coffee which is favoured by the local consumers.
8. SUGARCANE

- Sugarcane is planted for processing into sugar only in Perlis and Kedah.

- Suitable because distinct dry seasons enable sugarcane to mature and accumulate sugar.

- Local sugar production satisfies about 10% of domestic demand.
9. FRUITS

Over 375,000 ha. planted with various tropical fruits, excess of which is exported. We import temperate fruits.
10. PINEAPPLE

- Pineapple industry is the oldest agricultural export crop.
- For economic reasons, pineapple farmers have changed to other crops particularly oil palm, which brings more income and use less labour.
11. VEGETABLES

- Vegetables are smallholder crops in Malaysia, with average farm size less than one hectare

- Johor is the largest supplier of tropical vegetables while Cameron Highlands is the traditionally supplier for temperate vegetables
12. FLORICULTURE

- About 50% of floriculture production is located in Johor

- Orchid is the flower most commonly grown
13. LIVESTOCK PRODUCTION

- Malaysian livestock production is characterized by two subsectors: Non-Ruminant and Ruminant

- **Non-Ruminant** comprises **Poultry** and **Swine** production:
  - *highly commercialized* with total supply more than enough to meet domestic demand, excess exported
• Ruminant subsector is operated by smallholders with self-sufficiency levels for beef and mutton at 28% and 10%, respectively.

To reduce importation, the government has targeted to increase beef production to 40.6% self-sufficiency by 2015.
14. AQUACULTURE

- Aquaculture sector is an important supplier of animal protein.

- Aquaculture is the farming of aquatic organisms including fish, mollusks, crustaceans and aquatic plants.
NEW SOURCES OF GROWTH FOR MALAYSIAN AGRICULTURE: Herbs & Spices, Pharmaceuticals, Natural Products

Some common species include tongkat ali (*Eurycoma*) and misai kucing (*Orthosiphon*)
MARKETING

• Retail shops and hypermarkets

• FAMA (Federal Agriculture Marketing Authority)
CHAPTER 7

ECONOMICS OF AGRICULTURAL DEVELOPMENT (AGRICULTURE AND THE MALAYSIAN ECONOMY)
• Contribution of agriculture to Malaysian economy

• International trade in agriculture
Contribution of Agriculture to GDP has declined from 31% in 1965 to 9% in 2010.

However continued importance:
1. earn foreign exchange through exports of palm oil, rubber and fruits
2. contribute to employment
3. ensure food security.

9th Malaysia Plan emphasizes agriculture as the third engine of growth
Characterized by a dualistic system:

- Plantation (estate) sector and
- Smallholder sector.
• **Plantation:** single crop with land area of more than **40 ha.**

Crops such as **rubber, oil palm, coconuts, cocoa, pineapples** and **tea** are planted.
• Smallholdings are small areas below 40 ha, typically between 0.4 - 4 ha.
• Production capacity is low due to limited technology and poor management practices.
### Agricultural land use (hectares)

<table>
<thead>
<tr>
<th></th>
<th>1995</th>
<th>2000</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Industrial Crop</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubber</td>
<td>1727000</td>
<td>1430700</td>
<td>1301500</td>
</tr>
<tr>
<td>Oil Palm</td>
<td>2507611</td>
<td>3460000</td>
<td>3100000</td>
</tr>
<tr>
<td>Cocoa</td>
<td>234538</td>
<td>105000</td>
<td>105000</td>
</tr>
<tr>
<td>Pepper</td>
<td>8600</td>
<td>11480</td>
<td>12500</td>
</tr>
<tr>
<td>Pineapple</td>
<td>9081</td>
<td>10233</td>
<td>16000</td>
</tr>
<tr>
<td>Tobacco</td>
<td>10539</td>
<td>15000</td>
<td>12500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>5743137</td>
<td>5949934</td>
<td>6314977</td>
</tr>
<tr>
<td><strong>Food Crop</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Padi</td>
<td>592410</td>
<td>572196</td>
<td>611000</td>
</tr>
<tr>
<td>Coconut</td>
<td>298740</td>
<td>220000</td>
<td>201000</td>
</tr>
<tr>
<td>Vegetables</td>
<td>42000</td>
<td>51420</td>
<td>77290</td>
</tr>
<tr>
<td>Fruits</td>
<td>244471</td>
<td>297436</td>
<td>379613</td>
</tr>
<tr>
<td>Others</td>
<td>268146</td>
<td>67534</td>
<td>67737</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>5743137</td>
<td>5949934</td>
<td>6314977</td>
</tr>
</tbody>
</table>
## Total agricultural exports (USD million)

<table>
<thead>
<tr>
<th>Item</th>
<th>Year = 1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palm oil</td>
<td>3738</td>
<td>2558</td>
<td>2534</td>
<td>3824</td>
</tr>
<tr>
<td>Rubber</td>
<td>521</td>
<td>589</td>
<td>427</td>
<td>580</td>
</tr>
<tr>
<td>Fatty acid</td>
<td>422</td>
<td>389</td>
<td>322</td>
<td>430</td>
</tr>
<tr>
<td>Food prep.</td>
<td>96</td>
<td>106</td>
<td>119</td>
<td>142</td>
</tr>
<tr>
<td>Cigarette</td>
<td>142</td>
<td>141</td>
<td>139</td>
<td>117</td>
</tr>
<tr>
<td>Sugar</td>
<td>50</td>
<td>64</td>
<td>76</td>
<td>99</td>
</tr>
<tr>
<td>Cocoa butter</td>
<td>108</td>
<td>83</td>
<td>84</td>
<td>93</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>7117</strong></td>
<td><strong>5821</strong></td>
<td><strong>5521</strong></td>
<td><strong>7375</strong></td>
</tr>
</tbody>
</table>
Over the years, agricultural trade has consistently generated trade surpluses.

In 2002:

Exports: USD 7,375 million (palm oil, 52%)
Imports: USD 4,300 million
Surplus: USD 3,075 million
Do we have enough?

The good news is that we are pretty self-sufficient in producing most of the basic foods that we consume. But many of these items are price regulated or subsidised, making the cost unrealistic. Can the Government continue to subsidise our food and fuel?
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pork</td>
<td>104.0</td>
<td>99.0</td>
<td>100.0</td>
<td>132.0</td>
</tr>
<tr>
<td>Poultry</td>
<td>110.7</td>
<td>113.0</td>
<td>123.0</td>
<td>122.0</td>
</tr>
<tr>
<td>Eggs</td>
<td>110.3</td>
<td>116.0</td>
<td>109.0</td>
<td>115.0</td>
</tr>
<tr>
<td>Fruits</td>
<td>-</td>
<td>94.0</td>
<td>117.0</td>
<td>106.0</td>
</tr>
<tr>
<td>Fishery produce</td>
<td>92.0</td>
<td>89.0</td>
<td>90.0</td>
<td>103.0</td>
</tr>
<tr>
<td>Vegetables</td>
<td>-</td>
<td>95.0</td>
<td>74.0</td>
<td>91.0</td>
</tr>
<tr>
<td>Rice</td>
<td>76.3</td>
<td>72.0</td>
<td>71.0</td>
<td>72.0</td>
</tr>
<tr>
<td>Beef</td>
<td>19.2</td>
<td>16.0</td>
<td>23.2</td>
<td>28.0</td>
</tr>
<tr>
<td>Mutton</td>
<td>6.0</td>
<td>6.0</td>
<td>9.0</td>
<td>10.0</td>
</tr>
</tbody>
</table>
CHAPTER 8

INNOVATION & CHALLENGES IN AGRICULTURE
• Research and innovation technology

• Future challenges in agriculture
Oil Palm

- Malaysia’s golden crop contributing RM30 billion to GNP annually. Equals to petroleum (Star, 17 Sept 2007)

- Malaysia is currently one of the major world producers of palm oil
• Research improved yield of oil palm to 35 tonnes fresh fruit bunches/hectare/yr, 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 tonnes with newer hybrids from biotechnology research
Rubber

• Malaysia is the third largest rubber producer in the world with 1.7 million ha. trees.
Puncture or micro-tapping

Puncturing

Puncture tapped tree
Rubber can be turned into many manufactured goods and used for many purposes:

1. Conventionally, rubber can be made into tyres, gloves, shoes, condoms, mats, insulators, erasers, etc.

2. New latex-timber clones (LTC), RRIM 200 series have been introduced of which the trunk can be used for timber
Livestock

Livestock industry:

1995: RM953 million
2000: RM 1.1 billion (3.1% growth/yr)
VACCINES

MVP
FOWL POX VACCINE
BEAUDETTE STRAIN

Live virus. SPP and freeze dried.

Chicken showing signs of pox.
CHAPTER 9

APPROACHES TO AGRICULTURAL DEVELOPMENT IN MALAYSIA
• National agricultural policy (NAP)

• Education, research and development institutions, and extension services

• Legislations, policies and standards
NATIONAL AGRICULTURAL POLICY
The agricultural sector has contributed significantly to the Malaysian economy. The following provides the policy framework for future growth of the agricultural sector in Malaysia:

1. 3rd National Agricultural Policy (NAP 3) and its Action Plan
2. National Development Policy
3. Second Industrial Master Plan
4. Science and Technology Policy
5. National Biodiversity Policy
• NAP 3 covers the period from 1998-2010. It is largely guided by the National Development Policy.

• NAP 3 retains the objective of NAP 2 to maximize income through optimal utilization of resources in the sector.

• This includes maximizing agriculture’s contribution to national income and export, and income of producers.

• A new policy named the National Agrofood Policy has been formulated for 2011-2020. It emphasizes on food quality, safety, nutrition, functionality and environmental sustainability.
EDUCATION, RESEARCH & DEVELOPMENT INSTITUTIONS, AND EXTENSION SERVICES
Some universities such as UPM offer agricultural courses. Agricultural R & D institutions can be found in both the public and private sectors.

Institutions within the public sector engaged in R & D include:

1. MARDI
2. MPOB
3. MRB
4. MCB
5. Farmer’s Organisation Authority (FOA)
6. Federal Agricultural Marketing Authority (FAMA)
7. Fisheries Development Authority of Malaysia (LKIM)
8. Muda Agricultural Development Authority (MADA)
9. Kemubu Agricultural Development Authority (KADA)
10. Forest Research Institute Malaysia (FRIM)
11. Federal Land Development Authority (FELDA) (Sungai Tekam)
12. Malaysian Rubber Development Board (MARDEC)
13. Veterinary Research Institute (VRI)
LEGISLATIONS, POLICIES AND STANDARDS
Legislations and Policies

- Legislation is formulated to regulate the agro-forestry sector with respect to the environment and health of human, plants and animals.

- There are several Acts which have been enacted such as:

3. Poison Act (1952)
4. Food Regulation (1985)
6. Quarantine Act (1976)
Standards

For quality assurance and control in agriculture, several guidelines have been laid down in accordance with CODEX Standards.

A few examples of such standards, guidelines and certification agencies:

1. Good Agricultural Practices (GAP)
2. Best Management Practices (BMP)
3. Skema Akreditasi Ladang Malaysia (SLAM)
4. Skema Pensijilan Perladangan Organik (SOM)
5. Good Fumigation Practices (GFP)
6. Hazard Analysis Critical Control Point (HACCP)
ASSIGNMENT
Reports must be handed in on time to UPM, usually two weeks before the beginning of the final examination.
BEST OF LUCK!