TKP3501
Agricultural Mechanization

Topic 7b: Machinery in Oil Palm

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Why we need machineries?
Type of machine available
Traditional vs modern

Power tiller
Other small equipment
Compact equipment

Filters, oil, lubrication, parts

Maintenance

How to choose the tractor and implement size?
Tractor & power unit
Type of power available

Theoretical Field Capacity
Effective Field Capacity
Field Efficiency
Farm Efficiency

Land preparation
Crop type;
- Oil palm
- Rice
- Vegetable

Seedling & Planting
Crop type
Planter

Fertilization & Irrigation
Spreader
Pump
Sprinkler

Emerging Technologies
Sensor
Tracking
GPS, GNSS
GIS, Mapping

Livestock
Feeding system
Milking
Aquaculture

Cost analysis
Optimization

Forestry
Horticulture

Crop Production

Harvesting
Yield, Baller
Transportation

Others
- Bearing & seal
- Shaft
- Belt & pulley
- Chain & sprocket
- Gear
- Lubrication (grease, oil)

Tractors’ components & Systems
Main components
Systems;
- Fuel & Intake
- Combustion
- Cooling
- Electric & instruments
- Lubrication
- Hydraulic

Introduction to a tractor
Type of tractor
Specification

Involves calculations

* * *
What are the oil palm plantation production stages?
Nursery
Oil Palm Nursery

- **Site selection**
  - Should be undertaken approximately 2 years and not less than 18 months before field planting
  - Topography
    - Flat and undulating
  - Water source
  - Accessibility
  - Not prone to flooding or water logging

- **Land Preparation**
  - Clearing
  - Drainage
  - Irrigation
  - Soil selection

Source: Sime Darby Research Centre Sdn Bhd, Agronomy Department
Oil Palm Nursery

- Irrigation system
  - Type of irrigation
    - Sprinkler
    - Hand Watering
  - Drainage
    - Drain construction
    - Out let for rainfall
    - Avoid water logging
Oil Palm Nursery

- **Nursery Operation**
  - Soil selection
    - Topsoil
    - Sieving
  - Polybag Filling
    - Small Polybag
    - Large Polybag
  - Planting of germinated seed
    - Method of planting
    - Plumule and Radicle
Planting
Hole Digger
Replanting
WHERE IT ALL STARTED
Straight Line Planting
Roads maintenance

- Road grading carried out to achieve good gradient on both shoulder or known as “camber”.
- Rolling to follow immediately after grading
Security Trench
Zero Burning Replanting Technique

Shredding of old oil palm stand during zero burning replanting of a field
Besides reducing siltation of rivers, riparian borders of natural vegetation act as wildlife refuge and corridors.
Biodiversity

Zero burning and proper land preparation minimises environment disturbance during replanting. This helps to conserve biodiversity.
Biodiversity

Natural vegetation are conserved around water catchment areas to preserve water quality and biodiversity
Spraying
Table 2 – Effective field capacity of machine system for circle spraying operation.

<table>
<thead>
<tr>
<th>Days operation</th>
<th>Effective field capacity (ha ha(^{-1}))</th>
<th>Effective field capacity (ha man(^{-1}) per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.83</td>
<td>6.64</td>
</tr>
<tr>
<td>2</td>
<td>0.97</td>
<td>7.76</td>
</tr>
<tr>
<td>3</td>
<td>1.16</td>
<td>9.28</td>
</tr>
<tr>
<td>Average</td>
<td>0.98</td>
<td>7.89</td>
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</tbody>
</table>
Table 6 – Costs breakdown in circle spraying operation.

<table>
<thead>
<tr>
<th>Cost component</th>
<th>Cost</th>
<th>Percent. from total cost</th>
<th>Rank based on the highest cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depreciation cost, USD h⁻¹</td>
<td>0.84</td>
<td>13.99</td>
<td>4</td>
</tr>
<tr>
<td>Interest on investment cost, USD h⁻¹</td>
<td>0.51</td>
<td>8.53</td>
<td>5</td>
</tr>
<tr>
<td>Tax, shelter and insurance cost, USD h⁻¹</td>
<td>0.18</td>
<td>3.08</td>
<td>7</td>
</tr>
<tr>
<td>Repair and maintenance cost, USD h⁻¹</td>
<td>1.16</td>
<td>19.35</td>
<td>3</td>
</tr>
<tr>
<td>Fuel consumption cost, USD h⁻¹</td>
<td>1.61</td>
<td>26.79</td>
<td>1</td>
</tr>
<tr>
<td>Lubricants costs, USD h⁻¹</td>
<td>0.25</td>
<td>4.03</td>
<td>6</td>
</tr>
<tr>
<td>Operators cost, USD h⁻¹</td>
<td>1.47</td>
<td>24.23</td>
<td>2</td>
</tr>
<tr>
<td>Total spraying operation cost, USD h⁻¹</td>
<td>6.03</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
Fertilization
Harvesting
**TABLE 5: NUMBER OF FOREIGN WORKERS IN MALAYSIA BY SECTOR**

<table>
<thead>
<tr>
<th>Sector</th>
<th>2000</th>
<th>2005</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>307167</td>
<td>581379</td>
<td>764953</td>
</tr>
<tr>
<td>Plantation</td>
<td>200474</td>
<td>427415</td>
<td>341464</td>
</tr>
<tr>
<td>Agriculture</td>
<td>-</td>
<td>44831</td>
<td>177549</td>
</tr>
<tr>
<td>Construction</td>
<td>68226</td>
<td>281780</td>
<td>316559</td>
</tr>
<tr>
<td>Services</td>
<td>53683</td>
<td>159662</td>
<td>213360</td>
</tr>
<tr>
<td>Housemaids</td>
<td>177546</td>
<td>320171</td>
<td>309045</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>807096</strong></td>
<td><strong>1815238</strong></td>
<td><strong>2122930</strong></td>
</tr>
</tbody>
</table>
Lack of Innovation
Cantas
Manual Labour
To introduce an integrated system of collection and evacuation of FFB which will reduce handling, minimise manpower requirements, increase productivity and quality.
Irrigation
FLAP-TYPE WATER GATE
SCREW-TYPE WATER GATE

Serves a large drainage area, generally located in the main outlet.
Drainage
Irrigation
FLOOD PUMPS
Review

- Why there is still requirement for manual process in oil palm, beside the availability of the machinery in oil palm production?

- Which stage of the oil palm production required the most energy expenditure?
Thank you.