

OIL PALM MOTORISED CUTTER EVO2

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MPOB has introduced an oil palm motorised cutter known as 'Cantas Evo' that works effectively for palms with harvesting height of less than 7 m. Cantas which is powered by a small petrol engine has been proven to increase harvesting output compared to manual harvesting. Over the past two years, a new generation motorised cutter has been designed, developed and tested. The prototype employs a gearbox at the bottom of the machine, which brings down the centre of gravity and provides convenient handling of the machine. In addition, the components have also been reduced by half, saving more than RM 306/machine.

THE TECHNOLOGY

The main objective is to develop an Oil Palm Motorised Cutter Evo2. The cutter should be able to harvest fesh fruit bunch (FFB) and prune frond effectively. The main features of the technology are:

- Gearbox placed at the bottom of the machine to lower the centre of gravity, which eases handling and lifting.
- Reduced components by half, compared to the ordinary Cantas.
- Low maintenance with less mechanical parts.
- Low capital expenditure (CAPEX).

The novelty of the technology is described as follows:

- This design requires only seven components instead of 17 parts for the previous version.
- The gearbox which is placed at the bottom of the pole is convenient for the operator. The gearbox is used to convert rotational motion from the engine into a linear motion for the purpose of cutting.
- Higher reach as the pole length can be extended up to 8 m.

The Prototype

Specifications:

- Total length : 4.0 m
- Total weight : 7.1 kg

- Specific weight : 1.78 kg m⁻¹
- Cutting knife : C-sickle



Figure 1. Oil Palm Motorised Cutter Evo2.

Table 1 shows the technical specifications differences between the new technology (Oil Palm Motorised Cutter Evo2) and the ordinary Cantas.

FIELD TEST

Vibration Test

Vibration test was carried out to measure the magnitude of vibration on the hand of the harvester. Vibrations were measured at two points *i.e.* at the throttle and at the pole (P1) and the point where the harvester holds the pole during harvesting (P2) (Figure 2).

In the experiment, the magnitude of vibration was measured during cutting of frond using a Dewesoft vibration equipment.

Results showed that magnitude of vibration at the pole and throttle points were 1.8 and 1.5 m s⁻², respectively, and can be used up to 8 hr day⁻¹. The safe threshold level is 2.5 m s⁻² (Hand Vibration at Work User Guide, 2012).

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TABLE 1. DIFFERENCES BETWEEN NEW TECHNOLOGY AND ORDINARY CANTAS

Description	New technology (Oil Palm Motorised Cutter Evo2)	Ordinary Cantas
Activator	Petrol engine	Petrol engine
Power source	Fuel (petrol)	Fuel (petrol)
Gearbox placement	At the bottom of pole	At the top of pole
Transmission	nil	Mechanical – shaft and bearings
Cutting knife	Chisel and sickle	Chisel and sickle
Length (m)	4	4
Weight (kg)	7.1	7.4

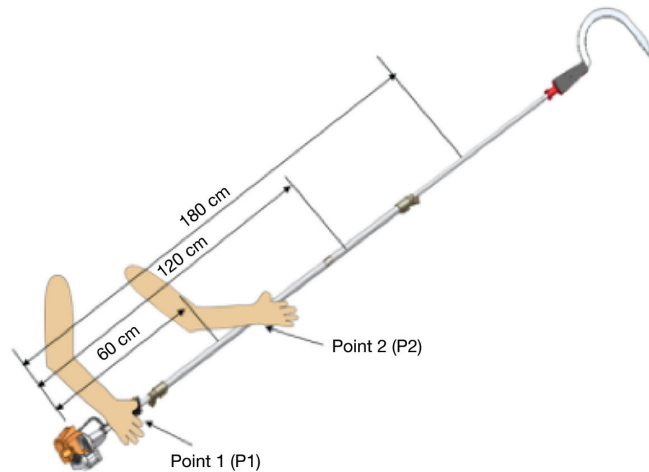


Figure 2. Vibration measurement at throttle point (left) and pole point (right).

Performance Test

The field trial of the prototype was carried out by a harvesting contractor smallholder at Banting, Selangor since July 2017. The total area was about 50 ha with two rounds of harvesting per month. The palms were about 3 to 5 m height and the topography was flat. Trial showed that the average harvesting productivity was about 6 t FFB day⁻¹ (5 hr working a day).

ECONOMIC ANALYSIS

Manufacturer's Perspective

From the manufacturer's perspective, the following economic analysis can be used as a reference.

Net present value (NPV)	: RM 553 775
Internal rate of return (IRR)	: 33.63%
Discounted payback period (PB)	: 5 yr
Discounted BC ratio	: 1.04

Assumption

Material cost machine ⁻¹	: RM 1600
Average production month ⁻¹	: 85 unit

Working day	: 26 day month ⁻¹
Utilities and office	: RM 10 000 month ⁻¹
Equipment and machine	: RM 1 000 000
Labour cost	: RM 105 day ⁻¹ (three workers)
Operating cost per month (OPEX)	: RM 93 000
Capital expenditure (CAPEX)	: RM 1 100 000

User Perspective

From the user perspective, the fixed costs include the engine, gearbox, and pole while variable costs are labour, repair and maintenance. The operational cost per tonne FFB was calculated using a straight-line depreciation method. The details of the calculation are shown in Table 2.

Assumption	
Machine selling price	: RM 3000 unit ⁻¹
Life span	: 2 yr
Performance	: 6 t day ⁻¹
Labour cost	: RM 50 day ⁻¹

TABLE 2. COST ANALYSIS OF OIL PALM MOTORISED CUTTER EVO2 USING STRAIGHT LINE DEPRECIATION METHOD

Description	Calculation	Cost (RM day ⁻¹)
Depreciation (price / (life span x 300 days))	3000 / (2 yr x 300 days)	5.00
Fuel Cost	0.0625 litre hr ⁻¹ x RM 2.30 litre ⁻¹ x 4 hr	0.575
R&M cost @ 10% per year of purchase price	10% x 3100 / (300 days)	1.00
Labour cost		50
Total		56.775
Cost per tonne = total cost/productivity	(RM 56.775 day ⁻¹) / (6 t day ⁻¹)	RM 9.42 t ⁻¹ FFB

Therefore the operational cost per tonne of FFB comes to about RM 9.42 (harvest only).

Nevertheless, the bottom line is that the industry is looking at the cost-effectiveness (CE) of the technology. The lower the CE, the more the technology will likely to be adopted by the industry. The CE is calculated by the following formulae (Stanners, 1992):

$$\begin{aligned} \text{Cost-effectiveness (CE)} &= \frac{\text{Tool or machine price (RM)}}{\text{Total bunches harvested (t FFB)}} \dots\dots\dots (1) \\ &= \frac{\text{RM } 3000}{(6 \text{ t FFB day}^{-1} \times 300 \text{ days yr}^{-1} \times 2 \text{ yr})} \\ &= \text{RM } 0.83 \text{ t}^{-1} \text{ FFB} \end{aligned}$$

Therefore, the cost-effectiveness of new generation motorised cutter tool is RM 0.83 t⁻¹ FFB.

IMPACT

The introduction of such technology is expected to offer more comfortable harvesting, thus provides significant impact to the industry and the country, in terms of increasing harvesting productivity and workers' income thus reducing cost of operation, maintenance and machine.

IP STATUS

A patent application has been filed.

CONCLUSION

This technology has been proven to offer less vibration compared to its predecessor. Apart from low vibration, this technology uses less components hence contributed to lower repair cost. This will increase profit margin of the harvester or the owner of the machine.

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