

# OIL PALM LOOSE FRUIT COLLECTING MACHINE WITH ELEVATED DISCHARGE MECHANISM (LFC MARK IV)

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**L**oose fruits are currently collected by hand picking or raking. This technique is not only labour demanding, and time-consuming but is also tedious and laborious. The worker needs to squat and stand up throughout the day during the collection process. On the average, the time taken for the worker to collect loose fruits is about 28% of total time of harvesting. In the previous work, the suction mechanism was mounted onto a three-wheeler chassis which enables the machine to manoeuvre in tight corners. The fruits are collected through a vacuum concept and stored in a cylindrical container or barrel, before being finally deposited into a bag. From previous field trials, it was noticed that if the fruits occupy more than 50% of the barrel volume, there is a higher tendency of trash not blown out, hence affecting its performance. In this new design, the barrel now acts as a temporary storage facility where its contents will occasionally be emptied into another container within the machine chassis and later discharged directly into an awaiting bin or steriliser cage on a trailer. The elimination of collection bags along the harvesting path can reduce manpower requirement.

## THE MACHINE

The machine maintains the suction concept (vacuum cyclone) as in the previous model (Rahim *et al.*, 2012). The loose fruits are sucked into a cylindrical shaped casing or barrel. As the fruits are circulating the barrel/chamber, the 'heavier' fruits will fall to the bottom of the barrel (as it loses the energy) while lighter materials such as dried leaves will be sucked out of the system (Figure 1). This technology is also capable of separating the collected loose fruits and the debris into two layers in the vacuum chamber hence producing clean loose fruits at the bottom of the fruit barrel. The machine is easy, and fast to operate.

The additional mechanism that has been improved include the barrel, which now functions as a temporary storage area. The contents in the barrel

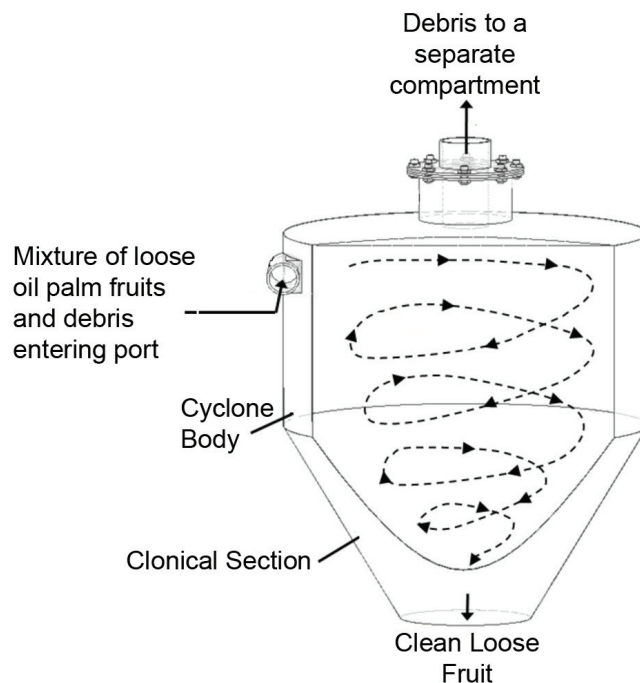


Figure 1. The cyclonic vacuum concept.

are occasionally emptied into another container that can hold up to 500 kg of fruits. Once the amount of fruits in the container reaches 500 kg, the operator will lift and unload them into a mainline transport system either a waiting trailer, bin or steriliser cage (Figure 2). Emptying the content is made easy with a hydraulic control lever. The concept and basic components of the machine are shown in Figures 2 and 3.

## SPECIFICATION:

Dimension (mm)	3440 (L) x 2050 (W) x 1850 (H)
Minimum tractor power	25 hp
Suction power	40 m /s @ 2000 rpm
Suction hose	7 m length @ 75 mm dia.
Fruits container	200 kg of fruits
Tyre size	7.5 x 16
Unladen weight	350 kg
Elevated discharge height	2.6 m



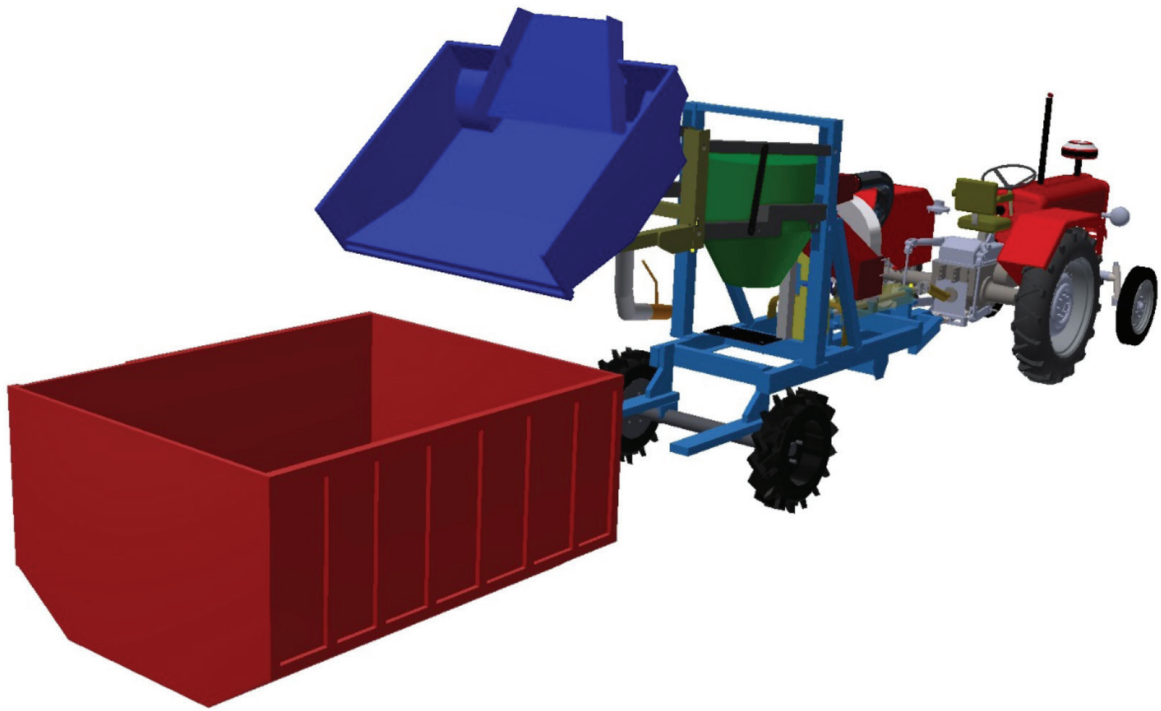


Figure 2. The machine concept.

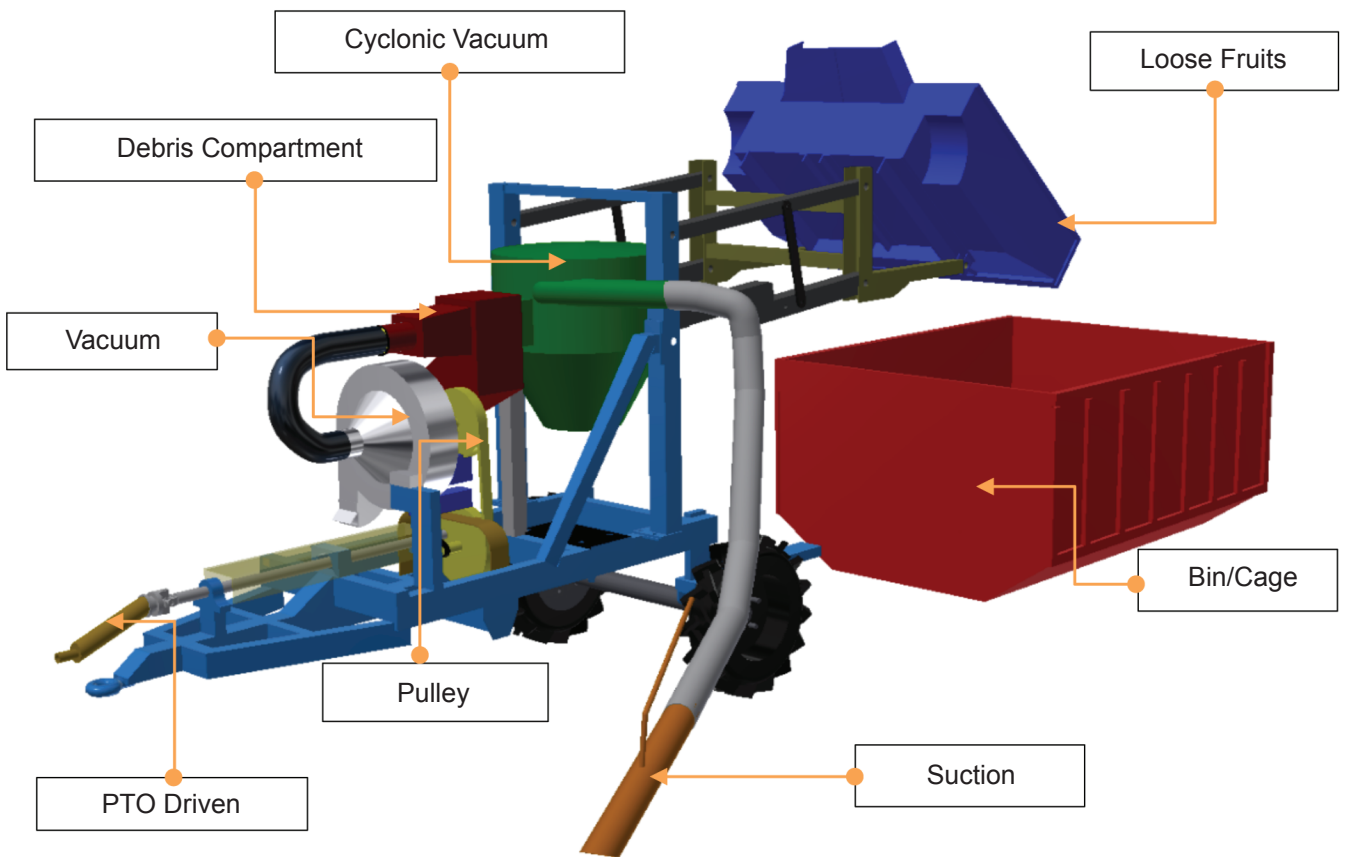


Figure 3. Parts of the machine.

## ADVANTAGES:

- Loose fruits can be collected with less time.
- Less back pain to workers as the operation can be carried out while standing.
- Less burden to workers as they do not need to carry bags containing loose fruits, along the harvesting path.
- Double up the worker's productivity.

## FIELD TRIAL

A field trial was carried out on a commercial oil palm estate (Figures 4 and 5) to evaluate the machine's performance. It was found that the suction power is sufficient with an average air velocity of 40 m/s. The machine is capable of collecting on average of 1500 to 2000 kg of clean loose fruits a day. With the proposed design, the machine is well integrated with the mainline transportation system *i.e.* the steriliser cage system.



Figure 4. Collection of loose fruits in progress.



Figure 5. Unloading loose fruits into steriliser cage.

## ECONOMIC ANALYSIS

### Manufacturer perspective

From the manufacturer point of view, the following economic analysis can be used as a reference if one to start the business.

#### Assumption

Material cost	: RM 15 000 machine <sup>-1</sup>
Average production	: 10 units month <sup>-1</sup>
Working day	: 26 days month <sup>-1</sup>
Utilities and office	: RM 5000 month <sup>-1</sup>
Labour cost	: RM 100 day <sup>-1</sup> (4 workers)
Operating cost per month (OPEX)	: RM 184 800
Capital expenditure (CAPEX)	: RM 1 500 000

Hence, given the value of:

Internal rate of return (IRR)	: 36%
Payback period (PB)	: 2.04 years
Benefit cost ration (B/C)	: 1.12:1

### User Perspective

To calculate the operational cost, The American Society of Agricultural and Biological Engineers (ASABE) Standard was used in the calculation. The assumption and parameters used in the cost analysis are as follows:

Initial Cost	RM 60 000
Operating hours (hr yr <sup>-1</sup> )	3000
Total economic Life (hr)	10 000
Economic life (yr)	3.33
Salvage Value	10% of the initial cost
Tax, shelter and insurance	2% of the initial cost
Interest on investment	5% of the initial cost
Fuel consumption (litre h <sup>-1</sup> )	3
Fuel price (RM litre <sup>-1</sup> )	2
Lubricant cost	15% of the fuel cost
Repair and Maintenance Cost (RM hr <sup>-1</sup> )	5% of the initial cost
Labour requirement	3 workers
Labour wages (RM man <sup>-1</sup> day <sup>-1</sup> )	36
Total labour wages (RM hr <sup>-1</sup> )	13.5

Based on the above parameters, the cost to operate the machine is RM 23.40 hr<sup>-1</sup>. With the loose fruits availability is 150 kg ha<sup>-1</sup>, machine's output 2.07 tonne day<sup>-1</sup> and labour cost of RM 31.05 hr<sup>-1</sup>, thus given the operational cost per tonne as in *Table 1*. This comparison is based on the productivity of the machine that needs to be achieved by manual workforce practice.

**TABLE 1. OPERATIONAL COST COMPARISON BETWEEN OIL PALM LOOSE FRUIT COLLECTING MACHINE AND MANUAL COLLECTION**

	<b>Machine</b>	<b>Manual</b>
Labour requirement (man-day)	3	7
Labour wages (RM day <sup>-1</sup> )	36	36
Output per unit (kg day <sup>-1</sup> )	2070	300
Operational cost (RM tonne <sup>-1</sup> )	90.43	120

## CONCLUSION

The development of this loose fruit collecting machine meets the criteria set in the objective. In general, the machine works well in areas that are accessible to the conventional wheel type transporter hence improving the recovery of loose fruits.

## REFERENCES

ABD RAHIM, S; MOHD RAMDHAN, K; MOHD SOLAH, D and AMINULRASHID, M (2012). Oil palm loose fruits collecting machine (MK III). *MPOB Information Series, TT No. 505*.

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