MOBILE LIFTER – A DEVICE TO ASSIST FRESH FRUIT BUNCH (FFB) LOADING OPERATION

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843

MPOB INFORMATION SERIES • ISSN 1511-7871 • JULY 2021 MPOB TT No. 678

Most small farm machinery usually drop their loads on the ground at the collection point and later the fresh fruit bunch (FFB) will be manually transferred into the bin. Currently, manual FFB loading involves picking up bunches with an iron spike and dropping them into a 1-1.5 m height bin (*Figure 1*). Multiple handlings will increase the overall time taken and lower the FFB quality. Workers are also prone to fatigue when handling big bunches. The current manual loading activities incurred a risk of injury to the workers (Ng *et al.*, 2013; Nur Syazwani *et al.*, 2016). The workers need to repeatedly lift load over their shoulders, hence giving extreme strain to the muscles and joints. Therefore, a solution is needed to reduce these risks.

Figure 1. Worker manually loading the FFB into a trailer.

THE TECHNOLOGY

The proposed device is a portable loading device to replace manual FFB loading activity into the mainline transporter (*Figure 2*). It is using hydraulic system and powered by battery to lift the FFB from the ground into a waiting bin, a lorry or a tractor trailer. This device can be attached or detached easily and to be pulled by a small infield transporter.

Using simple lifting mechanism, there are two major components *i.e.* chassis and bucket. A hydraulic power pack and a battery will be placed at the chassis. The hydraulic system is powered by 24 V battery to actuate two hydraulic cylinders located at each side of a frame. Independent diesel or petrol engine can also be used to replace the battery as a power source. The size of the bucket was designed to accommodate a maximum of 400 kg loads. Specifications of the prototype are as depicted in *Table 1*.

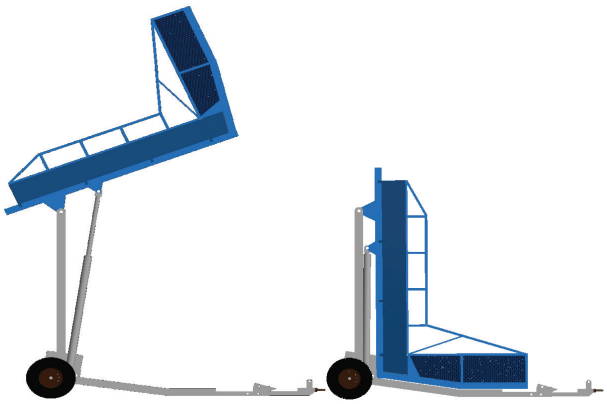

Figure 2. Schematic design of the proposed device.

TABLE 1. BASIC SPECIFICATIONS OF HYDRAULIC TYPE FFB LOADER

Dimension, L x H x W (mm)	**1900 x 1800 x 1400**
Hydraulic power pack	DC 24V, 2.2kW
Working height (m)	1.8

How it works?

a) The device will be attached to a transporter and moved to the field for collection.
b) The device will be placed at the side of a bin which is strategically determined earlier.
c) The operator or driver then starts his routine task by collecting the FFB in the field.
d) Once fully loaded, the transporter will then manoeuvre to the bin to unload the FFB.

ISSN 1511-7871
9 771511 787001

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e) The transporter will then unload the FFB into the bucket of the device in reverse position.
f) Once completed, the transporter will then move forward (about 1-2 m from the device) and with a single press of a switch, the device will slowly lift the bucket to transfer the FFB into the bin. The device will automatically retract to its original position once empty.
g) The transporter will then immediately move back to the field, looking for more bunches without the need to wait and load the FFB manually.

Field Trials

The prototype was tested at several oil palm plantations (*Figure 3*). The three-wheel transporter is able to pull/ maneuver the prototype in the field without any problem. Study also revealed that the average time taken to complete the total operation was about 5.24 min and 88 % of time was used for traveling and collecting FFBs. Average time for the tipping device to unload FBB into the bin and return to its ready position was only around 12 s.

A comparative study between machine and manual loading was conducted in continuous replicates (*Table 2*). It was found that there is a significant increase in productivity and the average time taken to complete the loading task for machine is lesser than manual loading. This demonstrated that the machine helped the operators by reducing their time to complete the task from 7.2 s per bunch (manual) to only 4.8 s per bunch, which was 35% faster. It was estimated that the battery can last up to two days operation, before next power charging.

Figure 3. Prototype in tipping position during field test.

NOVELTY OF THE PRODUCTS/ TECHNOLOGY

The technology comprises of a simple chassis design and system to receive loads from a transporter and to lift up the loads safely. A pair of adjustable supporting devices were developed to be attached to the side wall of the bin prior operation. This device acts as a support and safety mechanism to provide better stability to the prototype especially during the tipping operation. It can accommodate different height of bin by changing the location of bolts and nuts. Another special feature of this invention is that with a single press of a switch button, the device will slowly lift the bucket and it will automatically retract to its original position once the load is emptied.

TABLE 2. PERFORMANCE COMPARISON BETWEEN MACHINE AND MANUAL LOADING

Replicate (trip)	Machine		Manual	
	No. of FFB	Time to complete loading task (s)	No. of FFB	Time to complete loading task (s)
1	70	317	61	468
2	68	356	68	467
3	73	324	62	453
4	80	398	70	482
5	65	315	59	440
Total	**356**	**1710**	**320**	**2310**
Average time per bunch (s)	**4.8**		**7.2**	

BENEFITS AND ADVANTAGES

1. A significant increase of productivity for infield FFB evacuation activity hence potential reduce burden of human workers.
2. Better oil quality by reducing multiple handlings of FFB.
3. Reduces energy required to load the FFB.
4. Promotes green technology (battery powered) for the oil palm industry.

ECONOMIC ANALYSIS AND COMMERCIAL BENEFITS

Simple Operational Cost Analysis

Machine price	=	RM12 000
Economic life, E	=	5 years
Productivity	=	25 t day^{-1}
Labour cost	=	RM45 day^{-1}

26 days working day a month

Based on the figures above and using the straight-line depreciation formula, the costs of using the machine are:

Depreciation: $\frac{\text{RM12 000}}{5 \times 12 \times 26}$	=	RM7.70 day^{-1}
Labour cost	=	RM45.00 day^{-1}
Repair and maintenance cost (10% per year)	=	RM3.85 day^{-1}
Total cost	=	RM56.55 day^{-1}
Therefore;		
Cost per tonne	=	RM56.55 / 25
(Operational Cost)	=	RM2.26 t^{-1}

IMPACT

It is envisaged that the developed technology could provide numerous advantages towards reducing labour requirement, providing better working condition, reducing multiple handlings operation which at the end will lead for higher productivity. There is possibility that the concept of this device can also be utilised in other operations, not only for oil palm but also other crops such as bigger capacity device for loading FFB at ramp.

IP STATUS

In the process of application for patent filing.

CONCLUSION

The hydraulic type loading device was found to be more practical and functional hence producing better output. With the assistance of this device, workers can transfer the FFB directly into the bin without exerting their energy excessively.

REFERENCES

Ng, YG; Shamsul Bahri, MT; Irwan Syah, MY; Mori I and Hashim, Z (2013). Ergonomics observation: Harvesting tasks at oil palm plantation. *J Occup. Health*, *55(5)*: 405-414.

Nur Syazwani Mohd Nawi; Baba Md Deros; Mohd Nizam Ab. Rahman; Ezrin Hani Sukadarin and Norani Nordin (2016). Malaysian Oil Palm Workers Are in Pain: Hazards Identification and Ergonomics Related Problems. *Malaysian J. Public Health Medicine*, *16(1)*: 50-57.

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