International Journal of Engineering Innovation & Research
Volume 5, Issue 6, ISSN: 2277 – 5668

# Performance Study of an Oil Palm Mobile Bunch Catcher

**Azali Awaludin, Syed Salim Syed Ali, Abdul Halim Zainal Abidin and Rasidi Ismail**
Email ID : azali.a@feldaglobal.com

***Abstract*** **– A case study to determine performance of Mobile Bunch Catcher (MBC) was done at FGV Plantations (M) Sdn Bhd. One period time was used for test this machine and area coverage about 32 hectare. Using 2 workers as driver and co-worker, MBC will be used to minimize loose fruits collector during harvesting process. A machine was tested at different topography where the area are flat area, mild undulating and heavy undulating. This machine also tested with 2 method of testing, simulation test and Fresh Fruit Bunch (FFB) production test within limitation of palm height from 3 meter to 5.5 meter. From result, FFB production was recorded from 1.3 to 2.4 ton/worker/day. From experiment also shows MBC can maximize labours productivity in oil palm plantation.**

***Keywords*** **– Oil Palm Fresh Fruit Bunch, In – field Collection, Topography, Mobile Bunch Catcher.**

## I. INTRODUCTION

Oil palm planted area in 2015 reached 5.64 million hectares, an increase of 4.6% as against 5.39 million hectares recorded in the previous year. This was mainly due to the increase in new planted areas especially in Sarawak, which recorded an increase of 13.9%. Sabah is still the largest oil palm planted state, with 1.54 million hectares or 27% of the total oil palm planted area, followed by Sarawak with 1.44 million hectares or 26%, while Peninsular Malaysia accounted for 2.66 million hectares or 47%. In 2015, CPO production recorded a marginal increase of 1.5% to 19.96 million tons as against 19.67 million tons produced in 2014. The increase was due to higher FFB processed, arising from the increase in new matured areas coming into production, especially in Sarawak. CPO production in Peninsular Malaysia and Sarawak increased by 3.6% and 7.6% to 10.54 million tons and 3.70 million tons respectively. CPO production in Sabah, however, recorded a decline of 5.5% to 5.72 million tons. The FFB yield for 2015 was slightly lower by 0.8% to 18.48 tons per hectare from 18.63 tons per hectare achieved in 2014. Sabah registered a decline of 6.3% to 19.99 tons per hectare as against 21.34 tons per hectare achieved in the previous year. Peninsular Malaysia and Sarawak, however recorded increases. FFB yield for Peninsular Malaysia improved by 3.0% to 18.77 tons per hectare, while that of Sarawak increased marginally by 0.5% to 16.21 tons per hectare. Sarawak's FFB yield was relatively lower as compared to other regions as 25% of its matured area were young palms [1].

All figures above show a productivity of FFB where the total of CPO produce after processing all FFB at mill. To produce FFB, A work call harvesting of FFB, where works include cutting stalk, cutting frond, load FFB into transporter bucket, staging frond and collecting loose fruits. Loose fruits is presently in operation not amenable to mechanization, but loose fruits collection in in – field collection using traditional method as racking, scrapper and net [2]. Solah (2009) stated that 3% -5% not collected loose fruit when harvesting time [3]. When collected using traditional method it will be contributed 60% trash from consignment. Also Rahim 2012 [4] study a time uses during loose fruits collection which take about 28% from harvesting time. Important and the success factors for the machine characteristic must be robust, easy to use and simple maintenance. The easy to operate machine will increase productivity and the simple maintenance will decrease downtime and save your bottom line [5].To overcome this problem, Azali Awaludin (2016) designed a conceptual of mobile bunch catcher as figure 1 [2]. After fabrication and design this machine show as in figure 2.

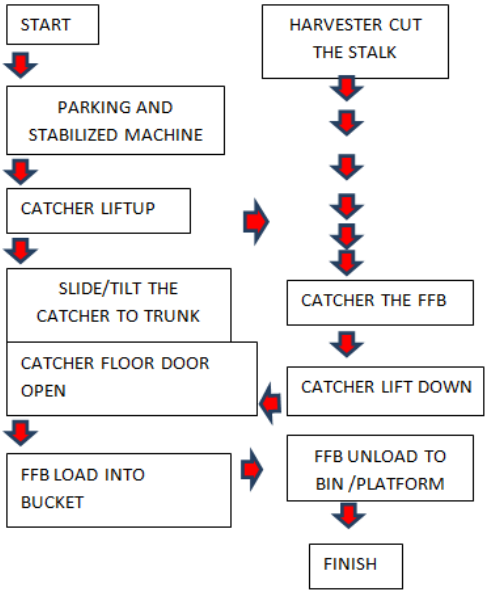


Fig. 1. Conceptual of MBC [2]

Fig. 2. After fabrication

This study focus to use MBC machinery application on the production of FFB in FGV plantation. Besides reducing of foreign labour, MBC reduce damage on FBB during harvesting and the major aims are no loose fruits leave at palm base. FFB delivered to the mill in clean condition and this also increase oil extraction rate at the mill. MBC requires a medium amount of capital, yet effective mechanization of returns to factors of work efficiency, quality of FFB produced, labour utilization and management of an effective oil palm plantations. While a recent study has been done on the MBC to get information related to the same information such as test equipment before. This testing purpose machinery to minimize costs, reduce labour and higher FFB productivity.

## II. INFORMATION OF MOBILE BUNCH CATCHER

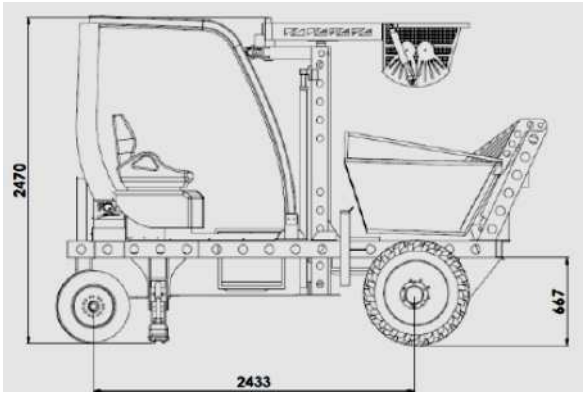

Fig. 3. Side view

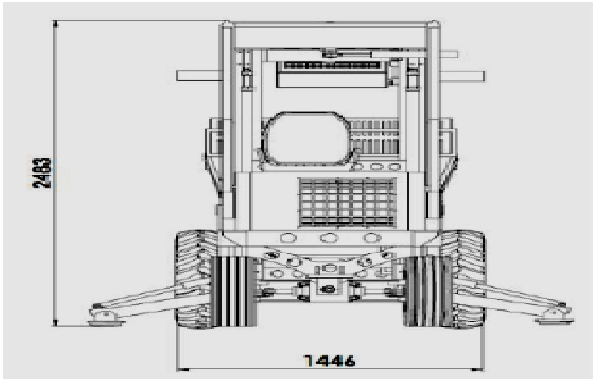

Fig. 4. Back view

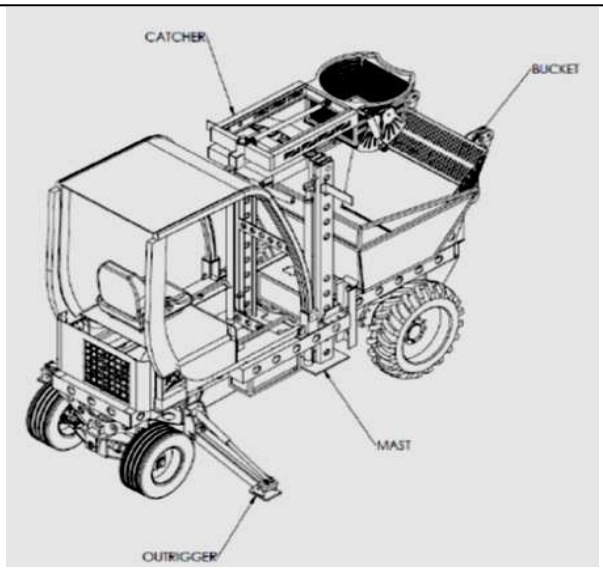

Fig. 5. Isometric view

| | |
|---|---|
| Total weight | 2170kg |
| Battery | 12/55 V/AH |
| Engine Model | Toyota/1DZ-11 |
| Tank capacity | 45 litre |
| Piston displacement | 2486cc |
| Transmission | power shift |

Fig. 6. Information of MBC

Mobile bunch catcher was designed to suit with harvesting work and objective to catcher loose fruits. Equip with large 'catcher' contain one FFB at time. MBC also design with hydraulic mechanical equipment and easy to drive and maneuver in harvesting path. Below in Figure3-7 shows an information and interesting part of MBC.

Fig. 7. Interesting part of mobile bunch catcher

## III. MATERIAL AND METHOD

The methodology of evaluation are background of topography, the system works and test procedure. In Malaysia, Felda Global Ventures have 258,000 hectare of plantation area. Yong (2013), Figure 8 presented a data topography for Felda Global Venture Plantation Malaysia, there is 26% of area is Flat to gentle undulating (below 4° slope), moderately hilly is 49% (slope 5° -12°) and hilly is 25% (slope over 12°) [6]. The evaluation was based on

time recorded where time was recorded during FFB harvesting. A total of bunches will counted to know average FFB tons per day in using MBC. MBC also tested for topography of flat, mild undulating and undulating. MBC machine, will entered the harvesting path and one labour were cut the frond harvesting FFB. MBC standby at harvesting path and adjust the catcher to 'catch' loose fruit and FFB. Production of FFB will recorded for this activity for each topography.

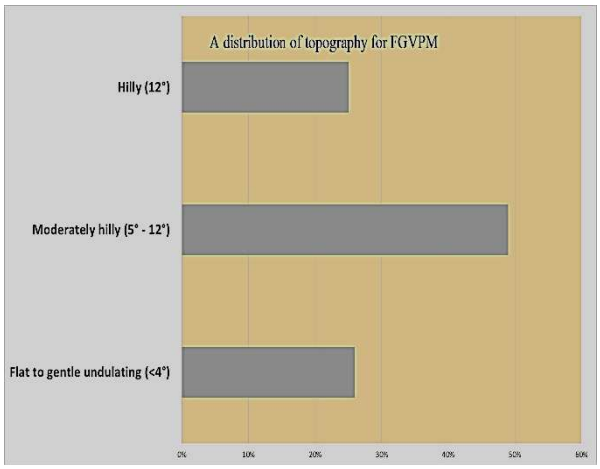


Fig. 8. A distribution of topography for FGVPM

## IV. Information of an Oil Palm Fresh Fruit Bunch Infield Collection

1. Requirements labour intensive to harvest. The ratio of workers to the acre is between 1:16 to 1:18
2. Individual Task - harvester workers divided according to individual tasks ranging from 8-10 rows harvested per harvester. This causes the day to harvest a large area and difficult job of quality control that works with supervision.
3. Load FFB - Evacuate FFB from the base of the tree requires people or wheelbarrow. This work can reduce production of FFB because energy is used manually to evacuating FFB.
4. Loose collection - To collect loose fruit for energy focusing to transport FFB bunches must be brought to the factory within 24 hours after harvest, resulting in a loose net seeds are not collected.

## V. Method of Mobile Bunch Catcher Testing

*Mobile bunch Catcher tested with 2 method*

- Simulation test

  In oil palm plantation, system of work implement to worker based on area coverage and job description. Works was divided based on area and total of labour. 30 sample were choice at plantation and suit with machine limitation. Simulation test have 6 parameter (figure 6) as below:

  - Topography flat (pattern 1 to 1)
  - Topography flat (pattern 1 to 2)
  - Topography mild undulating (pattern 1 to 1)
  - Topography mild undulating (pattern 1 to 2)
  - Topography undulating (pattern 1 to 1)
  - Topography undulating (pattern 1 to 2)

  Step – MBC move into harvesting path. Simulate as 1 bunch per palm (1 to 1) and 2 bunch (1 to 2). MBC park and align to suit FFB fall.MBC raise mast and move catcher to nearest ripe bunch. MBC movement will following harvester. Time will recorded for all activities.

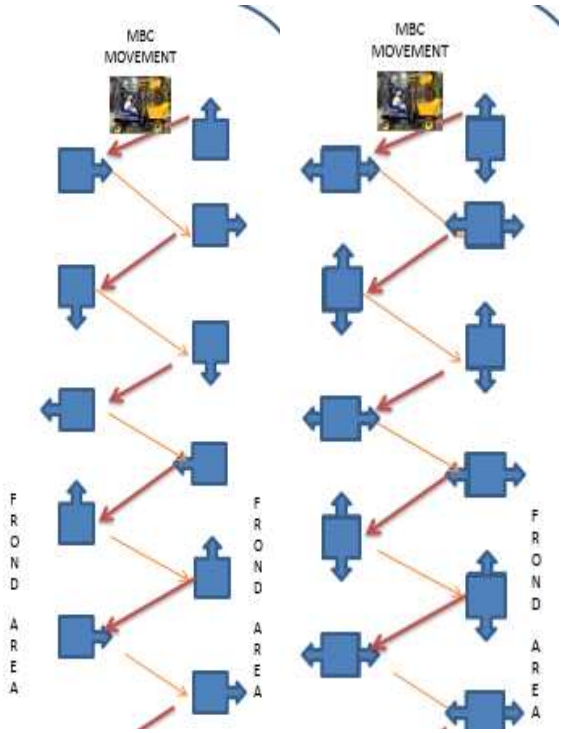


Fig. 9. Pattern of MBC movement

- Production test

  This method test MBC to the limit in harvesting FFB. All 'issue list' and production of FFB recorded. From Ramesh Veloo (2010) proposed ratio 1 labour to 7 hectare for activities in plantation [7]. 2 labour divided to do works as:-

1. Driver – Operator of machine, load FFB if not fall into bucket and collect loose fruit.
2. Co-driver – Harvester and staging frond.

## VI. Result

- Simulation test

  After testing, MBC can produced FFB per day as result below (figure 10):

| Pattern | 1 hectare | 8 hour working | Tonne/man-day |
|---|---|---|---|
| Flat (pattern 1 to 1) | 2.35 | 3.4 | 5.78 |
| Flat (pattern 1 to 2) | 3.51 | 2.28 | 3.88 |
| Mild (pattern 1 to 1) | 2.83 | 2.82 | 4.7 |
| Mild (pattern 1 to 2) | 4.09 | 1.95 | 3.32 |
| Undu (1 to 1) | 3.67 | 2.17 | 3.71 |
| Undu (1 to 2) | 4.41 | 1.81 | 3.07 |

Fig. 10. Result of simulation test

- Production test

Mobile bunch catcher machine can produce up to 4.8 (average) tons per day equivalent 208 bunches of FFB with the use of 6 liter. Hectare coverage about 2.7 hectare (average) per worker per day. This machine also can operating in certain topography. Below in figure 11 the performance result of MBC during the testing.

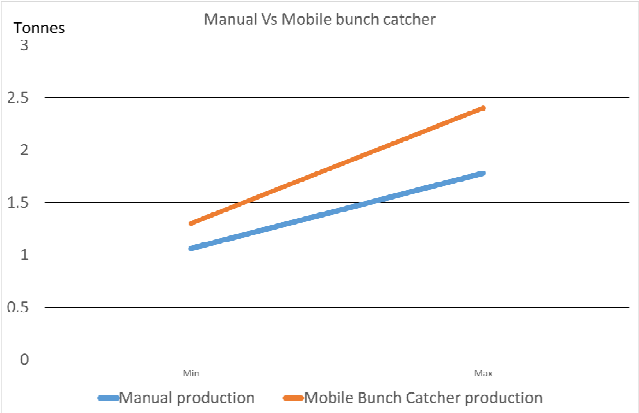


Fig. 11. Manual VS Mobile bunch catcher

## VII. Discussion

MBC FFB collection and in – field machine productivity was found between 1.3 tons to 2.4 tons per day. This is nearly same with others mechanization in oil palm plantation. A specification of MBC can 'catch' FFB and loose fruits equip with hydraulic control to suit with harvesting environment. Below shows in figure 12 a 'catcher'.

Fig. 12. Left: catcher in shortest arm and right: catcher in longest arm

The highest limitation of mast is 5.5 meter and lowest is 3.0 meter. The limitation of MBC on height of palm tree will be effected the production because harvesting operation using MBC need a suitable height to 'catch' FFB. This important to make sure all loose fruits not scattered at palm base. Collection of loose fruits will increase the consumption weight about 10%. From testing, MBC can do harvesting operation with infield collection include low labour usage. With a minimum capacity of 25 bunches FFB, MBC can easily move between harvesting path. Below shows data observed during testing:-

- Labour
  Intensive labour usage because only 2 worker needed to operate MBC. Based on data, Man-day/tons are same or more from manual tradition method using wheelbarrow and other.
- Robustness
  MBC during testing, this machine has high durability and low record replacement spare parts.
- Movement in harvesting path
  MBC using front wheel drive to move. Advantage of this driving because load can assist gripper of tire to ground surface.
- Loose fruit
  Loose fruits collected near to 90% because MBC reduce scattered of loose fruits using it catcher.

## VIII. Conclusion

Mechanization has become a common word in oil palm industry because the shortage of labour in works examples cultivating, processing and storage of oil palm. MBC was designed to solve UN collecting loose fruits and also to deliver clean FFB to mill[8].At same time the usage of labour are fully utilized because all job will complete with 2 labour will used to the limit without any leakage of energy in harvesting FFB. Testing show, MBC can assist FFB evacuate work better than mini tractor because can maneuver very fast in harvesting path. From collecting of loose fruits, MBC can minimize all loose fruits where this machine easily 'catch' FFB and loose fruits during harvesting time. All result shows, Mobile Bunch Catcher machine can help yield FFB increase and increase an oil extraction rate at mill.

## Acknowledgment

The authors would like to express their gratitude to FGV Malaysian Plantation Sdn Bhd, for the financial support given to this work under the research Fund

## References

[1] Malaysian Palm Oil Board, www.mpob.gov.my,http://bepi.mpob.gov.my/index.php/my/statistics/

[2] Azali Awaludin, Syed Salim Syed Ali, Abdul Halim Zainal Abidin and Azahah Aris (2016). *Conceptual of Mobile Oil Palm Fresh Fruit Bunch Catcher*, International Journal of Agriculture Innovations and Research Volume 4, Issue 6, ISSN (Online) 2319-1473

[3] Malaysian Palm Oil Board, *Roller – type oil palm loose fruit picker*, MPOB Information Series, ISSN 1511 – 7871, June 2009.

[4] Malaysian Palm Oil Board, Oil Palm Loose Fruits collector (mk 111), MPOB Information Series, ISSN 1511 – 7871, June 2012

[5] Ramzi Bin Ibrahim, FGV plantations mechanization experience, Palmech 2016, page 227 -246, Sandakan, Sabah

[6] Yong Kian Keong (2013), *Site yield potential of Felda Global Ventures Plantation Malaysian*, Mini R & D Seminar, Kuala Lumpur

[7] Ramesh Veloo, Jaai Haron and Zainudin Mohd Yatim (2010) , *Economic of Mechanisation- Estate Experience*, 4th National Seminar On Oil Palm Mechanization, PalmMech 2010 GEARED FOR FULL THROTTLE, page 227 -246, Kuala Lumpur

[8] Walker, A., (2010), '*Oil palm in Africa'*. http//:' oilpalmafrica.wordpress.com. (www.nifor.org)

## AUTHORS' PROFILES

**A. Awaludin** from Kuala Lumpur Malaysia. He works as Senior Researcher at FGV AT Sdn Bhd. He received his Master' Degree in 2007 from University Putra Malaysia. His experience about 22 year in Oil Palm Industry. He also doing research in biodiesel combustion engine and HCCI combustion.

**S. Salim Syed Ali**, a Malaysian, is the Head of Cluster R&D and Agri Services, CEO & Senior Vice-President of FGV Applied Technologies Sdn. Bhd. He is responsible for developing and adapting technologies for all business operations within the Felda Global Ventures group of companies. He holds a Bachelor of Science degree in Mechanical Engineering from the University of Newcastle, England.

**A.Halim Zainal Abidin,** A Malaysian, is the General Manager of FGV Applied Technologies Sdn. Bhd. He is responsible for developing and adapting technologies for all business operations within the FGV Applied Technologies Sdn. Bhd. He holds a Bachelor of Science degree in Mechanical Engineering from the University Teknologi Malaysia, Malaysia.

**Rasidi Ismail**, a Malaysian, is the Senior Executive of FGV Applied Technologies Sdn Bhd. He is responsible assisting on developing and adapting upstream technologies within FGV Applied Technologies Sdn Bhd. He holds a Dip. Electrical Power Engineering from Universiti Teknologi Malaysia, Malaysia. From the onset, he started his career as an Engineer and work in this capacity for several multi-national companies such as Intel Technologies, Komag USA and Celestica (M) Sdn Bhd.