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Empty Fruit Bunch Spreader Machine: Machine Concept

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Abstract **– Empty Fruit Bunch Spreader machine (EFBM), is an attempt to transform manuring EFB concept in plantation. EFBM main objective is to 'manure' the whole EFB at frond path with distribute evenly as per layer and width same in direction of path. All EFB shall be spreader continuously in row of frond path during spreader process. A major factor considered during EFB machine development is the adaption of proven technologies in market into a potential and workable solution in plantation area. In this concept, a EFB machine in market were modified and testing at plantation. This machine can not only produce EFB on the top of the frond path, it can also set the exact amount of EFB throughout this process. With this method, the amount of nutrient is equal to the regular distribution. The EFB machine ensures that productivity will increase by 10% to 25% FFB production. The EFB machinery also promises that spreader is very effective with the target of reducing the workforce, reducing the abundance of EFB piles, as widely as possible and effectively impart this useful bio material to the plantation.**

Keywords **– Empty Fruit Bunch, Oil Palm, Fresh Fruit Bunch, EFB Spreader and Loose Fruit.**

I. INTRODUCTION

Twice of year, spreading EFB will increase cost and working to oil palm plantation management. Due to lack of workers and equipment in suitable with the palm condition, indirectly spreading requires a mechanism that can facilitate this activity. One of the main problems in activity spreading EFB is distributing evenly in row and large amount of EFB. Mohd Najib (2018) claimed method of 'inter-palm' can save 50% amount of cost spreader EFB [1]. Total weight of EFB for 1 hectare is 40 ton and this amount can sufficient for palm oil nutrient. The current activity, EFB spreading are manually by hand picking or racking and covering for 1.5 hectare to 2.5 hectare per day. Nasrin A.B (2010) also stated the ability of EFB from palm oil mill where 66000 ton per year produce from 60 metric ton per hour mill [2]. Conventional EFB spread process using racking and wheelbarrow to distribute EFB 'inter-palm'. When EFB stacking at 'inter-palm', number of EFB are 100 bunches EFB form in rectangular shape.

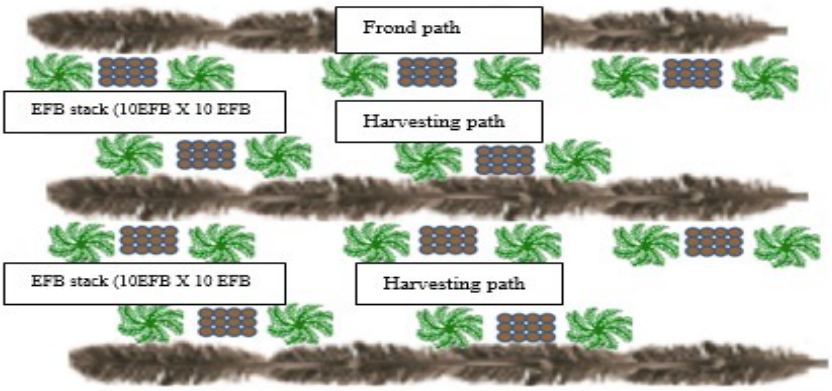

Fig. 1. 'Inter-palm' layout

Figure 1 above shows the sketch drawing of 'inter-palm' EFB layout when stacking EFB. EFB will be stack between palms with 2 palm. 1.5m to 2.5m. It will stacked using wheelbarrow and three wheeler machine. Below show conventional equipment use to EFB spreading.

Fig. 2. Equipment to spread EFB.

Azali 2018 [3] also showed an observed data from EFB manuring activity. In this observed, three wheeler use to perform of 'Inter-palm'. Below in Table 1 a data from EFB spreader activity.

Table 1. Data of spreader EFB.

Method of 'Inter-palm'	Three wheeler	wheelbarrow
Total EFB/Trip (bunches)	90 - 100	18-22
No of worker	3	3
Load (time)	3m24s	2m16s
Transport (time)	1m10s	1m24s
Arrange (time)	5m03s	2m28s
Total/trip (time)	9m37s	6m08s
Total complete (time)	9m37s	24m48s
Remarks	1trip to complete	5 to 6 trip to complete

II. Material and Method

Empty Fruit Bunch Machine, is specifically designed to fasten the EFB spreader process. To recover some of the lost, method 'inter-palm' process is carried out to spread fast using EFBM. There are several key objectives that EFBM shall produce:

1. To utilize palm waste such as EFB from Palm Oil Mill.
2. To avoid wastage of EFB supplies though a method of arrangement practical.
3. To improve soil moisture, yield and fertility.
4. To reviewing cost effectiveness.

The foundations created at the concept development stage of a design project are fundamental to its success; it is where we work out what works, what doesn't and what's possible [4], Moreover development of system, tool or design also indirectly helps the end users in acquiring a better and faster production [5]. Recent development in the mechanization of harvesting of agricultural products have brought about Concept design and concept

development of EFBM will also include basic computer aided design (CAD) to allow us to fully visualize and more importantly to develop real machine operating at plantation.

From above statement, two different tool and machine was designed and proposed. The Three Wheeler with EFB guider and tractor trailer with EFB spreader in design development at FGV AT Sdn Bhd. The Three wheeler EFB machine proposed install with guider to smooth stacking of EFB activity. Figure 3 shows design on Three Wheeler use for 'inter-palm method'.

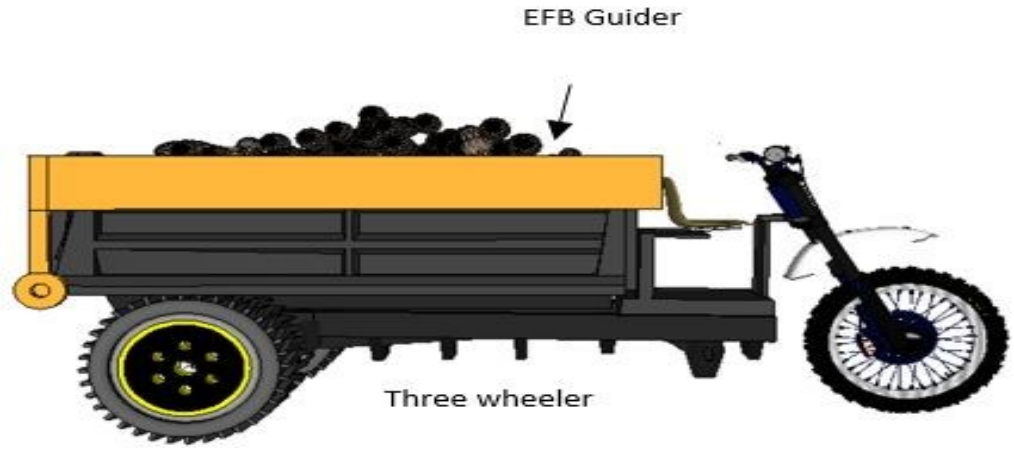

Fig. 3. Three wheeler with EFB 'guider'

The concept of Three Wheeler EFBM is derived from a proven work of EFB stacking. Hydraulic system is a prime working tool to perform stacking task. EFBM is powered by diesel engine and a back wheel drive machine to ensure maximum traction. Figure 4 shows working principle work 'guider' of EFBM.

Fig. 4. EFBM concept.

III. On Frond Spreading Method

The concept of EFBM using 'on frond spreading method', Three Wheeler EFBM is derived from a proven work of EFB stacking. Hydraulic system is a prime working tool to perform stacking task. EFBM is powered by diesel engine and a back wheel drive machine to ensure maximum traction. Figure 5 shows working principle work 'guider' of EFBM.

IV. EFBM Features

i. EFBM consists of guider and bucket in one machine.
ii. The EFBM guider lifter working direct to ground.
iii. The EFBM load capacity is 200kg.

iv. EFBM is capable to operate effectively in flat and mild undulating topography.

v. Harvester view and accessibility is not obstruct by EFBM or its components

vi. EFBM is capable of handling maximum load of 20 tonne per day.

viii. MBC works within acceptable noise level.

V. RESULT AND DISCUSSION

From result, a process flow design diagram to construct EFBM prototype. Diagram shows as below describe a motion study of EFBM prototype. This is important study to design MBC prototype because harvesting need a step of motion parallel with proposed design. Abdul Razak Jelani [6] was studied design of harvesting tool from using manual harvesting tool to motorized cutter based on movement of harvester, specification of cutting edge and production of fresh fruit bunch. From study also shows a new development of CANTAS was developed and improved production of fresh fruit bunch. Process flow diagram in figure 5 show a motion of EFBM begin from start until EFBM unload to frond path. This sequence important to guide design of prototype can achieve target of this project.

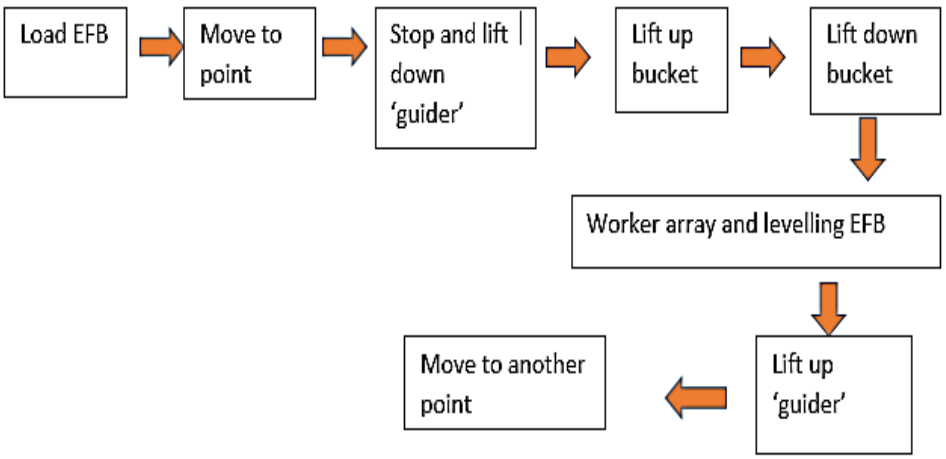

Fig. 5. Process Flow Diagram of EFBM motion study.

VI. PROCESS FLOW ILLUSTRATIONS

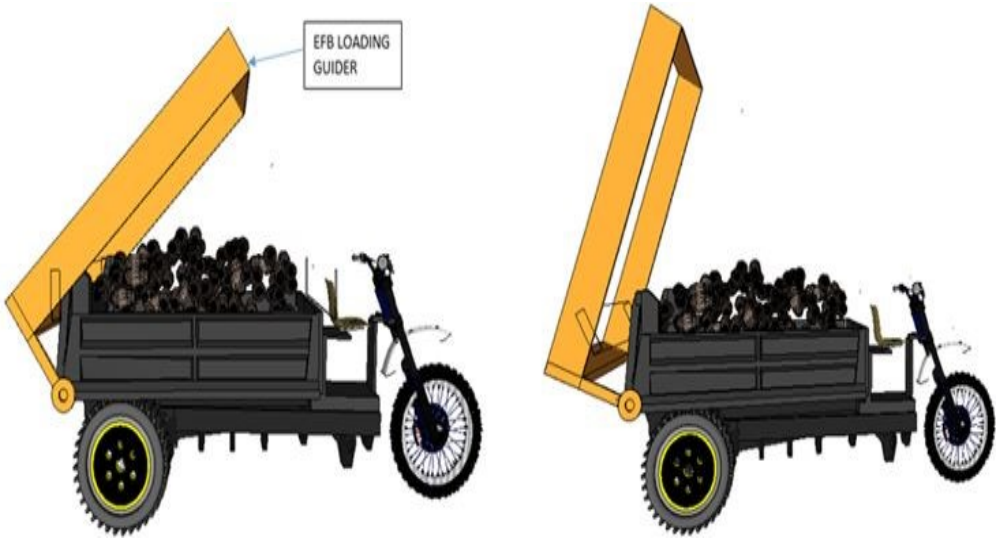

Fig. 6. Guider lifted up.

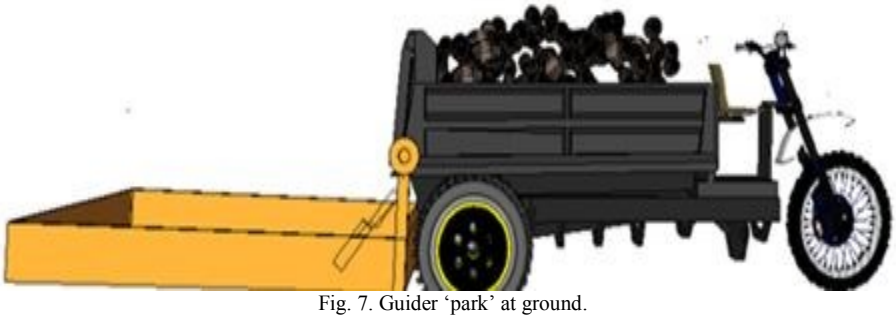

Fig. 7. Guider 'park' at ground.

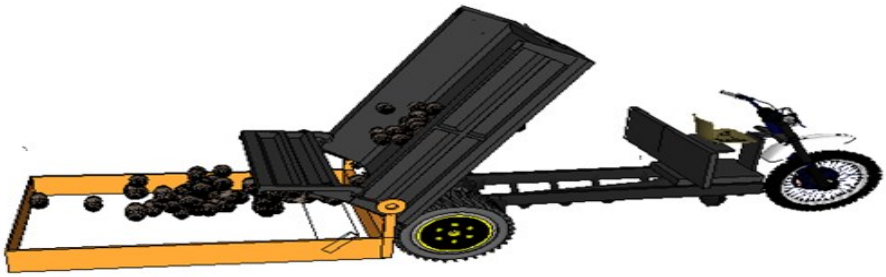

Fig. 8. Unload EFB.

The figure above shows the prototype EFBM illustration. Figure 6 shows the prototype in the park using the EFBM mechanism guider. Guider use to guide EFB in order to unload at frond path. After lifted up, Figure 7 show Guider park of EFBM. Figure 8 shows the lifting down of EFB. This guider and bucket are fully controlled by hydraulic system in hence to smooth spreading activity, Guider can guide EFB in count 100 bunches in square shape. This machinery can save up to 50% of the labor intensive by facilitating the spreader of this EFB. In the meantime, the scattering area can also be expanded further and further increase the use of this biomass material. The use of this machine also enhances the management / effectiveness of EFB use in all FGV plantations.

VII. CONCLUSION

There are lot of handful challenges and risks that may posed towards EFBM completion, implementation and plant wide practice. EFBM does not present new or advance technology. EFBM adapting technology that is proven and readily available in market. It may not pose a difficult task to maintain EFBM and make EFBM as a productive plantation machine. Maintenance team will be able to go through learning curve in a very short time and be independent fast. Extension of application from the EFBM current design is promising. Current design limits EFBM working weight to 200 kg per trip. With some understanding on how EFBM perform on various harvesting constrains, knowledge gains from EFBM implementation and some engineering work, MBC has a potential to be further developed to EFBM working weight of up to 3 tonne per trip. Management of plantation may have use on EFBM unless EFBM could outperform current harvesting method in termed of spreader number of EFB per day. EFBM has to demonstrate this capability in matching the run rate.

While that may prove a tall order, EFBM offers other benefits where the current spreader method may not able to achieve though, such as:

i. Economy value gain due to effective recovery of quantity of EFB spreader.
ii. Economy value gain due to OER improvement from effective EFB spreader frequently.
iii. Reduction in labor cost due to reduction or elimination of less EFB spreader.
iv. Improvement of EFB spreader, organic quality as the fertilizer in plantation sector.

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