MECHANICAL FFB LOADER FOR SHORT PALM - 'THE CRABBIE'

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Labour is an important input in oil palm cultivation. Shortage in labour would lead to several problems such as low fruit recovery, low quality oil and high operating cost.

Infield transporter and a mechanical loader (Grabber) for tall palms are already available in the market and have been widely used in oil palm estates. Virtually all these are not suitable to operate in young palm areas because of low frond canopy hindering movement and operation. Thus, it is necessary to develop a suitable infield transporter complete with mechanical loader for short palms.

Realising such needs, PORIM embarked into developing a mechanical loader for short palm, which incidentally could also be used for tall palms. Manoeuvrability and good traction is important in short palm area; thus the mechanical loader was designed based on a single chassis prime mover. Such machine was developed and tested both in short and tall palm areas. For short palm areas, frond deflector attachment was developed and fixed to the machine.

DESIGN CONCEPT

Several criteria are taken into consideration in designing the machine. These include:

- One-man operation
- Ease of handling
- Able to move under low canopy
- Operator to perform his task without leaving his seat
- Minimum spoilage or damage to the fruit
- Economical

In designing a mechanical loader for short palms, the following approaches were undertaken:

- Total linkages for loading fresh fruit bunches (FFB) must be short
- The loading fulcrum must be at low end of the vehicle/prime mover
- The prime mover must be of a single chassis type.

PROTOTYPE

Prime mover: A single chassis, oscillating and articulating prime mover is used for the prototype machine. It is powered by a diesel engine of 28 horsepower. This machine is used for its ease in manoeuvrability (especially amongst short palms) and better traction.

Frond deflector and driver cabin: For a normal tractor, moving through short palms would be difficult because frond canopy is still very low. With a frond deflector built in front of the prime mover, movement of this vehicle in this area is no longer a problem. Safety of the operator is also important while operat

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TABLE 1. PERFORMANCE OF MECHANICAL FFB LOADER

Palm age	Labour required	Output tonnes/day
Palm Age < 7 year	1	11 – 18
Palm Age 8< x<11 year	1	15 – 25

ing the machine. An operator cabin is also provided for the safety of the operator against snapped fronds.

Arms and grapple: Two sets of FFB loading arms with specially designed grapple were fitted at both left and right sides of the prime mover. The opening and closing of the grapple, and the lifting and lowering of side arms are activated by hydraulic ram. For a big bunch, the grapple can lift one bunch with a maximum weight of 50 kg. For smaller bunch, it can lift up to three bunches at a time. Whenever the machine is moving, the arms are at the upright position. However, the arms can be lowered slightly when low frond canopy hinders the movement of the machine.

Bin: This machine is equipped with hydraulic tipping bin. To further make unloading of FFB easier, the bin is provided with high lift mechanism that could lift up to 3.5m. Loading capacity of this bin is one tonne.

Low ground pressure (LGP) tyres: The machine is also fitted with LGP tyres, as this would make the operation easier during rainy season.

Machine weight: With the entire feature stated above the weight of the machine is only1.5 tonnes.

Operation: The machine with frond deflector attachment moves through short palm with low frond canopy effectively. Collecting FFB on the ground is done by lowering the arm. The FFB is placed or position in between the grapple plates. Closing the grapples would hold the FFB. The arm is then lifted to place the FFB into the bin by releasing the grapple's grip. All these movements are operated by controlled levers placed at the operator sides. For unloading the collected FFBs, the bin is lifted and tipped to load the FFB into a waiting lorry or mainline transporter.

FIELD TRIAL

Tests were carried out on the implements to evaluate its capability to grab and load the bunch into the bin with minimum spoilage to the fruitlets. Positioning of the grapple to the bunch (on the ground) becomes much easier and faster with the use of articulated and oscillating prime mover. On lifting the bunch and releasing the grapple, the bunch was able to fall into the bin as required. The bin needs higher sidewalls to prevent bunches from rolling out of the bin during travelling especially in an undulating area. These observations were incorporated into the field trial model of the prototype machine. Minor modifications have been made on the machine especially to the loading arms, grapples and the bin.

A field trial on this prototype model was carried out to determine the productivity of the system. An estate in the northern region of the Peninsular, with a very flat land area was chosen for this trial. The palm age ranged from three to eleven years. The weight of bunches ranged from three and a half to twenty-five kilogrammes. From this trial, it was observed that the accessibility and capability of the machine to operate in the short palm area was satisfactory without any problem. In the area where the palm age is less than seven years old, the machine was able to evacuate 10-18 tonnes per day. For eight to eleven years old palms, 15-25 tonnes per day of FFB could be evacuated.

As the machine could perform in short palm area effectively, another field trial was also carried out in tall palms over five months in a coastal area in Terengganu. The area was flat and gentle rolling. A harvesting group of one machine operator and eight FFB cutters were involved. With this group, the machine was able to evacuate 15-25 tonnes per day.

CONCLUSION

The machine can operate both in a low palm height environment as well as in tall palm areas. With the use of this machine, the number of manual loaders is reduced from three to one (excluding the group of harvester). The productivity of the machine ranges from 10-25 tonnes per day. The machine reduces human fatigue, which means that the operator could work longer hours. Fixing LGP tyres to the machine makes the operation during rainy season much easier. With this machine, lesser number of machines are required as it can serve both short and tall palm areas effectively.

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