DEVELOPMENT OF A MACHINE FOR HARVESTING TALL PALMS

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The ever increasing cost of production and poor commodity prices as a result of greater market competition have compelled the plantation industry to look for improved production techniques to reduce costs in order to maximize profits. One way towards achieving the above objective is through mechanization of the harvesting process. With mechanization, workers' productivity and efficiency are enhanced, thus reducing labour requirements and overcoming labour shortage in the plantations.

In recent years, the lack of an adequate and timely labour supply has been felt by the plantation industry. The increasing demand for the limited supply of labour occasioned by the sharp increase in area planted with oil palm has also resulted in increasing labour cost. Based on the present trend, a point will be reached when it may no longer be profitable for the plantation sector to accommodate further increases in labour cost. Hence, there is a need to maximize mechanization of estates operations to reduce labour dependence as well as cost of production. Mechanization has also been suggested as a means to improve productivity and make easier some of the arduous tasks now being performed manually.

Mechanical harvesting of oil palm fresh fruit bunches (FFB) remains an issue that needs to be solved. The current methods involve the use of a chisel or sickle, which requires manual labour and is tedious. It requires skill as well as energy to ensure an effective cutting operation. This paper presents a general view of the harvesting machine that was jointly developed with a foreign engineering firm.

CONCEPT OF HARVESTING TALL PALMS

Mechanized harvesting for tall palms has been assessed both by MPOB and the industry. A number of prototype machines, mostly fabricated by foreign engineering firms, have been tested. Two concepts of mechanized harvesting were considered (Abd. Rahim *et al.*, 1989):

Figure 1. Telescopic and elbow type arm harvester.

a) to bring the harvester on a platform close to the fruit bunches where he can cut the bunches at close proximity; and
b) to have a cutting tool at the end of a boom with the cutting controlled by an operator from the ground.

A principal factor in achieving good productivity of the equipment-plus operator combination is the time taken to move and reposition the equipment between palms. A manual harvester can move relatively quickly and efficiently between harvesting operations. Hence, a harvesting machine must similarly be able to move rapidly among the palms as well as between fields in order to achieve good productivity. Particularly with tall palms, the ease and speed with which the cutting device can be positioned against the selected bunch or frond will be critical to productivity. This must be achieved at

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heights of up to 12 m, despite poor access to the base of the bunch and poor visibility of the cutting target area.

Machine Concept

MPOB is currently working with a Japanese firm to develop a harvesting machine with the cutting mechanism attached to a boom. The maximum height that this boom can reach is 10 m. The arms, having both a cutter blade member and fruit catching mechanism (FCM), can be extended upwards and retracted using hydraulic cylinders. During harvesting, the operator drives the vehicle along the harvesting path by means of a joystick control. All the control levers to operate the booms and arms, FCM as well the cutter are within reach of the operator. When a bunch is sighted, the operator will manoeuvre the vehicle close to the palm and start the harvesting process. During the harvesting process, the arm is extended to the palm crown by shifting the respective joystick control. Once the cutter is brought to a suitable position, the operator will cut the frond and bunch. Prior to cutting the bunch, it will be grabbed using the FCM, then cut, brought down and placed into a bin.

The prime mover is a tracked type vehicle with a 500 kg loading capacity and is powered by a 31.5 hp diesel engine. A tracked vehicle is known to contribute less compaction to the ground while providing good traction both on rough terrain as well as on soft ground. The cutter is of scissors-type and hydraulically powered.

Field Trials

Field trials were conducted in commercial estates to evaluate the machine in terms of its mechanical availability, durability and productivity. The first step in the field trials exercise was to train a local driver to operate the machine. Initially the new operator may find difficulty in adjusting himself to control several levers before he can cut bunches. However, an operator requires less than two weeks training to become familiar with the controls.

One of the objectives in this field trial is to assess the overall performance of the machine particularly the cutter. This is due to the fact that previously tested harvesting machines failed mainly because the cutters were unable to cut effectively. Apart from cutter, another gadget that is also being incorporated to this machine is fruit catching mechanism. This catching mechanism is in the form of a grapple with two fingers to hold bunches. The practicality of cutter and grapple would be a deciding factor in determining the success or failure of this machine.

A time and motion study was carried out to determine its cycle time for the harvesting process. It was found that the machine took between 2.5 to 3.5 min for a complete cycle. The cycle includes positioning the cutter, cutting the frond and setting the grapple to hold the fruit bunch, cutting the bunch and bringing it down to place into a container. In terms of productivity, the machine is able to harvest between 4 to 6 t FFB day^{-1}. The productivity of the machine is affected by several factors such as cropping level, variability of palm height, ground condition, field layout and effective working hours.

CONCLUSION

This tracked machine has an acceptable level of ground pressure and also good stability, which is very necessary as the machine has to carry a telescopic boom which the cutting mechanism is mounted onto it. The machine that has been developed is able to meet the requirements of the harvesting process. It is able to cut the FFB and convey it into the container without letting it fall on the ground. In the absence of a fall, loose fruit scattering is reduced and less damage is done to the FFB as there is no impact due to gravity. This is an additional benefit of this harvesting system.

The machine was designed following discussion with relevant experts to meet local requirements. The challenge now is to reduce the capital cost of the mechanical harvester to an acceptable figure. Localizing the technology is the likely answer. MPOB would focus in producing the machine locally not only for cost reduction but also to benefit the local engineering fabrication firms, especially in terms of technology transfer and workers' skill.

REFERENCE

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