AN IMPROVED OIL PALM MOTORIZED CUTTER - *Cantas Mark II*

ABDUL RAZAK JELANI; MUHAMAD NAGINUDDIN MAJI; ABD RAHIM SHUIB; AHMAD TARMIZI MOHAMED and AHMAD KUSHAIRI DIN

504

MPOB INFORMATION SERIES • ISSN 1511-7871 • JUNE 2010 MPOB TT No. 448

MPOB introduced the oil palm motorized cutter, *Cantas*, in 2007. *Cantas* is suitable for harvesting fresh fruit bunches (FFB) from palms up to 5 m tall, which is the height normally reached by palms which are less than 13 years old. *Cantas* is easy to use and is less strenuous for the worker compared to the current manual harvesting method. It is able to increase harvesting productivity by more than double, thus increasing the take-home pay of the harvester, and reducing the number of harvesters required on the payroll, currently dominated by foreign workers. *Cantas* benefits the smallholder, the individual harvester, the contractor and the estate in terms of increased productivity and income, and reduced number of workers and operational cost.

Thus, *Cantas* has been well received by the industry. *Cantas* technology, however, is still new in the market, and it is in the process of refinement, which includes improving its durability, mainly that of the 'cutting head'. The cutting head is the 'heart' of *Cantas*, acting as the cutting mechanism which must have enough force and a sufficiently high revolutions, and be strong enough to overcome the toughness of the oil palm fronds and fruit stalks, as well as to withstand the rough handling by the harvesters. It has been calculated that the revolutions of the cutting mechanism (gears and connecting rod) is about one million revolutions in a day which works out to about 25 million revolutions per month. This high speed movement causes severe wear and tear on the moving parts as well as all the components which rub against each other. Rough handling by the operators is another factor that can cause machine breakdown. MPOB is improving the machine from time to time to ensure that the machine is durable, thus minimizing downtime.

IMPROVED VERSION

New Design of the Cutting Head

This new version incorporates an anti-friction mechanism which offers a much smoother movement of the sickle with very minimal friction. This low friction reduces damage to the parts inside the cutting head. Wear and tear of the moving parts is therefore reduced, lengthening the life-span of the machine. The main components, *i.e.* the connecting-rod, v-shaped guider and sickle sleeve, are made of hardened steel which is strong enough to resist excessive friction, thus producing very low wear and tear. These are the parts that have been improved for better durability. In the previous version (*Figure 1*), a sickle moves in a guided groove, making it prone to high friction which causes severe wear and tear, ultimately damaging the components. The sickle is directly fixed to the connecting rod inside the cutting head, which thus requires extra cost for fabrication. Also,

Figure 1. First version of cutting head.

replacement of the sickle becomes difficult because the head cover has to be opened. However, in the new design, the sickle is much shorter and is fixed to a holder attached to the connecting rod, thus, making the replacement of the sickle much easier and faster without having to open the head cover. This also allows for fast replacement of either the sickle or the chisels to be used by the operator. The new version of the cutting head with a sickle holder is shown in *Figure 2*.

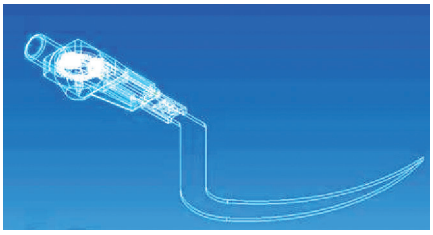
New Pole Gripper

The gripper is used for adjusting the reach of *Cantas*. It has to be strong and durable to retain the force exerted during the cutting operation. It has

ISSN 1511-7871
9 771511 787001

Malaysian Palm Oil Board, Ministry of Plantation Industries and Commodities, Malaysia
P. O. Box 10620, 50720 Kuala Lumpur, Malaysia. *Tel:* 03-87694400 *Website:* www.mpob.gov.my *Telefax:* 03-89259446

MPOB



(a)

(b)

Figure 2. Newly designed cutting head with a sickle holder: (a) wire-mesh drawing and (b) the prototype.

also been improved because the existing gripper, which is made of plastic, does not give confidence that it will be easily broken off. The new clamp made of pressed-steel of 1 mm thickness is much stronger and cheaper to manufacture. *Figure 3* shows the pole grippers of the existing and new designs.

Figure 3. Pole gripper: existing (top) and new design (bottom).

PERFORMANCE TESTS

Endurance and Fatigue Test

The cutting head has gone through endurance and fatigue tests to evaluate its reliability and durability over a period of time. A hardness test was carried out prior to the endurance and fatigue tests to measure the original strength of the material used for each component to ensure that it was within the limit that was set. The hardness of each part of the cutting head was tested using a hardness tester with the brand name *Timeleebs TH 130*, giving readings in units of 'Leeb's **hardness** value' (HLD). The results of the hardness tests are shown in *Table 1*.

The tests show that the hardness of all the components, particularly the sickle sleeve and v-shaped guider, was greater than 100 HLD which is considerably strong enough to overcome high friction and the high-speed linear movement of the sickle sleeve.

The endurance and fatigue tests were conducted to evaluate the durability of each component over a period of time. A test jig was developed to carry out these tests (*Figure 4*). An artificial load of 200 Newton was applied to the cutting head to simulate the load in an actual operation in the field. A sequencer was used to control the activation of the engine's accelerator in activating the cutting head. A sequence gap of 5 seconds was applied to control the engine~~'s~~ speed in activating the head; the engine running speed was set at ~~of~~ 6000 rpm, which is similar to the speed ~~in~~ during actual field operation. The results so far indicate that there is no significant wear and tear on the critical components of the cutting head, namely, the sickle sleeve and the v-shaped guider.

Function Test

A function test was then carried out on the new prototype in the field (*Figure 5*). The test showed that the prototype functioned as expected more importantly, the operator felt that the sickle movement was much smoother, and reported that the machine generated less vibration and produced a cleaner cut compared to the previous version of the cutting head. This consequence was mainly due to the low friction developed in the cutting head which translated into better cutting efficiency, less vibration and lower wear and tear of parts. Due to its superior performance over its predecessor, the new version of the machine has been named *Cantas Mark-II*.

TABLE 1. HARDNESS OF THE COMPONENTS OF THE CUTTING HEAD

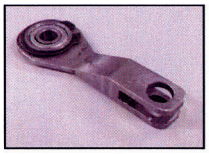
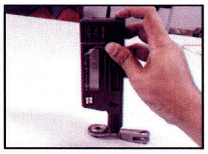
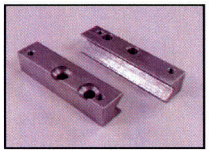
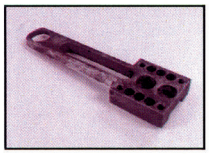
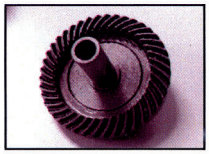
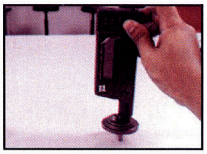
No.	Part	Hardness test	Hardness (HLD)/Remarks
1	 Connecting rod		Dir ↓ +90° Material steel Hardness : 112HLD
2	 V-shaped guider		Dir ↓ +90° Material steel Hardness : 290HLD
3	 Sickle sleeve		Dir ↓ +90° Material steel Hardness : 517 HLD
4	 Main gear		Dir ↓ +90° Material steel Hardness : 564 HLD

Figure 4. Endurance and fatigue test jig.

Figure 5. Function test of Cantas Mark-II.

As for the new pole gripper, it has been used for more than 350 hr harvesting more than 35 000 FFB without any problem, proving that the new gripper is much more durable compared to the previous version.

BUSINESS OPPORTUNITY

The potential market size for this technology is about 20 000 units a year. With a capital expenditure (CAPEX) and an operating expenditure (OPEX) of RM 1.6 million and RM 2.7 million per yr, respectively, the interested taker will gain about RM 4.2 million in revenue a year, with IRR, NPV and payback period of 36%, RM 930 and 1 year, respectively.

CONCLUSION

Cantas Mark-II with its new cutting head and pole gripper was found to be superior to the previous versions. The cutting head has been designed to be strong and durable enough to overcome high friction due to the high speed of cutting, as well as the rough handling by the operators. This new version shows very promising results in terms of functionality and durability as proven by the endurance and fatigue tests carried out. Better

durability will result in less downtime, making the operators more interested in using the machine because they can then increase their productivity significantly.

Cantas Mark-II with its new cutting head, sickle attachment and pole gripper was found to be more efficient and durable compared to the earlier versions. All these improvements help to increase the efficiency and quality of the technology to fulfil the requirements of the users. A lot more improvements are in the pipeline, and will eventually be introduced to the industry.

For more information, kindly contact:

Director-General
MPOB
P. O. Box 10620
50720 Kuala Lumpur, Malaysia.
Tel: 03-8769 4400
Telefax: 03-8925 9446
Website: www.mpob.gov.my