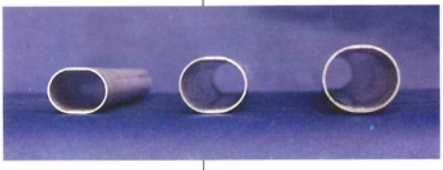
HI-REACH HARVESTING POLE

by: ABDUL RAZAK JELANI AND AHMAD HITAM

AUGUST 2000
1990
MPOB TT No . 86

MPOB INFORMATION SERIES (formerly known as PORIM Information Series) ISSN 1511-7871

In the early days, fresh fruit bunches (FFB) of tall palm trees were harvested using a sickle attached to a long wooden pole or bamboo. This device is inconvenient in that the pole length is fixed making it difficult to harvest FFB from palms of varying heights. The heavy weight of the wooden or bamboo poles makes the handling of the harvesting device inefficient and clumsy. Further, the durability of the pole is poor. Dry bamboo or wooden poles tend to break when a slight force is applied along the longitudinal axis. They are also not stiff enough - an essential factor in harvesting poles. Scarcity of getting the desired lengths of bamboo or wood to harvest very tall palms (> 12 m high) and the problems mentioned earlier have made them inappropriate for commercial use. These disadvantages generally decrease the productivity of a harvesting worker and thereby increase the cost of production.



Having realized these problems, PORIM, in 1986 introduced an aluminium pole (popularly known as Zirafah) to complement the wooden and bamboo poles. Zirafah is oval in shape and available in two sections, namely basic (the bigger diameter) and extension. The dimensions of the basic and extension poles on the major to minor axes are 45 mm x 35 mm and 39.5 mm x 29.5 mm, respectively. The ratios of diameters of the major to minor axes are 1.28 and 1.34 for the basic and extension poles, respectively. They are available in two lengths, viz 6 m and 9 m.

Trials carried out showed that Zirafah was found to be effective for palms of below 12 m but could not perform well on palms above 12 m. This was proven from field trials carried out in tall palm areas (12 m ñ 15 m). The productivity per harvester per day was low because the harvester faced difficulty in the lifting of the pole and moving from palm to palm. These problems are due to high deflection of the pole particularly on its minor axis which resulted from the high diameter ratio of major to minor axis (1.28 and 1.34 for basic and extension poles, respectively). Hence, the pole tends to be twisted at the time of lifting, resulting in higher deflection. This makes the pole difficult to handle and finally the pole will fall down.

DESIGN CONCEPT

Analysis on the effect of physical characteristic (weight, deflection, distance of centre of gravity and lifting moment) on the harvesting productivity in harvesting tall palms (12 m ñ 15 m) showed that deflection and lifting moment of the pole played a significant role. Trials had proven that poles with lower deflection and lifting moment would be easy to handle, thus more fruits can be cut. The cross-sectional diameter, and the combination of length are crucial factors in lowering the deflection and lifting moment. To lower the lifting moment of the pole, its centre of gravity should be brought down towards the lower

ISSN 1511-7871
9 771511 787001

MALAYSIAN PALM OIL BOARD (MPOB)
P. O. Box 10620, 50720 Kuala Lumpur, Malaysia. Tel: 03-8259155, 8259775, Homepage: http: //mpob. gov. my, Telefax: 03-89259446

part of the pole.

A new pole, the Hi-Reach was then designed and developed to overcome the weaknesses of commercial poles. The main criteria in the design was to reduce deflection and lifting moment. The oval shape was maintained as it was proven to provide a higher surface area for better hand gripping and also exhibits higher stiffness for preventing buckling of the pole.

PROTOTYPE DEVELOPMENT

Aluminium alloy was chosen as a base material for developing the prototypes as it offers the desired characteristics as proven in aircraft application. This alloy has better strength and longer life span. A pole of three different sections namely bottom, middle and top sections were fabricated, in which the top section will be able to slide into the middle section, similarly the middle section will be able to slide into the bottom section. In this design, the ratios of major to minor axes were reduced from 1.28 and 1.34 for bottom and top sections, respectively (commercial pole), to 1.07, 1.12 and 1.22 for bottom, middle and top sections, respectively (Hi-Reach). The bottom pole was designed to have the lowest ratio with the objective of minimising deflection effect during the lifting activity, while for the middle and top sections, their major to minor axes ratios have been designed to be higher for getting a one-way movement making an easier placement of the knife. The wall thicknesses of the sections are 1.6 mm for bottom section, 1.4 mm for middle and top sections. The thickness along the major axis is 2 mm for bottom and middle sections, and 1.8mm for top section. This increases the strength by reducing deflection.

The standard section lengths fabricated are 3 m and 6 m. The method of joining the sections is by sliding the smaller pole section into the bigger pole section and tightened by an U-clamp or a specially designed clamp. Three combinations can be assembled to make up a total length of 15 m, viz. 3 m + 6 m + 6 m, 6 m + 3 m + 6 m and 6 m + 6 m + 3 m. Figure 1 shows the cross-sectional configuration of the sections of the pole.

PHYSICAL TEST

The physical test is a test to determine the weight, deflection, centre of gravity (cofg) and lifting moment of the pole. These characteristics are very crucial in the design of a harvesting pole as they will affect the efficiency of the pole. Physical tests carried out showed that all the three combinations have improved physical characteristics. Figures 2,3, 4 and 5 show the comparisons of the physical characteristics (weight, deflection, centre of gravity (Cofg) and lifting moment) of the Hi-Reach and a commercial pole.

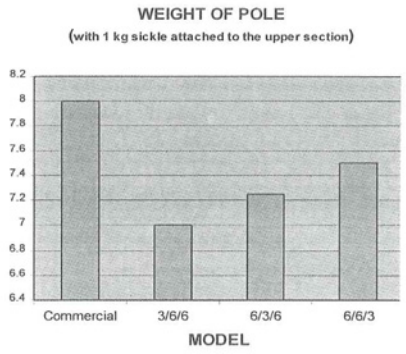


Figure 2. Comparison of weight between Hi-Reach and a commercial pole.

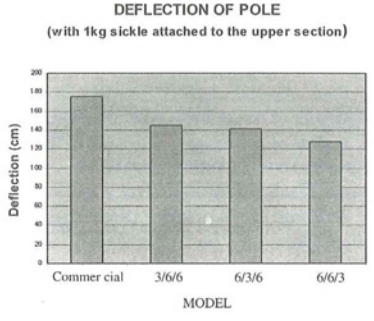


Figure 3. Comparison of deflection between Hi-Reach and a commercial pole.

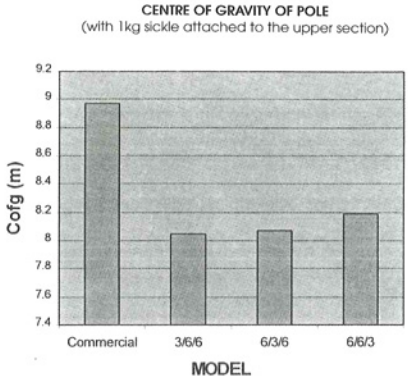


Figure 4. Comparison of centre of gravity between Hi-Reach and a commercial pole.

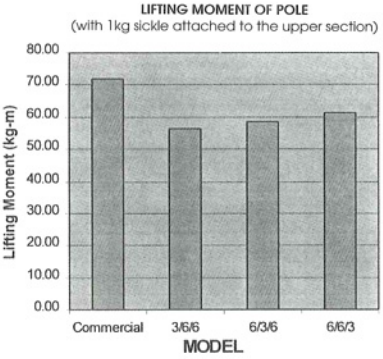


Figure 5. Comparison of lifting moment between Hi-Reach and a commercial pole.

FIELD TRIALS

A series of field trials were carried out in a number of commercial estates in Peninsular Malaysia to assess the performance in terms of productivity and durability. Figure 6 shows a harvester using the Hi-Reach in tall palm harvesting. The estates chosen for the trial were those having palms of more than 12 m high. From these field trials, it was found that the poles girth, flexibility, weight and comfortability of the pole were acceptable to the harvesters. Figures 7 and 8 show the harvesting productivity by the harvesters in ESPEK Bera and P PNJ Bukit Bujang estates. The harvesting productivity ranged from 90 to 170 FFB/day and 100 to 170 FFB/day for PPNJ Bukit Bujang and ESPEK Bera, respectively. However, the productivity depends very much on the cropping level (as shown in the graph), field topography as well as the harvesters skill. It has been observed that the pole could last for about eight to 12 months depending on the method of usage.

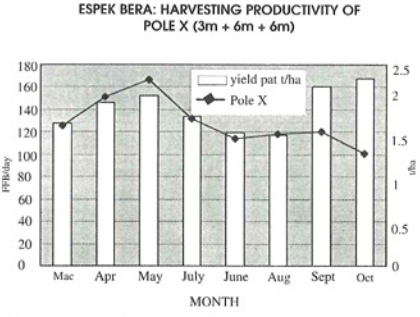


Figure 7. Harvesting productivity of Hi-Reach at Bera Estate.

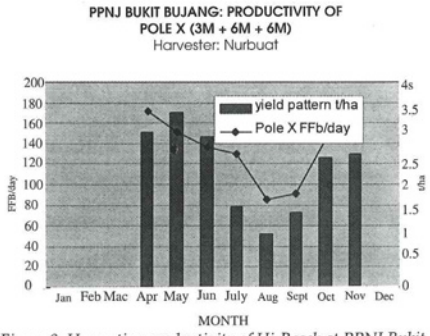


Figure 8. Harvesting productivity of Hi-Reach at PPNJ Bukit Bujang.

CONCLUSION

It can been seen that the use of Hi-Reach pole increases the efficiency of the harvesting operation. Workers can harvest more fruits as taller palms can be reached. As the pole is light, the complaint of back strain is no longer reported. Its telescopic feature enables the workers to harvest palms of different heights.

For more information kindly contact:

Director-General
MPOB
P. O. Box 10620
50720 Kuala Lumpur, Malaysia.
Tel: 03-89259155, 89259775,
Homepage: http: //mpob. gov. my
Telefax: 03-89259446