

# Pole harvesting - A skillful operation in oil palm fresh fruit bunch (FFB) harvest

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## Abstract

The study demonstrates the importance of skilled pole harvester (PH). Skill in pole harvesting ultimately reduces the human drudgery, time and cost involved in rope and cutlass harvest (RCH) while harvesting oil palm fresh fruit bunches (FFBs). Comparative cumulative harvesting activities in FFB harvest apparently showed that average number of strokes for frond(s) and FFB harvest by skilled PH (8.6) were less than unskilled PH (22.0). The slashing time required to harvest FFB was less in case of skilled PH (2.1 min) compared with RCH (3.2 min.) and unskilled PH (17.8 min.) which eventually is reflected in total slashing and harvesting time for 1 MT FFBs. The difficulty experienced by unskilled PH was likely to be more than RCH and skilled PH method of harvest.

**Keywords:** Fresh fruit bunches, oil palm, pole harvesting

## Introduction

Oil palm (*Elaeis guineensis* Jacq.) was introduced in India during early 1990's, to meet the demand and to attain sustainable vegetable oil production in India due to its unparalleled oil productivity compared to other oil seed crops. In India this crop is being widely cultivated in Andhra Pradesh, Karnataka, Mizoram, Tamil Nadu, Odisha, Kerala, Gujarat, Anadaman and Nicobar Islands, Maharashtra, Goa, Chhattisgarh and Tripura. Among all cultural activities, harvesting of oil palm fresh fruit bunches (FFBs) is considered as challenging, laborious (43 to 45 per cent of total annual man-days in productive life span of 9 to 25 years) and expensive (16 to 18 per cent of total production cost) (Evan and Gray, 1969; Awaludin *et al.*, 2015; Prasad *et al.*, 2015). Unlike other perennial fruit crops and other palm species, the indeterminate growth habit of this monocot and left over leaf base during FFB harvest and leaf pruning makes climbing intricate, risky and eventually the FFB harvest. Oil palm starts producing economic yield from 4<sup>th</sup> year up to 25-30

years. In young plantations, especially 4 to 10 year old palms with height up to 5 to 10 feet, harvesting could be done with minimum efforts using hand tools *viz.*, sickle or chisel of 9 to 14 cm width attached to the tip of long poles with nut-bolt or screw system. The pole should be of lightweight aluminum with adjustable height by inserting one pole inside another (telescopic type) (Fig. 1) according to the height of the palm (Arulraj, 2015; Awaludin *et al.*, 2015).



Fig. 1. Harvesting pole – Telescopic type

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The curvature or cutting angle of the sickle and sharpness at the cutting edge are the most important criterion to harvest the leaf axil intact FFBs. Most of the FFBs are embedded in the leaf axil. Hence, removal of underlying leaves or fronds favours easy FFB harvest and free fall of bunches to the ground. Different types of sickles are available for harvesting purpose *i.e.*, Malaysian sickle, Kerala sickle, Andhra Pradesh sickle and Tamil Nadu sickle. DOPR-1 and DOPR-5, developed by ICAR-IIOPR, are found to be ideal and recommended. Local harvesters modify the sickle shape according to their requirement and convenience.

Apart from above models, there are numerous manual and mechanical tools *i.e.*, cantas motorized cutter, vacuum operated cutters for young plantations and tractor operated lifting platforms for aged plantations have been fabricated for ease of harvest (Kusuma and Singh, 2015). In taller plantations, rope-and-cutlass method (RC) is extensively practiced, which requires greater skill to climb and handle the cutting tools (Adetan *et al.*, 2007). In plantations with tall trees, RC method is also considered to be dreadful which can be replaced by pole harvester (PH). But, when the height of the palm increases, handling of harvesting tools requires greater skill. This paper investigated the importance of skill in handling pole harvesting in taller plantations to reduce the time and burden of FFB harvesting.

## Materials and methods

The harvesting trial was conducted in 10 to 15 year age old plantations with the average height of 20 feet at ICAR-IIOPR, Pedavegi. Following two methods of FFB harvesting *viz.*, RC and PH, the harvesters were grouped as skilled RC FFB harvesters (RCH), Skilled RC FFB harvesters operating PH (Unskilled PH) and skilled PH operators (Skilled PH) (Fig. 2).

The treatments were trailed during peak production periods (April 15<sup>th</sup> and May15<sup>th</sup>) in the same plantation at consequent cycles of 15 days interval. The harvesting tools used by RCH and PH for FFB harvest were modified Andhra Pradesh sickle and DOPR-5 sickle, respectively (Fig. 3).

The overall discomfort and body part discomfort during harvesting operation was assessed using body map (Fig. 4) and a ranking procedure in 0 to 10 scale (Fig. 5). proposed by Hogan and Fleishman (1979) and Corlett and Bishop (1976) was adopted.

The experiment was carried out with three treatments (harvesters) and five replications (60 palms in each replication) in a completely randomized block design. Comparison of mean by analysis of variance (ANOVA) was analyzed at 5 per cent significance level using strengthening Statistical Computing for NARS (<http://stat.iasri.res.in/sscnarsportal/main.do>) developed and hosted by ICAR-IASRI, New Delhi.



Fig. 2. Harvesting of oil palm FFB by (A) Skilled RC FFB harvesters, (B) Unskilled PH and (C) Skilled PH

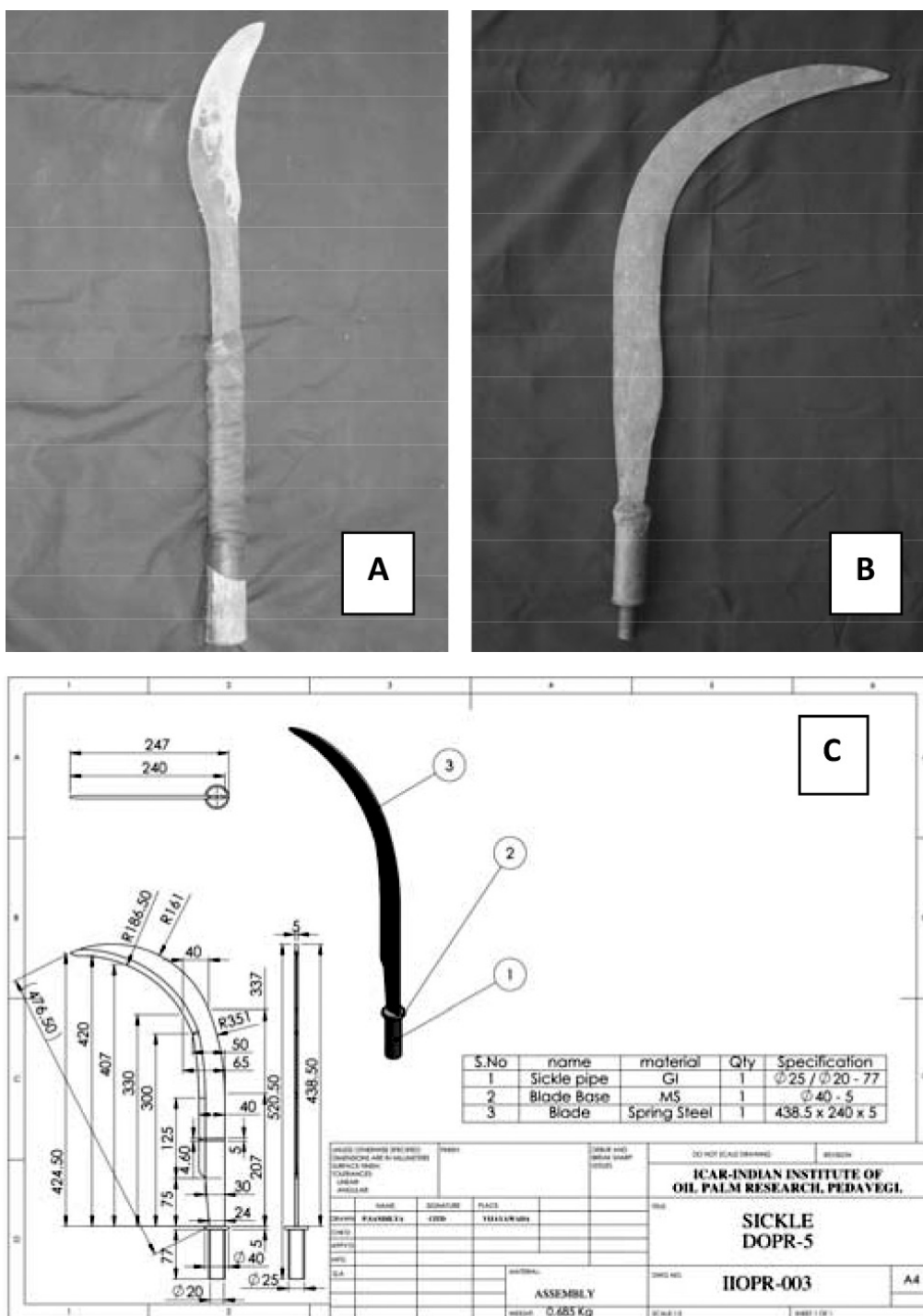
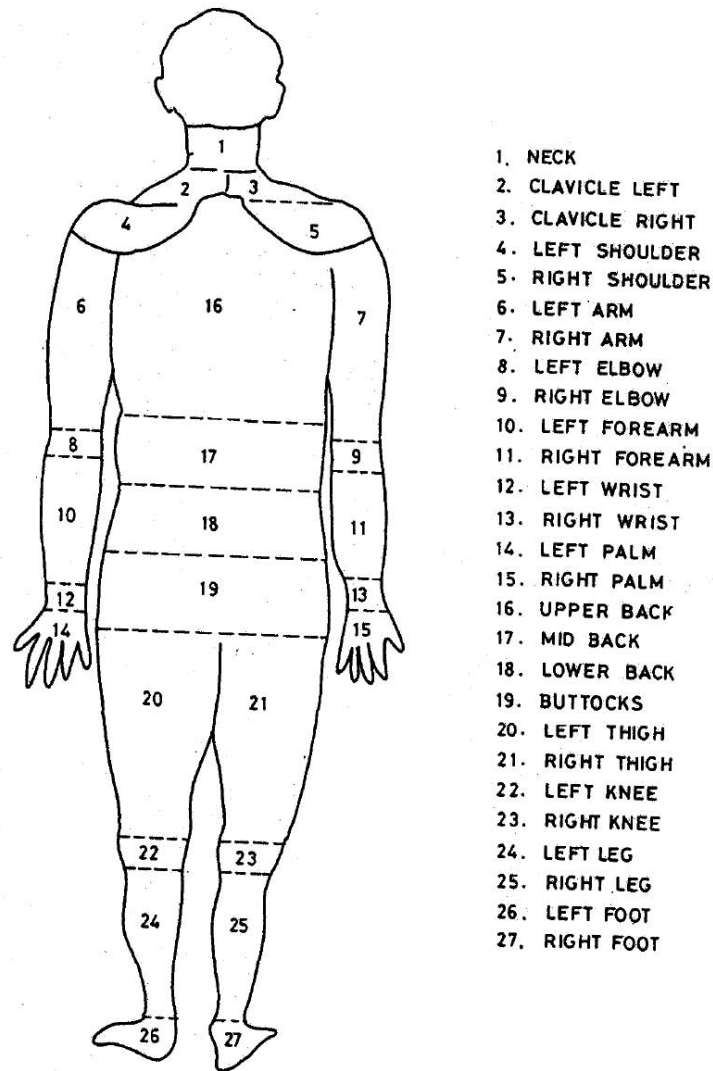


Fig. 3. Harvesting tools used for FFB harvest (A) Sickle used by Skilled RC FFB harvesting, (B) DOPR-5 sickle for pole harvesting and (C) CAD drawing of DOPR-5 sickle

### Results and discussion

In oil palm, FFB stalks are usually embedded in the axil of respective underlying frond which has to be removed for ease of harvest (Ng *et al.*, 2013).

The average number of fronds removed during FFB harvest had no significance among the harvesting methods as one or two fronds needs to be removed for harvesting each FFB.



1. NECK
2. CLAVICLE LEFT
3. CLAVICLE RIGHT
4. LEFT SHOULDER
5. RIGHT SHOULDER
6. LEFT ARM
7. RIGHT ARM
8. LEFT ELBOW
9. RIGHT ELBOW
10. LEFT FOREARM
11. RIGHT FOREARM
12. LEFT WRIST
13. RIGHT WRIST
14. LEFT PALM
15. RIGHT PALM
16. UPPER BACK
17. MID BACK
18. LOWER BACK
19. BUTTOCKS
20. LEFT THIGH
21. RIGHT THIGH
22. LEFT KNEE
23. RIGHT KNEE
24. LEFT LEG
25. RIGHT LEG
26. LEFT FOOT
27. RIGHT FOOT

Fig. 4. Systematic division of human body for body part discomfort survey

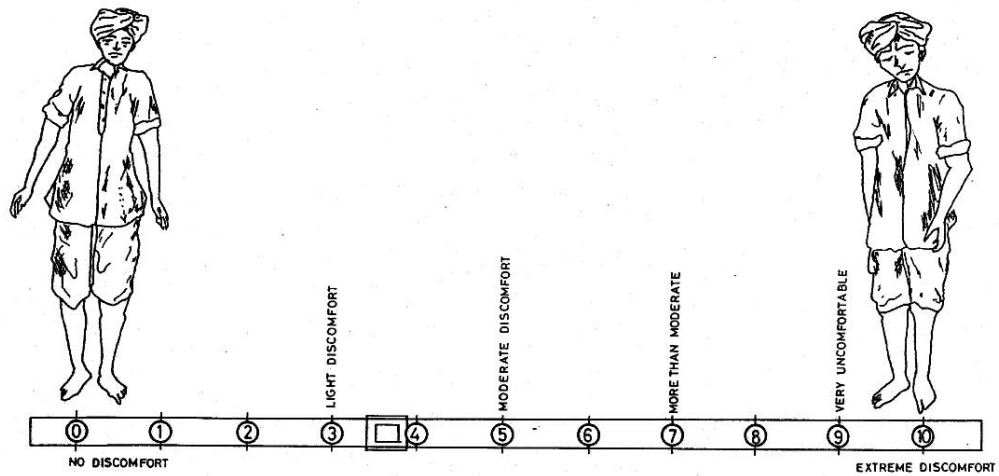


Fig. 5. Ten point scale for assessment of whole body discomfort

The FFB and underlying leaves required 4.5, 22.0 and 8.6 strokes and 3.2, 17.8 and 2.1 minutes slashing time in RCH, Unskilled PH and skilled PH respectively. RCH required lesser number of strokes for cutting frond and FFB harvest compared to PH method. The reduced distance between the harvester and the FFB eventually leads to forced strokes. In PH method, pole along with sickle were raised to reach frond and FFB stalk. Considering proper angle of sickle insertion, standing position and location as important criteria for handling PH (Arulraj, 2015), skilled PH required lesser number of strokes and slashing time, whereas, more number of strokes and slashing time is required in unskilled PH due to more number of false strokes (Table 1).

**Table 1. Comparison of various harvesting activities and method of harvesting carried out by different harvesters**

Method of harvest	Average no. of fronds removed per FFB*	Average no. of strokes for frond(s) and FFB harvest**	Slashing time for frond(s) and FFB harvest (min.)**	Harvesting time for 1 MT FFBs (60 Palms)		Charges for harvesting 1 MT FFB (₹)**
				Total slashing time (min.)**	Total harvesting time (min.)**	
RCH	1.5	4.1 <sup>a</sup>	3.2 <sup>b</sup>	196.5 <sup>b</sup>	256.5 <sup>b</sup>	360.0 <sup>b</sup>
Unskilled PH	1.5	22.0 <sup>c</sup>	17.8 <sup>c</sup>	1102.4 <sup>c</sup>	1162.4 <sup>c</sup>	1673.0 <sup>c</sup>
Skilled PH	1.6	8.6 <sup>b</sup>	2.1 <sup>a</sup>	130.8 <sup>a</sup>	190.8 <sup>a</sup>	266.0 <sup>a</sup>
Mean	1.5	11.7	7.7	476.6	536.6	766.3
S.Ed.	0.03	0.49	0.42	118.48	118.5	171.65
CD (0.05)	NS	1.09	0.36	1.35	1.35	1.87

\* Non significant at P<0.05 by Least Significant Difference (LSD)

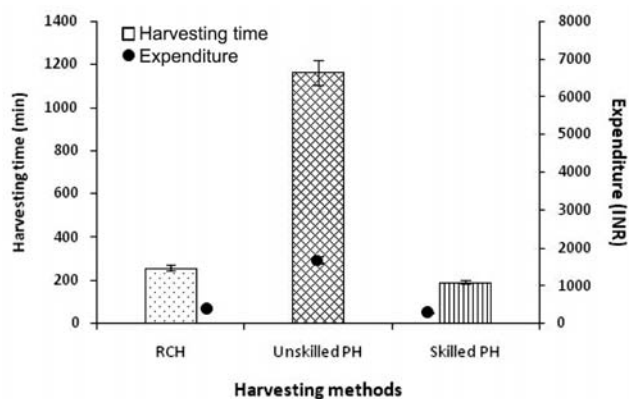
\*\*Means followed by different letters within the column are significantly different at P<0.05 by LSD

The slashing time in RCH method is more because that included palm climbing and descend time and sometimes the energy focused on force strokes might reduce the performance of climbing and descend action. Awaludin *et al.* (2015) also made similar performance reduction in manual evacuation of harvested FFB compared with machine evacuation.

The total slashing time required completing the harvest of 1 MT (60 numbers of FFBs) were proportionate to slashing time obtained by individual fronds and FFB. Identification and selection is a vital skill for acquiring matured FFB, because ripening phase is ideal for oil synthesis and free fatty acid formation. Hence, more harvesters are required during high production period (peak season) and less during low production periods (lean season) (Arulraj *et al.*, 2015). The average time required to

search and selection of physiologically matured FFB was an hour approximately; the total harvesting time at every treatment increased by an hour and thereby 256.5 min, 1162.4 min and 190.8 min, respectively for RCH, unskilled PH and skilled PH methods (Table 1, Fig. 6). The wages of local FFB harvester in West Godavari district, Andhra Pradesh is 500 on daily basis with 6 hours of working period. Based on the total harvesting time, the amount spent on harvester for harvesting 60 numbers FFB for RCH, unskilled PH and skilled PH methods were 360, 1973 and 266 respectively. Time and cost involved in harvesting 1 MT FFB was increased by 3.5 fold in unskilled PH compared with RCH, whereas, skilled

PH required 0.25 fold less time and cost than RCH (Fig. 7). The study concluded that, though the total harvesting time spent and labour charges for FFB harvest of RCH and skilled PH has no significance,



**Fig. 6. Time and expenditure for harvesting 1 MT (60 palms) of FFB involving different harvesting methods**

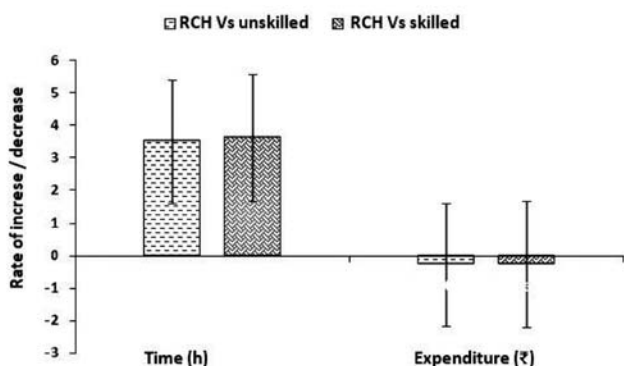


Fig. 7. Comparison of RCH with unskilled and skilled PH in reducing or increasing time and cost involved in harvesting 1 MT of FFB

with respect to safety measures, PH is the best applicable method and skilled PH operation is cost effective and time saving harvesting activity in taller plantations.

At the end of harvest of 1 MT of FFB, the harvesters were very comfortable while following the RCH method rather than PH, whereas, between the two PH methods, skilled PH recorded better comfort compared to unskilled PH. The body part discomfort ranking showed that the level of pain experienced by body parts in unskilled PH is more compared to RCH and skilled PH (Table 2).

Table 2. Rate of discomfort experienced through different harvesting methods

Method of harvest	Overall discomfort score	Body part discomfort score
RCH	0.7	2.5
Unskilled PH	8.6	5.2
Skilled PH	3.6	3.7

**Conclusion**

The challenges and risks associate with oil palm FFB harvest are eminent due to its unique growth pattern and consequent flowering cycle. The commonly followed practice method of

rope and cutlass (RC) along with transportation consumes nearly 43-45 per cent of total production cost. Moreover, the operational risk increases proportionately with the height of plantations. Pole harvester (PH) reduced this risk. But, skill and practice in handling PH is pivotal to avoid the logarithmic increase in FFB harvesting charges and also over all body comfort. Hence, Skill in handling PH is prioritized not only reduces the risk but also time and increases the economic feasibility of oil palm growers.

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