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Harvesting of Oil Palm Bunches: A Cost Economics Study on Harvesting Methods

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ABSTRACT

Oil palm is one of the most promising oil-bearing crops for obtaining self-sufficiency in edible oil production as it yields higher oil than any other oil-bearing crop. Considering the uniqueness of oil palm in terms of higher oil yield, government is now promoting oil palm cultivation in the country to ensure self-sufficiency in edible oil production. Harvesting of oil palm bunches is one of the most challenging, laborious and expensive operations in oil palm cultivation. Harvesting by climbing is a regular practice for harvesting oil palm bunches. However, considering problems faced by harvesters in the climbing harvesting method, pole harvesting method is introduced to harvest oil palm bunches. Harvesting data using these two harvesting methods was obtained from harvesters. A cost economics study was conducted for both harvesting methods using data obtained from harvesters along with standard assumptions. Different costs such as fixed cost (depreciation and interest) and operational cost (wages and repair and maintenance cost) were considered, and cost of operation per tonne and per hectare per year were calculated for both harvesting methods. Cost economics study revealed that climbing harvesting method requires Rs. 501 per tonne and Rs.10,011 per ha per year with an average yield of 20 tonne per ha per year whereas pole harvesting requires Rs. 304 per tonne and Rs. 6082 per ha per year. A farmer having 1 ha oil palm plantation can earn an additional income of Rs. 3929/- per year using pole harvesting method over climbing method. Similarly, a harvester can earn an additional income of Rs. 1,00,000/- per year (66.67% higher) using pole harvesting method over climbing method in addition to other added advantages like low drudgery and high safety in pole harvesting over climbing harvesting method. The study concluded that pole harvesting method was found to be most economical as compared to climbing harvesting method for harvesting oil palm bunches.

Key words: *Oil palm, Pole harvesting, Climbing harvesting, Cost economics, Net returns.*

Introduction

Oil palm (*Elaesis guinensis* Jacq.) originated in tropical rainforest of western Africa and is now being cultivated in more than 45 countries around the world especially tropical regions *i.e.,* Malaysia, Indonesia, Thailand, Nigeria, Columbia and Ghana. This perennial monocotyledon was introduced to India during the second half of 20th century to balance the demand and supply of edible oil, because it is the highest oil-yielding perennial crop, outperforming other vegetable oil crops (Basiron, 2007). In India, various Committees constituted by Department of Agriculture Cooperation and Farmers Welfare (DAC & FW), Government of India and have identified 27.99 lakh ha area suitable for oil palm cultivation in the 22 states of the country. So far, an area of 4.20 lakh ha has been covered under oil palm cultivation. Oil palm crop has an economic life span of plant 30 years, comprising three distinct phases *viz.*,

juvenile period (1-3 years), stabilizing period (4-8 years) and stabilized period (9-30 years). With good planting material, irrigation and proper management, there is a potential for production of 20-25 tonne fresh fruit bunches (FFBs) per hectare on attaining age of 8-9 years.

In oil palm cultivation many practices have been involved among them harvesting is considered as most challenging, laborious (43-45% of total annual man days in productive life span of 9 to 25 years) and expensive (16-18% of total production cost) (Bevanand Brian, 1969; Awaludin *et al.,* 2015; Prasad *et al.,* 2012). A study by Abdullah *et al.* (2011) revealed that the statistics of workforce participation according to job categories in the upstream plantation activities, which naturally skewed towards harvesting tasks, as in this case, harvesting and collection of fresh fruit bunches (FFBs) as in many other agricultural practices. For short height oil palm trees, harvesting oil palm bunches can be done using sickle by standing on the ground but in case of long height oil palm trees harvesting has to be done by climbing trees. Harvesting oil palm bunches with sickle by climbing (traditional harvesting) for long height trees is the regular practice in vogue and which is associated with physical work stress. Climbing harvesters are facing several problems *viz.* skill frequency, working hour's frequency, insect bites, time consumption, season complications and physical strain etc. Use of traditional tools for long hours with inappropriate working posture in field leads to drudgery (Singh, 2013). Fathallah (2010) have revealed that labour-intensive agricultural practices have been associated with high prevalence of musculoskeletal disorder (MSD). So, pole harvesting method is an alternative to overcome these problems while harvesting oil palm bunches.

Pole harvesting tool is a simple attachment of telescopic pole with sickle which is used only in oil palm trees with height of 8 ft above (Shinoj, 2004). The pole harvesting tool is feasible to use, compatible with attachments, and more of no need of maintenance. Pole harvesting contributed for higher fresh fruit bunch harvesting per day and higher number of harvests during rainy and winter season than climbing (Prasad *et al.,* 2023). However, no studies were reported to assess the cost economics of different harvesting methods for oil palm bunches. Hence this study made an attempt to asses the cost-economics of harvesting methods for oil palm. Cost of harvesting using climbing method and pole harvesting was evaluated to compare.

Materials and Methods

Cost economics study was conducted for climbing harvesting and pole harvesting methods for harvesting of oil palm bunches. Data reported in previous study (Prasad *et al.,* 2023) along with some standard assumptions were used for calculating the harvesting cost. Costs incurred with pole harvesting method is compared in detail with climbing harvesting method.

Cost of operation for climbing harvesting and pole harvesting

Fixed cost (depreciation and interest) and operational cost (Labour wages and repair & maintenance cost) were considered. Cost of operation per tonne, per hectare per year was calculated using standard formulae (Mehta *et al.,* 2019) for both harvesting methods and compared.

Fixed cost = Depreciation + Interest

$$\text{Depreciation per day (D)} = \frac{IC - S}{L \times d}$$

$$\text{Interest per day (I)} = \frac{IC + S}{2} \times \frac{i}{d}$$

Where, IC = Capital investment (Rs)

S = Salvage value (Rs), 10% of capital investment

L = Life of tool in years

d = Number of working days

i = % rate of interest per year

Variable cost = Repair and maintenance Labour wages

Repair and maintenance = 10% of capital investment

Labour wages = 750 Rs/day

Cost of operation (Rs/day) = Fixed cost + Variable cost

$$\text{Cost of operation per tonne (Rs/tonne)} = \frac{\text{Cost of operation per day}}{\text{Harvesting capacity}}$$

Cost of operation per ha per year (Rs/ha/year) = Cost of operation per tonne × Yield per ha per year

Payback period

Payback period is the number of years takes for an investment to return its original cost through annual cash revenue generated by particular investment. If

the net cash revenues are constant each year, the payback period was calculated by using the following equation proposed by (Hunt, 2001).

$$\text{Payback period (PBP)} = \frac{\text{Initial investment}}{\text{Cash flow per year}}$$

General assumptions for cost-economics study

- Number of harvesting days (d) = 200 days per year
- Average yield per ha(Y) = 20 tonne/ha in a year
- Wages of harvester (W) = 750 Rs/day
- Salvage value (S) = 10% of initial cost(C)
- Rate of interest (i) = 12 % per year
- Repair and maintenance (R) = 10% of initial cost per year
- Pole harvesting capacity = 2.5 tonne/day
- Climbing harvesting capacity = 1.5 tonne/day

Results and Discussion

Cost economics of climbing harvesting and pole harvesting methods were calculated and compared the costs incurred for both harvesting methods from the obtained results.

Cost economics for climbing method of harvesting

Life of rope and average cost of rope and sickle were considered as 5 years and 500 Rs/piece respectively. Fixed cost and variable costs of traditional harvesting were calculated as 0.615 Rs/day and 750.25 Rs/day. In traditional harvesting of oil palm bunches; cost of operation per day, cost of operation per tonne, and cost of operation per ha per year were calculated as 750.865 Rs/day, 500.57 Rs/tonne, and 10011.4 Rs/ha/year. Detailed cost of operation using climbing method of harvesting is presented in Table 1.

Cost economics for pole harvesting method

Life of pole and average cost of pole with sickle were considered as 10 years and 8000 Rs/piece respectively. Fixed cost and variable costs for pole harvesting method were calculated as 6.24 Rs/day and 754 Rs/day respectively. In pole harvesting of oil palm bunches; the cost of operation per day, cost of operation per tonne, and cost of operation per ha per year were calculated as 760.24 Rs/day, 304.09

Table 1. Mathematical calculations for economic aspects of climbing harvesting

S. No.	Economical aspect	Value
1	Depreciation of rope and sickle	0.45 Rs/day
2	Interest on capital investment	0.165 Rs/day
3	Repair and maintenance of rope and sickle	0.25 Rs/day
4	Harvester wages	750 Rs/day
5	Total fixed cost (1+2)	0.615 Rs/day
6	Total variable cost (3+4)	750.25 Rs/day
7	Cost of operation (5+6)	750.865 Rs/day
8	Cost of operation per tonne	500.57 Rs/day
9	Cost of operation per ha per year	10011.4 Rs/ha/year
10	Income earned by harvester per year (Approx)	150000 Rs/Year

Table 2. Mathematical calculations for economic aspects of pole harvesting

S. No.	Economical aspect	Value
1	Depreciation of pole and sickle	3.6 Rs/day
2	Interest for capital investment	2.64 Rs/day
3	Repair and maintenance of pole and sickle	4 Rs/day
4	Harvester wages	750 Rs/day
5	Total fixed cost	6.24 Rs/day
6	Total variable cost	754 Rs/day
7	Cost of operation	760.24 Rs/day
8	Cost of operation per tonne	304.09 Rs/day
9	Cost of operation per ha per year	6081.8 Rs/ha/year
10	Income earned by harvester per year (Approx)	250000 Rs/Year
11	Payback period	2.036 years

Rs/day, and 6081.8 Rs/ha/year respectively.

Cost economics study revealed that climbing harvesting method requires 501 Rs/tonne and 10011 Rs/ha/year with an average yield of 20 tonne per ha per year. Whereas pole harvesting requires 304 Rs/tonne and 6082 Rs/ha/year. Cost of operation per tonne and cost of operation per ha per year using pole harvesting method was lower as compared to climbing harvesting method due to high harvesting capacity in pole harvesting method. A farmer having 1 ha oil palm plantation can earn an additional income of 3929 Rs/year using pole harvesting method over climbing method. Harvester wages is dominating all economic aspects of harvesting operation. Pole harvesting has high harvesting capacity which can reduce number of working days leads to reduce investment on harvesters. Payback period of pole harvesting tool is nearly 2 years. Detailed cost of operation using pole harvesting method is presented in Table 2.

Income earned by harvesters was calculated and results revealed that, a harvester can earn an income of Rs. 1.5 lakhs in a year by practicing climbing method of harvesting. However, the same harvester earns an income of Rs. 2.5 lakhs in a year by adopting pole harvesting method. The net rise in harvester income per year *i.e.,* the difference between pole harvesting and climbing methods of harvesting was reported as 1,00,000 Rs/ year.

Percentage of income increased by using pole harvesting method instead of climbing method of harvesting

$$= \frac{\text{Increase in income}}{\text{climbing income}} \times 100$$

$$= \frac{100000}{150000} \times 100 = 66.67\%$$

Harvester can earn an additional income of Rs. 1,00,000/- per year (66.67% higher) by adapting the pole harvesting method over climbing method.

Conclusion

A cost economics study was conducted for traditional harvesting (climbing method) and pole harvesting using data obtained from harvesters along with some standard assumptions. Different costs *viz.,* fixed cost (depreciation and interest) and operational cost (wages and repair & maintenance cost) were considered, and cost of operation per tonne, and per hectare per year were calculated for both harvesting methods. Cost economics study revealed that climbing harvesting method requires higher cost of operation compared to pole harvesting method. A harvester can earn about 66.67% of higher income using pole harvesting method over climbing method in addition to other added advantages like low drudgery and high safety. The study concluded that pole harvesting method was found to be most economical as compared to climbing harvesting method for harvesting oil palm bunches.

Conflict of Interest: None

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