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THE EFFECTIVENESS METHODS OF COCONUT HARVESTING IN KURUNAGALE ESTATE: BARRIERS TO THE ADOPTION OF LIGHTWEIGHT PICKING POLES

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Abstract

Coconut cultivation is an important economic activity in Sri Lanka, which contributes significantly to the agricultural sector and rural livelihood. Despite its importance, the process of coconut harvesting faces many challenges that negatively affect productivity and profitability. The purpose of this study is to identify obstacles in adopting light picking poles in coconut harvesting within the Kurunegala district, which is 38% of the country's total coconut production alone. Data were collected through a face-to-face interview with 20 medium-sized coconut estates, with a 20 medium-sized coconut estate and a face-to-face interview, while employing mixed-methods approach. A stratified sampling technique was used to ensure diverse representation of wealth based on size and age. The data collection was conducted over a six-month period, from January to June year 2024, capturing insights from six consecutive harvest cycles to analyze seasonal variations in coconut yield. Major findings suggest that 42% of the surveyed coconut gardens are more than 50 acres, with majority (53%) of the age group of 41 and 50 years. The study identified that while the pole picking method is the major harvesting technique, it is interrupted by labor shortage, wages disputes and shortage of skilled workers. Statistical analysis indicated that the cost of the poll picking method is much lower than the climbing method, yet the damage caused by erosion-less harvesting leads to overall economic losses, which contains about 22% rejection rate for immature nuts. The study concludes that addressing labor related issues and promoting mild picking poles can increase harvesting efficiency and reduce operating costs. The recommendations include providing target training for property workers and searching mechanized solutions to improve overall productivity. The originality of this study lies in a comprehensive examination of socio-economic factors affecting coconut harvesting in Sri Lanka, providing valuable insight to policy makers and researchers.

Keywords: coconut plantation, export income, pole picking method, climbing picking method, labour shortage

1. Introduction

Sri Lanka is one of the leading global producers and exporters of coconut and coconut-based hurts. In 2022, the coconut industry contributed about 12% to the country's agricultural gross domestic product, producing coconut -related exports more than USD 600 million in Forex (Central Bank of Sri Lanka, 2023). Coconut products, including coconut, coconut oil, and care fiber, are full-groups for both domestic consumption and international trade. Coconut palm is often referred to as a "tree of life", holding sig-

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nificant cultural and economic values in rural livelihood, with more than 2.5 million people directly or indirectly join the coconut field (Perera and Vracodi, 2021). Coconut Kal-Tent is a Sri Lankan agriculture foundation stone, which contributes significantly to the economy and rural livelihood. The nation's annual coconut production has experienced fluctuations, with a notable decline from 3.3 billion nuts in 2022 to 2.8 billion nuts in 2023 (Sunday Times, 2024). This decrease poses challenges for both domestic consumption and the export sector.

Coconut harvesting in Sri Lanka faces important challenges, mainly due to lack of labor and insufficiency in traditional cutting methods. Major coconut growing areas including Gampaha, Coolie-Yopitia and Kurunegala report in some areas with lower availability rates with lower availability rates (Gunthillak and Warnecullasuria, 2016). This labor deficit resulted in delay in harvesting and increases operating costs, adversely affecting the profitability of coconut cultivation. In addition, annual coconut production has seen a decline of 2.8 billion nuts in 2022 from 3.3 billion nuts in 2023, which reduces economic stress (Sunday Times, 2024) on the industry. Despite the onset of mechanized solutions such as light picking poles, their adoption is limited to change again, lack of training, and financial obstacles (morning, 2023). Understanding these obstacles to improve harvesting efficiency and stability in the coconut industry, exposes the need for this research to face the challenges faced by coconut farmers and assess the feasibility of innovative harvesting devices.

Despite its potential, the Sri Lankan coconut industry faces several challenges that limit its full utilization of global market opportunities. Rising input costs, environmental pressures, labour shortages, and technological stagnation are key obstacles (Fernando & Abeywickrama, 2020). Harvesting, which accounts for approximately one-third of the total production cost, remains a particularly labour-intensive process (Jayasinghe, 2019). Traditional methods such as pole picking and tree climbing require specialized skills and significant physical effort, making it difficult to find enough skilled labourers. This has led to wage inflation and inefficiencies in production, further exacerbating the challenges in the coconut sector (De Silva, 2022). To address these issues, it is crucial to improve the efficiency of coconut harvesting methods. This study investigates the challenges associated with current harvesting practices in Sri Lanka and assesses the feasibility of introducing a lightweight picking pole as a sustainable solution to enhance the sector's productivity.

The coconut palm can be identified as one of the most useful and important trees in Asian countries because there is nothing to throw away from this tree without any usage. Therefore, in Sri Lanka, it is known as "*Kapruka*" and it has a long-lasting association with the human being. In scientific nomenclature, the coconut palm is named Cocos nucifera. Coconut comprises an important part of the diet of Sri Lankans in addition to being a very important source of export earnings. The coconut tree yields more products of use to mankind than any other tree known to man. The variant of products derived from the coconut palm throughout the world is practically boundless. The nut of the coconut palm could truly be counted among the most important fruits of the world. As well as the Coconut palm is one of the most economically valuable cultivation in the world. It plays a significant role in the daily lives of people in over 90 countries of the tropics. More than 80% of the total world production comes from the Asia–Pacific countries (International Agricultural Research, 2006).

The small and medium producers are not only important for the economic development but also for the social development of a nation by participating in the development of networks of the producers (Nuskiya, 2019). Coconut is one of the main plantation crops in Sri Lanka. It is a commercial crop, which earns high foreign exchange (US$ 550 Mn.) contributing to the Agriculture GNP and National GDP. Coconut

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is also a livelihood crop of Sri Lankans (Livelihood - 700,000 and employees - 135,000). Coconut industrially produces several important export products, such as copra, desiccated coconut, virgin coconut oil, and a variety of other products such as coconut milk, vinegar, alcoholic drinks, and confectionery (Coconut Research Institute, 2017). Since the last two decades, the coconut industry has been facing many problems, of which, the declining profit from coconut cultivation is notable. The declining profit is due to the increased cost of production fuelled by the high cost of inputs, mainly fertilizer and labour. The contribution of labour cost to the cost of production is around 30% (Raddagoda Estate, 2015). Apart from the cost, the labour availability in the coconut cultivation sector has shown a declining trend over the recent years irrespective of whether skilled or unskilled. The coconut growers complain of the shortage of labour and the rising labour costs. Coconut harvesting needs a large number of skilled labour and it is done using two methods, the climbing picking method and the pole picking method. Both methods incur high costs and the most problematic situation is the shortage of trained pickers. Those pickers have to be hired from outside. It is difficult to get the coconuts picked at the right time and the plantation owners find it difficult to negotiate fair fees. This study aims to explore the challenges in coconut harvesting in Sri Lanka, focusing on the barriers to adopting lightweight picking poles. By identifying and addressing these barriers, the research seeks to enhance the sustainability and profitability of coconut cultivation in the country.

2. Methodology

A systematic and structured quessionnire was employed for data collection and analysis, using a mixed-method method that integrates both quantitative and qualitative techniques. This broad method structure was designed to ensure intensive examination of study objectives related to challenges in coconut harvesting in Sri Lanka.

2.1 Study Area and Sample Selection

Kurunegala district, which was recognized as a major coconut growing area in Sri Lanka, was selected as a study area. This district is 38% of the total coconut farming sector (Department of Census and Statistics, 2017). From the region, twenty medium -sized coconut wealth was objectively chosen to represent a diverse range of farming practices and management styles. The selection criteria included the size of the property, the age of the plantation and the factors such as the harvesting practices, ensuring that the sample reflects the broad coconut industry in the district.

2.2 Sampling

A stratified sampling technique was employed to ensure that a variety of coconut wealth was adequately represented in the study. Estates were stable based on their size and age, allowing for a wide understanding of challenges faced in various contexts. Within each stratum, the rain-dome sampling was applied to select specific wealth for participation in studies. This approach increases the generality of mini-magual bias and conclusions.

2.3 Data Collection Instruments

The primary data was collected through a structured questionnaire that included both closed and open-ended questions. The approach to this dual format facilitates quantitative analysis by allowing participants to discover the outlook of participants through qualitative reactions. The questionnaire was designed to collect information on the methods of harvesting, challenges, labor dynamics and subsequent crop issues.

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2.4 Data Collection and Analysis

The data collection included face-to-face interviews with estate manager, estate owners and coconut harvesting contractors. These interviews provided valuable insight into the operational movements faced during coconut harvesting. In addition to the interview, the questionnaire was systematically distributed to the participants to catch their reactions.vOverviews on selected plantations were also conducted to collect data on various coconut necklace-waste methods, challenges faced during the harvesting process, and percentage of coconut projected again. This observation component supplemented the interview data, which offers a holistic approach to the harvesting practices.

More data were collected from six consecutive crops held in six months (January to June), ensuring that coconut harvesting refers to the seasonal variations and dynamics of labor. The data collected using the Microsoft Excel was described analysis and interpreted. Quantitative data from the questionnaire was subjected to statistical analysis to identify trends and patterns, while coconut harvesting challenges were analyzed by open-ended reactions and interviews to remove key subjects and insight. This comprehensive method of comprehensive method ensures that the study provides a strong understanding of issues around coconut harvesting in the Kurunegala district, making research objectives effectively addressed.

3. Result and Discussion

3.1 Overview of Coconut Estates in Kurunegala District

Data was collected from 20 selected coconut estates in the Kurunegala district, providing insight into the general characteristics of these plantations. The findings indicate that the majority of coconut estates (42%) exceed 50 acres in size, while only 2% of the estates are smaller than 5 acres. Table 1 summarizes the general characteristics of the surveyed coconut estates, including the extent of land, age of plantations, height of palms, and the type of irrigation systems employed.

Table 1: General Characteristics of Coconut Estates Surveyed

Description	**Description**	**Description**
Extent (Acres)	Less than 5	0%
	6 – 10	2%
	11 – 20	5%
	21 – 30	2%
	31 – 40	20%
	41 – 50	29%
	Greater than 50	42%
Age of Plantation (Years)	1 – 5	0%
	6 – 10	0%
	11 – 20	7%
	21 – 30	10%
	31 – 40	30%
	41 – 50	53%
Height of Palms (Feet)	Less than 20	1%
	20 – 40	42%
	40 – 60	57%
Irrigation System	Manual	45%
	Automated	55%

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3.2 Processes Used in Coconut Harvesting

Coconut harvesting practices in Sri Lanka shows remarkable variability in plantation. This section provides a comparative analysis of the primary harvesting processes observed in the assets made, which focuses on intervals and methods of harvesting.

3.2.1 Picking Interval

The interval created for coconut were raised in different ways in estates, as detailed in Table 2. About 42% of the plantation is cut by coconut every 60 days, while 27% follows 30-day intervals. Estate's majority (80%) did not maintain uniformity at the age of nut harvested.

Table 2: Picking Interval and Age Uniformity of Nuts in Surveyed Coconut Estates

Description	Category	Percentage of Estates
Picking Interval (Days)	60 Days	30%
	45 Days	45%
	30 Days	25%
Uniformity in Nut Age	Yes	20%
	No	80%

These findings suggest that a lack of standardization in harvesting practices may impact the overall quality and yield of coconut production.

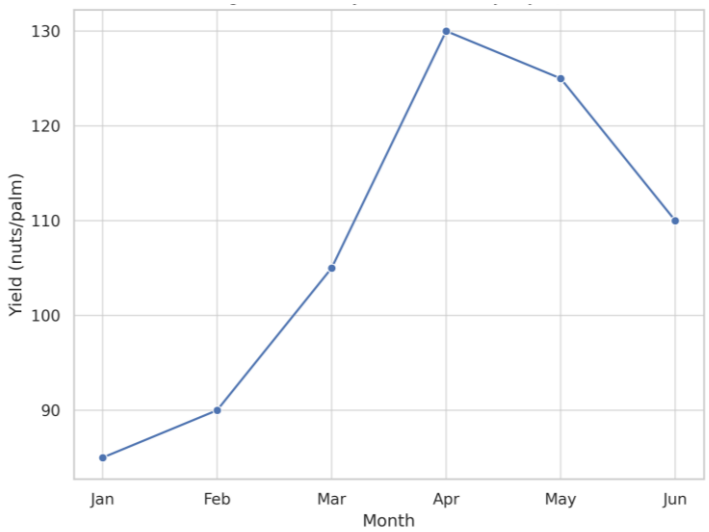

Figure 1: Monthly Coconut Yield (January-June)

Figure 1 illustrates the monthly variation in coconut yield per palm from January to June, showing a clear seasonal trend. Yield begins at a relatively low level in January (85 nuts/palm), gradually increases through February and March (90 and 105 nuts/palm, respectively), and peaks in April at 130 nuts/palm—the highest during the six-month period. May maintains a high yield (125 nuts/palm), while June shows a slight decline to 110 nuts/palm. This pattern suggests that coconut productivity is strongly influenced by seasonal conditions, with optimal yields occurring in April and May, likely due to favorable climatic

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factors. These insights are essential for optimizing harvesting schedules, resource allocation, and agronomic decision-making within coconut estates.

3.2.2 Harvesting Methods

In Sri Lanka, two primary methods for coconut harvesting are prevalent: climbing picking and pole picking.

- **Climbing Picking Method**: This traditional method involves climbing the picker on the coconut tree, which depends on a rope or a simple ring made of cloth for the support of the foot, using the minimum equipped-mansic. Although efficient, this method pose a significant security risk.
- **Pole Picking Method**: Uses a traditional tool that includes a dried bamboo stick and a curved knife. The height of the poles ranges from 12 feet to 65 feet, causing challenging to cross the 65 feet pole during harvesting.

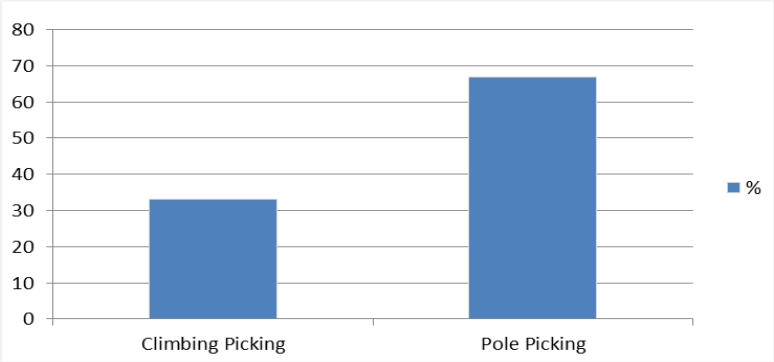

Figure 2: Harvesting methods in coconut estates

The data indicate a preference for the pole picking method, which, despite its advantages, is not without challenges. Interviews with plantation managers revealed that labor shortages and increasing wage demands among coconut pickers significantly impact the efficiency of the harvesting process.

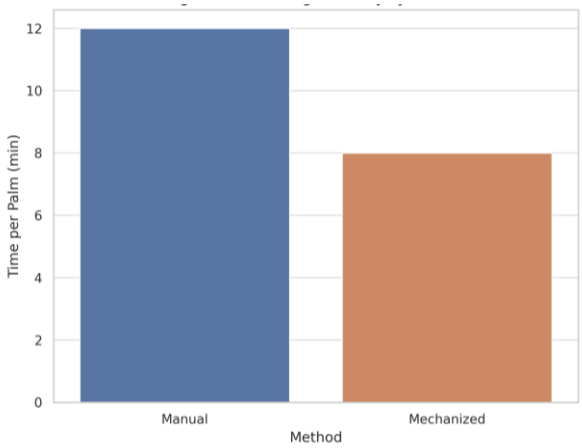

Figure 3: Harvesting Efficiency by Method

Figure 3 compares the efficiency of two coconut harvesting methods manual and mechanized based on the average time taken to harvest a single palm. The results show that mechanized harvesting is more

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efficient, requiring only 8 minutes per palm compared to 12 minutes for manual harvesting. This indicates a 33% reduction in time when using mechanized tools, which can significantly improve labor productivity, reduce operational costs, and increase the feasibility of large-scale harvesting, especially in estates with tall or densely planted palms. Although the time savings are clear, further assessment is needed to evaluate cost, safety, and adaptability across different estate conditions.

3.3 Challenges in Coconut Harvesting

To gain a deeper understanding of the practical issues facing coconut harvesting in the Kurunegala Estate, qualitative data were gathered through semi-structured interviews with estate supervisors, managers, and owners. This allowed for the exploration of firsthand experiences, perceptions, and challenges that hinder efficient harvesting practices. The analysis of the interview responses identified three core themes: labor availability, wage-related disputes, and picker reliability and professionalism.

Table 3: Identified Key Challenges

Challenge	Description	Impact
Labor Shortages	Decreasing interest in coconut picking among younger generations; inconsistent workforce availability.	Delays in harvest, reduced productivity.
Wage Disputes	Disagreements over payment rates, demands for higher wages.	Financial unpredictability, operational disruptions.
Reliability Issues	Poor punctuality, last-minute absenteeism, lack of accountability.	Schedule breakdowns, inefficiencies in daily operations.

One of the most pressing challenges mentioned by nearly all participants was the difficulty in sourcing sufficient labor for harvesting operations**.** Due to a decreasing interest in manual agricultural work, particularly among younger generations, there is a growing shortage of skilled coconut pickers. Mr. D.P. Galpokuna, a senior supervisor at Silva Estate, explained: *"Even when we plan the harvesting schedule a week in advance, there is no guarantee that the pickers will show up. We often find ourselves under pressure because the labor is simply not available on the required day."* This shortage is exacerbated during peak harvesting seasons when demand for labor across multiple estates increases, leading to competition and logistical difficulties in securing a committed workforce.

The issue of wage dissatisfaction emerged as a significant barrier to smooth operations. Coconut pickers frequently express discontent regarding their remuneration, leading to last-minute absenteeism or demands for unreasonably high wages. Estate managers reported that wage expectations are often inconsistent and not aligned with estate budgets. Mr. Herrath, the owner of Rayagama Estate, stated: *"Many pickers have begun setting their own terms. They refuse to work unless we agree to daily wages far above the standard rates. This makes it hard to maintain cost predictability."* Similarly, Mr. Sugath, the Manager of Panveva Estate, highlighted the difficulty in negotiating fair wages: *"They expect immediate payment and demand extra money for minimal additional tasks. Managing costs becomes extremely difficult under such circumstances, especially when market prices for coconuts are volatile."* These wage-related conflicts not only strain financial resources but also contribute to scheduling uncertainties and harvest delays.

Another recurring concern was the lack of discipline and professionalism among coconut pickers. Supervisors indicated that even when laborers are available, their commitment to punctuality and consistent performance is questionable. Mr. Galpokuna recounted frequent incidents of unreliability: *"It's common for*

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them to promise arrival in the morning and then turn up late afternoon or not at all. This throws off the entire day's plan, especially when we're coordinating with transporters and buyers." This unreliability undermines operational efficiency and increases dependency on an already unstable workforce. It also results in delays that can affect the quality of harvested coconuts, particularly if they are not picked at optimal maturity stages.

3.4 Economic Analysis of Harvesting Methods

Table 4 presents a comparative analysis of the costs associated with different coconut harvesting methods. While the pole picking method appears more cost-effective at Rs 2.68 per nut compared to Rs 9.30 for climbing picking, both methods are ultimately constrained by post-harvest damage resulting from the careless practices of pickers.

Table 4: Comparison of Harvesting Cost

Picking Method	Rate (Rs/Tree)	Nuts per Tree (Assuming 7 nuts/tree)	Cost per Nut (Rs)	Cost as Percentage of COP (18 Rs/nut)
Climbing Picking	65	7	9.30	51.66%
Pole Picking	18.75 (Rs 1200/acre)	7	2.68	14.88%

The analysis indicates that despite lower harvesting costs associated with the pole picking method, the overall profitability is diminished due to post-harvest damage and the inclusion of immature nuts in the harvest.

3.5 Perspectives of Coconut Harvesting Contractors

Mr. P. Dayaratta, a coconut harvesting contractor from Kanadulla, Kuliyapitiya, emphasized that contractors have a sufficient workload and are willing to work only if their wage demands are met. Similarly, Sajith, another contractor from the same area, highlighted the scarcity of skilled coconut pickers, noting that harvesting assignments are always directed toward the few available workers, who respond based on their availability rather than scheduled commitments. Mr. Muthubanda, a contractor from the Panwewa area in Wariyapola, stressed that coconut harvesting is a highly skilled task requiring experience. He asserted that traditional coconut breakers, who have inherited the profession for generations, possess the necessary expertise, whereas new entrants lack the ability to execute the task efficiently. He also pointed out that even crafting a picking pole requires specialized knowledge.

Mr. Nandana, a contractor from Natthandiya, explained that producing traditional coconut picking poles involves extensive labor, particularly in sourcing and processing bamboo. He stated that due to the physical demands of this process, contractors are unwilling to accept lower wages. Furthermore, he expressed skepticism about the success of any new harvesting equipment, suggesting that alternative designs would likely fail. Similarly, Mr. Rohana, another contractor, indicated that a daily wage of approximately LKR 4,500 to 5,000 is necessary to attract coconut pickers. He argued that without adequate financial incentives, labor shortages in the sector would persist.

Accordingly, the discussions revealed a strong resistance among contractors toward adopting new technologies or alternative methods for coconut harvesting. Many respondents demonstrated skepticism

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about innovative designs, with some dismissing the concept outright. Furthermore, there were indications of a perceived traditional monopoly over the profession, as contractors expressed reluctance to seek external advice or adopt alternative techniques. These findings highlight the socio-economic and cultural factors influencing labor practices in the coconut harvesting industry, underscoring the challenges associated with introducing sustainable mechanized solutions.

4. Conclusion

The results of this study emphasize the complexities of coconut harvesting in the Kurunegala district, revealing significant challenges related to labor availability, economic viability, and harvesting practices. The need for innovative solutions that address these challenges while enhancing efficiency and sustainability in coconut production is crucial for the future of the industry. Analyzing the information obtained in the study, it appears that coconut harvesting in the coconut industry has reached a problematic situation. It is a sad situation that such internal problems have arisen in the coconut industry, which is embarrassed by the growing competition in the export market. Failure to pay attention to and ignore the subtle issues that arise internally in management can lead to acute problem situations at times. Among the facts revealed here is the growing labour shortage in plantations and the creation of external labor brokers and contractors on top of that.

Taking advantage of the shortage of skilled labour in the estates, contractors are tempted to charge exorbitant prices and a bargaining power they possess has also been created. On the other hand, they seem to be trying to maintain their professional monopoly. There have been cases where it is clear. Apart from the comments outlined above, there were many similar comments. They even refused to comment on a new design to replace the cumbersome traditional picking pole. They implied that such a design would threaten the demand for their services. Some of them thought that this was their own hereditary profession. It seems that some neglections of the estate management and responsible institutions has caused the above situation. This situation has been caused by not creating the necessary skilled labor within the estates and tending to depend on external resource providers.

5. Recommendations

Coconut harvesting by improved Pole picking method

The pole picking method, which is employed on 67% of plantations, is the most economical, time-efficient, and safest way to harvest crops. Comparing this procedure to the climber picking method, however, revealed greater rejection rates of nuts. More than ten percent of the coconuts were lost after harvest. Therefore, enhancing the pole picking technique as a harvesting method that works is a relevant and crucial goal to address the labor issue in coconut harvesting. To address the lack of climbers for coconut trees in the coconut plantation industry, a modified coconut picking pole that assists farmers who are willing to collect nuts from coconut trees must be created.

Suggestions to Promote Pole Picking Method

Since most climber pickers (on contract) come from outside the estate and are in high demand, increasing the capacity of competent laborers is the most critical issue. As a result, the laborer cadre should receive training on pole picking gangs within the estate. However, because they use heavy, long bamboo poles (up to 75 feet), harvesting coconuts by the pole is a difficult task. For ease of handling, it is crucial to introduce a light pole composed of a light metal, such as aluminum. Additionally, basic methods and information should be provided for identifying the appropriately mature group. If not, the mature bunch is chosen by the pickers, who select one nut from every two to three bunches, those are dumped as rejections.

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Additionally, the plantation organizations might encourage the picking workers by offering them special rates and promoting them to the position of "Picking Technician" within the labor cadre. That being said, they must also be held accountable for the crop they have collected. The suggested picking pole that will be altered will be lightweight, self-controlling, safe to use, simple to construct, height adjustable, and financially feasible. It should include a harvesting knife, nylon hinged clamps, two adjustable aluminum alloy poles, and a protective handle. The harvesting pole's minimum and maximum lengths should be 7 and 17 meters, respectively.

Responsible Institutions to Promote the Technology

The primary institutions that use extension staff to carry out awareness and skill-training programs are the Ministry of Plantation Industries' institutes, including the Coconut Research Institute (CRI), CDB, CCB, and Regional Plantation Companies associated with coconuts. As a result, one important organization that has the ability to alter the technology pertaining to pole picking harvesting is the Coconut Research Institute. Smallholders and the private sector can also support these initiatives.

Measurable Outcomes of the Promotion

It will be possible to reduce rejection rates and waste in the coconut business if the upgraded picking pole is widely used. The most successful and efficient method of harvesting is the pole picking method. This harvesting approach is inexpensive, quicker, and safer. In particular, worker risks can be reduced. The pole selection method's results and advantages are all quantifiable.

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