

DEVELOPMENT OF THE PORTABLE ARECA NUT CUTTER

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ABSTRACT

This research aims to develop The Portable Areca Nut Cutter. The data was collected through in-depth interviews and focus groups with 5 Dried areca nut farmers in Phuket, Thailand and 1 expert in mechanical engineering related to product design and development. The analysis of efficiency in terms of time, cost, and reliability revealed that using a traditional big knife for cutting 50 areca nuts results in an average time of 16 minutes and 33 seconds. In contrast, utilizing a Portable Areca Nut Cutter for the same quantity takes an average time of 2 minutes and 43 seconds. Regarding cost, the labor cost for cutting 1,000 areca nuts before having the Portable Areca Nut Cutter was 5 hours and 56 minutes, equivalent to labor wages of 255.76 Baht per day. After having the Portable Areca Nut Cutter, the time was reduced to 1 hour and 19 minutes, resulting in labor wages of 54.74 Baht per day, leading to a total labor cost reduction of 201.02 Baht. In terms of reliability, the Portable Areca Nut Cutter achieved 100% accuracy, areca nuts that meet specified standards, exhibiting a beautiful appearance and without any damage.

Keywords: Development of Equipment, Cutting, Areca Nut, Portable

INTRODUCTION

Currently, the process of peeling fresh palm nuts still heavily relies on manual labor, requiring significant time and manpower. Moreover, skillfulness is required for those peeling the nuts to ensure they are aesthetically pleasing and can be sold at higher prices. Despite the expertise of the labor force, prolonged manual peeling can lead to fatigue, resulting in accidents or reduced work efficiency. However, there is still a lack of machinery or equipment utilizing mechanical power in the peeling process, making it challenging for farmers to process fresh palm nuts promptly and adequately meet market demands. Based on research conducted by Sunan Panasakorn, Jaturong Langkapin, and Rungruang Kalasinsilp in 2016, focusing on the design and construction of a palm nut peeling machine, aimed at reducing the time and labor required for peeling nuts to separate the sugar juice from the seeds. Testing revealed that the prototype machine is capable of processing 46 nuts per hour, which is three times more efficient than manual labor (typically yielding around 15 nuts per hour). This prototype machine has the potential to replace manual labor in the future.

OBJECTIVES

1. To develop The Portable Areca Nut Cutter
2. To measure efficiency in using The Portable Areca Nut Cutter

METHODOLOGY

The selection of an appropriate design for cutting areca nut is based on evaluations to choose the best-suited pattern. This serves as a guideline for the development of The Portable Areca Nut Cutter.

1. Key Informants

Researchers analyzed three prototypes of The Portable Areca Nut Cutter using a questionnaire to collect feedback from five dried areca nut farmers. The focus group included Mr. Yuchit Tantiwitthayaphan, Mr. Sitthisak Chuaytuektrong, Miss Naruedee Mulikabut, Mr. Phorn Krailert, and Mr. Krissada Yuyen to determine the best design.

2. Research Tools

The research tools utilized for the study included interviews with questions designed by the research team, featuring open-ended questions and a questionnaire related to the "Development of The Portable Areca Nut Cutter" The questions in the questionnaire were structured to assess and rate the best design using a 5-level Rating Scale.

3. Equipment Benchmarks

In conclusion, measuring equipment performance assesses operational outcomes, using efficiency values for comparisons. This study evaluates The Portable Areca Nut Cutter in terms of cost, time, and reliability.

RESULTS

The design results from group discussions with all 5 experts can be used to design as follows.

Figure 1

Image of Prototype No.1

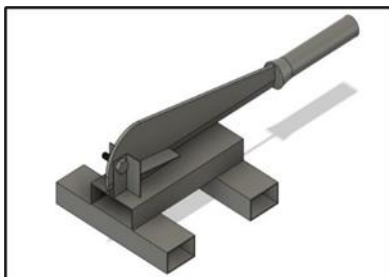


Figure 2

Image of Prototype No.2

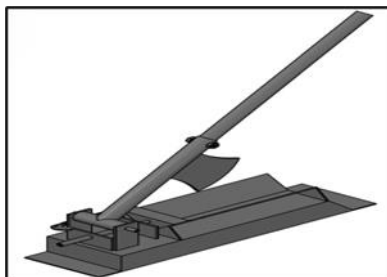
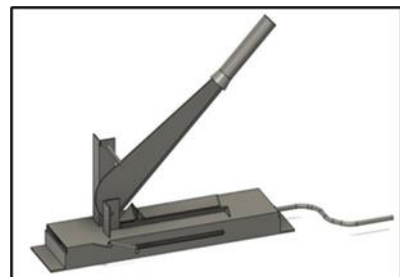


Figure 3

Image of Prototype No.3



Evaluation of three designs for The Portable Areca Nut Cutter in terms of cost, time, and reliability identified Prototype No.3 as the top performer. It received the highest scores in all aspects, totaling 337 points, surpassing Prototype No.1 (270 points) and Prototype No.2 (268 points). Consequently, Prototype No.3 was chosen as the preferred option by the research team.

Figure 4 Image of Prototype No.3



Time efficiency analysis results cutting areca nuts with a traditional large knife. Found that the first round of 50 areca nuts took 18 minutes and 35 seconds. Later, the second round, 50 betel nuts, took 16 minutes and 12 seconds. And the third round, 50 betel nut results, took 14 minutes and 53 seconds. By cutting the betel nut with a machete, all 3 rounds took an average of 16 minutes and 33 seconds. And using a portable betel nut cutting machine, it was found that round 1, 50 areca nuts, took 2 minutes and 28 seconds. Later, round 2, 50 areca nuts, took 2 minutes 49 seconds, and round 3, 50 areca nuts, took 2 minutes 53 seconds. Using portable dissection equipment, the three rounds took an average of 2 minutes and 43 seconds. Reducing cutting time by 13 minutes and 50 seconds.

Cutting the betel nut with a large knife Starting with the process of dissecting the betel nut. packaging process Betel nut loading and unloading process Until bringing 5 sacks of betel nuts onto the truck, it took a total of 11 hours and 23 minutes to use portable betel cutting equipment. The total time was 5 hours, 34 minutes. Time can be reduced to 5 hours and 49 minutes.

The results of the cost efficiency analysis found that before having the equipment for cutting areca nuts, it was found that 1 minute can cut 3 betel nuts, then 1 hour can cut 180 betel nuts, and in cutting 1,000 betel nuts it would take a total of 5 hours 56 minutes after having the equipment for When cutting areca nuts, it was found that 1 minute can cut 21 betel nuts, then 1 hour can cut 1,260 betel nuts, and in cutting 1,000 betel nuts, it takes a total of 1 hour and 19 minutes. It can be concluded that in cutting 1000 betel nuts before having portable betel nut cutting equipment, It takes 5 hours 56 minutes, valued at 255.76 baht. After having portable betel dissection equipment, it takes 1 hour 19 minutes, valued at 54.74 baht, able to reduce the cost of hiring a total of 201.02 baht.

Reliability efficiency analysis concludes that The Portable Areca Nut Cutter achieves a 100% accuracy rate, ensuring smooth and undamaged surfaces when cutting 50 areca nuts.

CONCLUSION AND FUTURE WORK

In summary, the Time Efficiency Analysis indicates a significant reduction in cutting time, with an average of 16 minutes and 33 seconds using a traditional big knife compared to 2 minutes and 43 seconds with The Portable Areca Nut Cutter. This aligns with previous research on Bengal currants seed-cutting equipment by Jennifer Nartnapha Mingma and Nisarath Noimueang (2020), The results showed that a karanda seed splitting and punching machine has an average production capability of 1.08 kilogram per hour and an average production efficiency was 60.29%. Splitting and removing the seeds by human labor has an average production capability of 0.57 kilogram per hour. The average production efficiency was 86.58%. It shows that the average production capability from Karanda seed splitting and punching machine compared with the human labor, was increased by 0.51 kilogram per hour

and the average production efficiency from Karanda seed splitting and punching machine compared with the human labor, was decreased by 26.29 percent. and the research on the development of a semi-automatic toddy palm flesh cutting equipment by Jiratikul Klahan (2014). The results of the trial of labor compared with traditional instruments and test results by the manual labor on the pulp sugar 1 person 2 balls with the same cloth fabric has two children.

The Cost Efficiency Analysis demonstrates a considerable cost reduction, with the traditional method costing 255.76 Baht for 1,000 pieces in 5 hours and 56 minutes, while The Portable Areca Nut Cutter takes 1 hour and 19 minutes, costing 54.74 Baht. This is consistent with research on automatic toddy palm seed-cutting equipment by Supachai Madeua, Wanpracha Nuansroi, and Worapong Boonchuytaen (2021). In the experiment of cutting 50 seeds, each step of the work process was tested and adjusted to achieve the best results. The results showed that the machine was able to work efficiently with 100% dissection accuracy. An average incision time was 3 minutes 10 seconds per seed and the power consumption was 0.19 kW-hour. These results are comparable to Cutting Palmyra Seeds machines in earlier research. This present research is highlighted by applications in which the user controls the machine for only 5 seconds per seed and is able to control dozens of machines simultaneously. Furthermore, an engineering economic analysis showed that, if one user controls the operation of two machines at the same time, the machine cost was on average THB 1.08/seed, the payback period was on 5.4 months.

The Reliability Efficiency Analysis concludes that The Portable Areca Nut Cutter achieves 100% accuracy in cutting areca nuts with beautiful and undamaged surfaces, This is consistent with research Development of egg size sorting device in Bang Sai District, Phra Nakhon Si Ayutthaya Province by Kulthida Suren, Ratsatit Thulaphat, Pichamon Phoemphiansin and Maneerat Sangthong (2022) It was found that the time was reduced from the previous size sorting by sight. The average time of sorting 100 chicken eggs takes 13.61 minutes from 27.48 minutes. The cost of using 1-2 workers has been reduced to 1 person, costing about 150 baht/day from the normal 300. baht/day and credibility The use of egg-size sorting cones produces a relatively high accuracy of 100%.

RECOMMENDATION

1. For the next phase of research on The Portable Areca Nut Cutter designed for efficient and rapid cutting, there might be a need to utilize high-quality components in producing The Portable Areca Nut Cutter. However, it's important to note that the cost of high-quality components tends to be higher.
2. For those interested in studying The Portable Areca Nut Cutter, it is recommended to engage in research and development to ensure that the tool's design is robust, allowing for the efficient cutting of a significant number of areca nut pieces in a short amount of time. However, due to time constraints for the research team, this model has been developed accordingly.

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