TIME EFFICIENCY CALCULATION OF THE NUTMEG (*Myristica fragrans* Houtt.) Mifra®22 Pericarp Grater

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Abstract

The purpose of this study was to obtain production time efficiency on the MIFRA®22 nutmeg pericarp grater. Research at the Agricultural Engineering Laboratory, Faculty of Agriculture, UNSRAT Manado. The research period starts from March 25 to April 30, 2022.

This study was designed using a completely randomized design (CRD) method with 3 treatments and 4 replications. Treatment consists of: 1). The interval of grating duration is 10 minutes, 2). The interval of grating duration is 15 minutes, and 3). The interval of grating duration is 20 minutes. Each time interval is repeated 4 times. Grated using a nutmeg pericarp grater MIFRA®22 roller grater with 250 blades. Data were tabulated and analyzed using One-way ANOVA Confidence Interval 95% and continued with 5% BNJ test (Pongoh et al, 2022). The results of calculating the best efficiency were obtained in the treatment duration of 15 minutes with an average grating time of 81.5 seconds. The calculation of the pericarp weight of grated nutmeg resulted in an average weight of 435 grams. Calculation of the weight of the flesh of nutmeg is not shredded with an average weight of 65 grams. The percentage efficiency of grating time with an average of 84.92%.

Keywords: Nutmeg pericarp, MIFRA®22, Grater efficiency.

INTRODUCTION

Nutmeg (*Myristica fragrans* Houtt.) is a native Indonesian plant originating from the Malaise Archipel, namely the Banda and Maluku archipelago which then spread and developed to islands such as Aceh, North Sulawesi and Papua (Drazat, 2007). The types of Myristica sp are scattered in the forests of Papua Province and are known as Papuanoot. Most of Indonesian nutmeg is produced by smallholder plantations, which is around 99%, with post-harvest handling which is still traditional with makeshift equipment and is carried out less hygienically so that the problem faced is the low quality of nutmeg, so proper handling processes are needed starting from post-harvest. The post-harvest process includes wet sorting, washing, drying, and dry sorting (Paat, 2021). The yield and quality of nutmeg is influenced by several factors which can be classified into two, namely pre-harvest and post-harvest. Nutmeg flesh is the largest part of fresh nutmeg, which is around 80% and only a small part has been utilized, most of it is only disposed of as agricultural waste. Nutmeg flesh has the potential to be processed into various food products. Various products that are well known include candied nutmeg, nutmeg syrup, jam, lunkhead and so on. Processing of nutmeg flesh into food products will increase the economic value of nutmeg flesh which so far has only been a waste (Drazat, 2007).

The MIFRA®22 nutmeg pericarp grater is an agrotechnology product for household needs that is useful as a tool to reduce the size of the nutmeg flesh to make it easier in the extraction process by converting the larger nutmeg flesh size into a smaller, smoother and uniform size. The

obstacle faced by the community is the process of grating the nutmeg flesh which is done manually, namely cutting using a knife so that the time required is relatively long, not uniform and has the potential to cause cuts on the fingers. The design and application of the nutmeg flesh grater is designed to get the right technology in the process of changing the shape to a size that suits the needs of nutmeg derivative products. Limited production capacity due to low capability, process capability and production efficiency with production facilities that are still manual so that the quality and quantity of products cannot be maximized (Mulyadi, et al. 2015). Green Chemical Agroecotechnology are thinking and implementing innovative green agro-ecotechnology innovations that are environmentally friendly, non-toxic, reduce waste, emissions, pollutants, recycle, restore the balance of ecosystems and the biosphere, reduce pressure on natural resources and encourage investment in green agro-ecotechnology through ecologically sustainable use of renewable resources (Paat, et al. 2021).

In an effort to fulfill the need for a lot of nutmeg flesh extract, people tend to buy grated nutmeg flesh that has been grated by traders in the market. The nutmeg pericarp grater used by market traders uses a grater with a fossil fuel motor, the price of this grating machine is more expensive and requires complicated maintenance and more expensive maintenance costs. The design method of the nutmeg flesh grater machine includes problem identification, idea inventory and analysis. The stages of problem identification are seen from the problems of farmers, environmental emissions, and home industry entrepreneurs in terms of technical, waste, social, and economic issues. MIFRA®22 Nutmeg Flesh Shredder is an agrotechnology product for household needs that is useful as a tool to reduce the size of the nutmeg flesh to make it easier in

the extraction process by converting the larger nutmeg flesh size into a smaller, smoother and uniform size. and driven without fossil fuels to be environmentally friendly (Paat, et al 2022). Substitution engineering without fossil fuels includes; nutmeg shell biochar substitution, POC biogas from nutmeg waste waste, nutmeg shell chitosan, nutmeg organic waste ecoenzyme. The biomaterial section of nutmeg flesh is limited by two methods of extraction process. Another part of engineering is based on base flow inventory and product flow through the design of environmentally friendly plant energy input processes without fossil fuels (Paat, et al 2022)

The idea inventory includes observing the development of tools that have been used previously and thinking about possibilities that can be modified as needed. Identification of problems that occur in nutmeg farmers and home industry entrepreneurs, namely the process of changing the shape of the nutmeg pericarp, the use of tools and the relatively long duration of time.

METHOD

Research Time and Place

The research location is at the Agricultural Engineering Laboratory, Faculty of Agriculture, UNSRAT Manado. This research has been carried out in two stages, namely the stage of making the tool and the stage of testing the tool. The manufacture and testing of tools was carried out in the mechanization workshop of the Agricultural Engineering Laboratory, Faculty of Agriculture, Sam Ratulangi University, Manado. The research period starts from March 25 to April 30, 2022.

Tools and Materials

The tools used are build-up motors, meters, drills, hammers, tools for wrenches, welding equipment, hacksaws, grinders, stopwatches, scales, iron plates,

wood, iron elbows, iron cylinders (rollers), nuts, bolts, screws, iron shafts, sponge rubber, bearings, iron pipes, iron axles. The materials used are the image design of the Mifra®22 tool and nutmeg. Nutmeg samples were taken from a nutmeg plantation in Batu Village, South Likupang District, North Minahasa Regency, North Sulawesi, Indonesia. Nutmeg is picked from local varieties of nutmeg trees that have not yet been released. Nutmeg tree as a source of test fruit was ± 7 years old with a full maturity level of ± 3 months.

Research Method

This study was designed using a completely randomized design (CRD) method with 3 treatments and 4 replications. Treatment consists of: 1). The interval of grating duration is 10 minutes, 2). The interval of grating duration is 15 minutes, and 3). The interval of grating duration is 20 minutes. Each time interval is repeated 4 times. Grated using roller grater blade 250. Data were tabulated and analyzed using One-way ANOVA Confidence Interval 95% and followed by LSD 5% test (Pongoh et al, 2022). The things that were observed

and measured included: grating efficiency time (seconds), capacity (grams/second), weight of grated nutmeg flesh/pericarp (grams), weight of nutmeg flesh/pericarp not shredded (grams), and efficiency percentage (%).

Research Procedure

Nutmeg samples were taken from local varieties of nutmeg trees aged ± 7 years with full maturity ± 3 months at a nutmeg plantation in Batu Village, South Likupang District, North Minahasa Regency, North Sulawesi, Indonesia.

Nutmeg is split open, the seeds are removed. The flesh of the nutmeg is grated using a roll grater 250 blades. Enter the capacity of the nutmeg pulp/pericarp grater, the percentage not shredded, the effective capacity, the yield of the grated product, and time efficiency. The output to be achieved is the effective capacity of the nutmeg pulp/pericarp grater, the percentage not shredded, and time efficiency. The working procedure can be seen in the flow chart of the technical test of the nutmeg pulp/pericarp grater, which can be seen in Figure 1.
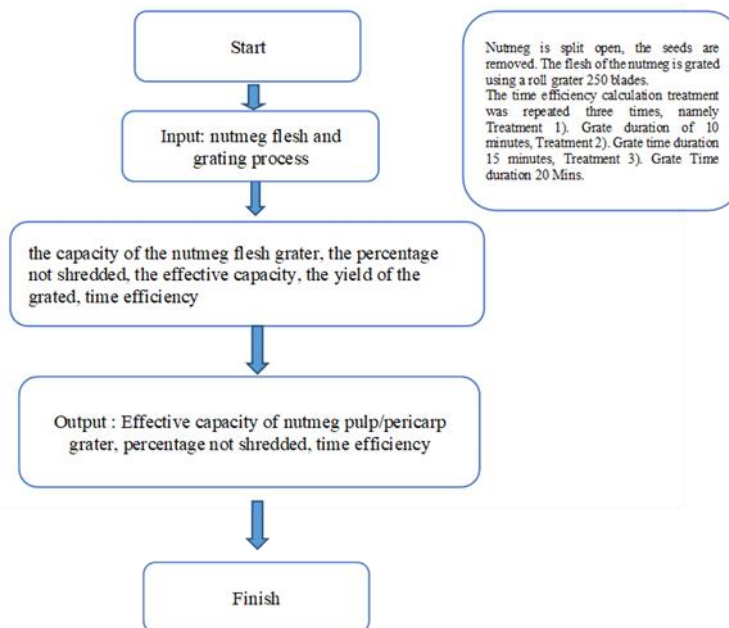
Tabel 1. Persentase serangan di lokasipengamatan

Parameter Measurement and Data Analysis

The calculation of the working efficiency of the Mifra®22 tool uses the following equation:

1. Input Capacity (IC) of Nutmeg Flesh Grate/pericarp

Observation and measurement of the capacity of the nutmeg/pericarp grater Mifra®22 can be calculated by dividing the amount of nutmeg flesh to be grated by the duration of the grating time with the formulation:

$$IC = \frac{AONF}{t}$$

Description:
IC = Input capacity (nutmeg flesh/minute)
AONF = Amount of nutmeg flesh
t = Grate Duration (Minutes)   …………..(1)

2. Effective Capacity (EC) of Nutmeg Flesh Grate

Measurement of the effective capacity of

the nutmeg/pericarp grater Mifra®22 can be determined by dividing the amount of grated nutmeg flesh by the duration of grating time or by the formulation:

$$EC = \frac{AONF}{t}$$

Description:
EC = Effective Capacity (nutmeg flesh/minute)
AONF   = Amount of nutmeg flesh
t = Grate Duration (Minutes) ……………..(2)

RESULTS AND DISCUSSION

Grating Time Efficiency Calculation of Treatment

The results of observations and measurements of the average efficiency of grating time with a ®Mifra 22 grater for the treatment are shown in Table 1.

The working procedure can be seen in the flow chart of the technical test of the nutmeg pulp/pericarp grater, which can be seen in Figure 1.

Table 1. The average efficiency of grating time on treatment

Treatments	Unit	Average
I (10 minutes)	Second	99.0 a
II (15 minutes)	Second	81.5 a
III (20 minutes)	Second	100.0 a

Description : HSD 5% = 40.0. The notation followed by the same letter in the notation column was not significantly different based on the HSD test at the 5% level. Grate at the full maturity level of nutmeg ± 90 days, plant age ± 7 years. The weight of the nutmeg flesh per replication is 1,000 grams = 20 nutmegs.

Analysis of Variance

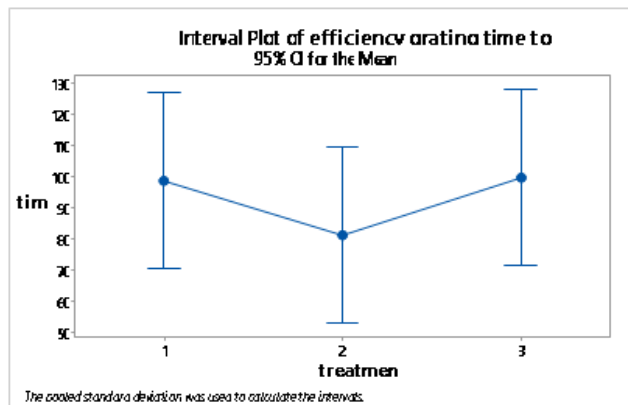| Source	DF	Adj SS	Adj MS	F-Value	F tabel
p	2	866,0	433,0	0,69 ns	5,12
Error	9	5615,0	623,9		
Total	11	6481,0			

HSD 5% = 40,0

Figure 2. Interval Plot of Efficiency grating time

Based on the results of the analysis of variance on the 5% BNJ test in Table 1, statistically, it showed that the efficiency of grating time between treatments was not significantly different. The second treatment with a duration of 15 minutes resulted in the best average efficiency with a grating time of 81.5 seconds. The third treatment with a duration of 20 minutes resulted in an average time efficiency of 100.0 seconds. The first treatment with a duration of 10 minutes resulted in an average time efficiency of 99.0 seconds.

CONCLUSIONS AND RECOMMENDATION

Conclusions

The calculation of the best efficiency using a pulp/nutmeg pericarp grater MIFRA®22 roller grater blade with 250 blades resulted in a treatment duration of 15 minutes with an average grating time of 81.5 seconds. The 10 minute duration treatment resulted in an average time efficiency of 99.0 seconds. The 20 minute duration treatment resulted in an average time efficiency of 100.0 seconds.

Recommendation

Recommendations for calculating the efficiency of grating nutmeg/pericarp on a 150 blade grater roller and 200 blade roller.

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