Security in food, renewable resources, and natural medicines

SFRN 2019

PROCEEDING

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3rd INTERNATIONAL CONFERENCE ON SECURITY IN FOOD, RENEWABLE RESOURCES, AND NATURAL MEDICINES 2019 (SFRN 2019)

Convention Hall Politeknik Pertanian Negeri Payakumbuh
INDONESIA

QUANTUM-LEAP OF AGRI-FOOD SYSTEM 4.0 AND DELIVERY OF SUSTAINABLE DEVELOPMENTS GOALS (SDGS)

September 25-26, 2019

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Welcome Message
Executive Chairman of The 3rd International Conference on Security in Food, Renewable resources, and Natural Medicines (SFRN) 2019

Dear Honorable ladies and gentlemen,

Good Morning and Assalamu'alaikum wr.wb

On behalf of the SFRN 2019 organizing committee, I am really honoured and delighted to welcome all of you to the 3rd International Conference on Security in Food, Renewable resources, and Natural Medicines (SFRN) 2019 at the State Polytechnic of Agriculture Payakumbuh, West Sumatra Indonesia

Our technical program is rich and varied with 8 keynote speeches and 4 invited talks and more than 170 technical papers split between 8 parallel oral sessions and 1 poster sessions. The speakers and participants came from 8 different countries, consist of Academicians, Scientists, Researchers, Practitioners, Professionals, and Government Officialsin multidiscipline branch of knowledge, who gathered here today to share and discuss new findings and applications of innovations for promoting Food Security, Renewable Energy, Sustainable Resources and HealthCare Free for All, in particular for those who in needs. As the chairman of conference 2019 SFRN, I know that the success of the conference depends ultimately on the how many people who have worked in planning and organizing both the technical program and supporting social arrangements. This year, the conference is jointly organized by the Payakumbuh State Agricultural Polytechnic and Andalas University. We also thank to the steering committee fortheir wise and brilliant advice on organizing the technical program; and also to the the Program Committee, both from the Payakumbuh State Agricultural Polytechnic and Andalas University , for their thorough and timely reviewing of the papersand to the Directorof Payakumbuh State Agricultural Polytechnic and the rector of Andalas University, and the Head of the Institute forResearch and Community Service of Andalas University, and Payakumbuh State Agricultural Polytechnic. Our recognition should go to the Organizing Committee members who have all worked really hard for the details of the important aspects of the conferenceprograms and social activities, and then we extend our gratitude to our students who bore the arduous burden for preparing this event.

We hope this event is also a good step in gaining strengthenn cooperation between our universities as we know that the State Agricultural Polytechnicof Payakumbuh is part of the Andalas University previously, of course the psychological relationship between the State Agricultural Polytechnicand the Andalas University is really close.

Finally on behalf of the committee, we apologize profusely for all the shortcomings and everything that is not properly in organizing this event and hopefully AES-Network contributes significantly to the research and technology for the good of humanity.

Thank you

Fithra Herdian, S.TP, MP

Message from Afro-Eurasia Scientific (AES) Network
3rdInternational Conference on Security in Food, Renewable resources, and Natural Medicines (SFRN) 2019

Dear Honorable and Distinguished guests,
Ladies and gentlemen,

Assalamu'alaikum Warahmatullahi Wabarakatuh and Good Morning

On behalf of the AES Network, I am honored and delighted to welcome you to the 3rdInternational Conference on Security in Food, Renewable resources, and Natural Medicines (SFRN) 2019 at the Agricultural State Poly Technique of Payakumbuh, Indonesia. I believe we have chosen a venue that guarantees a successful technical conference amid the culture, delicacy and scenery of Payakumbuh, the city of "Rendang".

The AES-Network aims to Promote Livelihood Through Food Security, Promote Future Smart and Green Mobility by Using Renewable Energy, Promote Prosperity by Equally Managing and Distributing the Sustainable Resources and Promoting Enjoyable Long-Life by using Natural Medicines With Free Health Care For All. The AES-Network was established in 2018 and already have memberships from 12 countries. Our members consist of Academicians, Scientists, Researchers, practitioners, professionals, and government officials from multidiscipline branch of knowledge, who gathered and contributed their expertise to share and discuss new findings and applications of innovations for promoting Food Security, Renewable Energy, Sustainable Resources and Free Health Care for All.In particular, the network aims to alleviate the condition of those who in dire needs. In the future, we also expect to provide technical demonstrations, and numerous opportunities for informal networking for Promoting Food Security, Renewable Energy, Sustainable Resources and Free Health Care for All. In this opportunity, we invited you to become our members and join our efforts for a better life to all of mankind.

As a team, we acknowledge the existence of mutual interest among university and college educators, researchers, activists, business sector, entrepreneurs, policy

makers, and all society members. We must promote the need to strengthen cooperation for establishing Security in Food, Renewable Resources, and Natural Medicines in Africa, Europe, and Asia.

The AES-Network believe, a firm foundation for mutual collaboration with the spirit of equality and partnership and thereby contribute towards sustainable development in these three regions.

Therefore, through networking, friendships, and joint efforts, the capacity of our network can be enhanced to address major challenges in securing the Food, Renewable Resources, and Natural Medicines in Africa, Europa, and Asia.Our Network goals areto increase the awareness of educators, researchers, scientific community, business sector, entrepreneurs, and policy makers in Africa, Europa, and Asia, that the future of a better world, lies within their responsibilities, and to improve the networking, mobility and mutual collaboration of scientific community, business sector, entrepreneurs, and policy makers in Africa, Europe, and Asia to energize the delivery of Sustainable Development Goals.

Finally, I hope that, by registering our network, you will be provideda common platform and support the exchange of knowledge, while at the same time, we offer constructive dialogue across and within the various interest and stakeholder groups, including the intended beneficiaries, and arrived at the best solutions to our terminal goal, Promoting Food Security, Renewable Energy, Sustainable Resources and Free Health Care based on scientific evidence in Africa, Europa, and Asianregion.

Thank You for Joining us!

President
Assoc. Prof. Dr. Eng. Muhammad Makky

Welcome Message
Head of Institute for Research and Community Service
Universitas Andalas

Dear Honorable and Distinguished guests,
Ladies and gentlemen,

Assalamu'alaikum Warahmatullahi Wabarakatuh and Good Morning

It is with great pleasure that I welcome the participants of the SFRN 2019 in Payakumbuh, the city of "Rendang", the prime of Indonesian delicacy.

In this esteem event, we share the knowledges, and imparted it to the people. The quest for knowledge has been from the beginning of time but knowledge only becomes valuable when it is disseminated and applied to benefit humankind. It is hoped that this conference will become a platform to gather and disseminate the latest knowledge which can be adopted for securing the food, resources, and health for mankind, in Asian, European and African region.

Academicians, Scientist, Researchers and practitioners from multidiscipline branch of knowledge who gathered here today will be able to share and discuss new findings and applications of innovations for ensuring food security, in particular for those who reside in developing countries. It is envisaged that the intellectual discourse will result in future collaborations between universities, research institutions and industry both locally and internationally. In particular it is expected that focus will be given to issues on environmental and sustainability. Therefore, we urge to all participants, to establish a scientific network that will voice the needs

Researchers in the multi sectoral aspects related to the benefit of mankind have been progressing worldwide. Food is a basic right, while energy drive the world. Human need a lot of resources so the civilization can be flourished. But human is not immune, and thus, ones need to take care of their health regularly. Modern Agri-food systems is the foundations of a decent life, a sound education and the achievement of

the Sustainable Development Goals. Over the past decade, we have witnessed a chain reaction that threatens the very foundations of life for millions of the world's people. Rising energy prices drove up the cost of food and ate away the savings that people otherwise would have spent on health care or education. Unsustainable plantation management induced forest fire and posed haze hazard to the whole Sumatra island and our neighboring countries.

The human cost of the food and energy crisis has been enormous. Millions of families have been pushed into poverty and hunger. Thousands more suffering from the collateral effects. Over the past year, food insecurity led to political unrest in some 30 countries. Yet because the underlying problems persist, we will continue to experience such crises, again and again -- unless we act now. That is why we are here today.

We must make significant changes to feed ourselves, and most especially, to safeguard the poorest and most vulnerable. We must ensure safety nets for those who cannot afford food, or energy, nor even a health service. We must transform agricultural development, markets and how resources is distributed. We must do so based on a thorough understanding of the issues. That is the only possible way we can meet the Goals of Sustainable Development.

Thank You,

Assoc. Prof. Dr.-Ing. Uyung Gatot S. Dinata,MT.

Opening Ceremony
Rector of Andalas University

Dear Honorable and Distinguished guests,
Ladies and gentlemen,

Assalamu'alaikum Warahmatullahi Wabarakatuh and Good Morning

I welcome the opportunity to address you at this important event.

It gives me great pleasure in welcoming you to this 3rdConference on "Security in Food, Renewable resources, and Natural Medicines (SFRN)" 2019. I am delighted that so many have accepted our invitation. I am particularly happy that we have in this room, dedicated individuals from so many stakeholder groups — including our most respected and distinguished guest "The ministry of Agriculture of the Republic of Indonesia". We also welcome the mayor of Payakumbuh and the Regent of Lima Puluh Kota. We extend our welcome to the civil society, the private sector, international organizations; the science community; and others dedicated to help create an environment in which people can escape food insecurity. Imagine what we can do together if we make the security for all as an our top priority, and pull in the same direction. We can make a difference in the lives of millions.

Food is a basic right. Food security are the foundations of a decent life, a sound education and the achievement of the Sustainable Development Goals Access to medicines - a fundamental element of the right to health. Health is a fundamental human right, indispensable for the exercise of many other rights in particular the right to development, and necessary for living a life in dignity. Moreover, human rights principles and language are being used to support resource access claims as rights-based approaches empower individuals and groups to gain or maintain access to natural resources

Much progress has been made during the last decades but much more needs to be done. Millions of people are Insecure worldwide, meaning that they either starve or they do not know from where their next meal, health care or resources will come.

Much of the progress on security has occurred at the expense of our environment. With business as usual, we foresee that the production improvements during the next decade will be less than the last one, while the environmental degradation will continue, and health will deteriorate significantly. Without available resources to seek, mankind will become endanger species in a very short time.

Solutions to the security problems need to be designed and implemented within a new and rapidly changing environment. Globalization and sweeping technological changes offer new opportunities for solving these problems. A number driving forces or trends must be taken into account in developing appropriate action. Some of the action needed, such as appropriate technology for small farms, is not new but it must be cast in the new and changing global and national environment, taking into account new opportunities and risks. I hope that by providing a forum for knowledge exchange, this conference will help identify the action to be taken. Furthermore, this conference will help to provide constructive dialogue across and within the various interest and stakeholder groups, including the intended beneficiaries, and arrive at the best solutions.

In conclusion, even if those responsible give high priority to achieving sustainable security for all and back it up with action, the world may not achieve the goal by 2030. But we will be much closer than with business as usual. I urge all of us to provide the strongest support for this event, to enable securing the food for all in the closest time possible. It is my sincere optimism that through the accomplishment of the objectives of this event, we will come to an important step nearer to secure the food for all.

Finally, I would like to thank the organizing committee who have spent their utmost efforts to prepare and manage this event successfully. Let me conclude my remarks by wishing our guests happiness, good luck and great success in the conference.

May I announce now the opening of the "3rd International Conference on Security in Food, Renewable resources, and Natural Medicines (SFRN) 2019" in Payakumbuh.

Thank you.

Rector,
Prof. Tafdil Husni, SE, MBA, PhD

Welcome Message
Director of Politeknik Pertanian Negeri Payakumbuh

Dear Honorable ladies and gentlemen,

Good Morning and Assalamu'alaikumwr.wb

I congratulate to all participants on the invitation and participate at our beloved campus Payakumbuh StateAgricultural Polytechnic. I feel really honoured to welcome all of you at our event, the 3rd International Conference on Security in Food, Renewable Resources, and Natural Medicines (SFRN) 2019 at thePayakumbuh State Agricultural Polytechnic, Indonesia.

Food security is a very important aspect in a country's sovereignty. Food also determines the future direction of a nation. Many social and political fluctuation can also occur if food security is disrupted. Food availability that is smaller than its needs can create economic instability. This critical food condition can even endanger economic and national stability. In the current situation, there are many challenges in exteriorize food security, such as climate change, population, limited natural resources and other challenges both locally, regionally and globally.

Renewable resources are also our starting point to start sustainable development. Research on renewable resources is also very important as the solution in meeting the principles of sustainable development. As we know that Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainability is the foundation for today’s leading global framework for international cooperation - the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs)

The discovery of treatment based on local culture also contributes greatly to the good of humanity. Unfortunately, there are still many treatments that have not been carried out by scientific research. So, through this conferencewe hope it can be a trigger to increase in traditional plant-based treatments that not go through complex

chemical processes, so that the effectiveness of the pillars can be further suppressed and also contribute to the community's economy.

Finally, I would like to express my gratitude to all people who involved in organizing this event and to all ofstakeholders who have helped to make this event go on succesfully. Please accept my apologize for any shortage, Assalamu'alaikumwr.wb.

Thank you

Ir. Elvin Hasman, MP

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Physical and Mechanical Properties of Pinang (Areca catechu, L.)

Irriwad Putri, Putri Wladari Zainal

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Abstract. Areca palm (Areca catechu L.) is one type of palm which has many uses, such as for consumption, cosmetics, health, and coloring materials in the textile industry. For processing the areca palm, the farmers need a tool or machine, but to design Areca palm's tool or machine requires the physical and mechanical properties of the product. This study aims to measure the physical properties of areca nuts, which will be used to design postharvest areca nut processing tools. Measurement of physical properties of the Areca nut such as GMD (Geometric Mean Diameter), sphericity, initial moisture content, the thick of the areca nut (t1,t2, t3, and t4). Measurement of mechanical properties of the Areca nut, such as the force of the areca nut. The researchers took the areca nut from five regions in West Sumatera, Padang, Pasaman, Pasaman Barat, Pesisir Selatan, and Pariaman. Fruits were selected from old areca nut, and skin color is reddish yellow. The physical properties (GMD, sphericity, thickness) have a significant relationship, which is an analysis of variance with sig. < 0.05 while moisture content has not significant (sig. > 0.05). Furthermore, this research has a cumulative probability test with a length range from 42.91 mm to 59 mm of 538 samples. The areca nut which has a thickness around 3.5 mm to 6.7 mm (t1) of 150 samples, 14.025 mm to 21.525 mm (t2) of 73 samples, 3.5 mm to 10 mm (t3) of 122 samples, 7.55 mm to 12.05 mm (t4) of 124 samples.

Keywords*:* Physical properties, mechanical properties, pinang

INTRODUCTION

Areca nut (Areca catechu L.) is one type of palm that has many uses, as like for consumption, cosmetics, health, and coloring materials in the textile industry. Areca nut (Areca catechu) is a type of palm that grows in the Pacific, East Asia, and Africa (Syamsuhidayat and Hutapea, 1991). These plants are widespread in Indonesian territory, both individually and in population, and are generally planted as hedges or garden dividers (Novarianto and Rompas, 1990). Based on the available data, areca nuts from Indonesia are in high demand or in other words, 80% of the world's demand for areca nuts is fulfilled from Indonesia. The export of areca nuts is a very promising business opportunity because of the high demand accompanied by an abundance of available raw materials (Ritonga, 2010).

For some people, the riped areca nut harvested will be immediately divided and then dried. Or else they dried it and then proceeded to the stripping stage. The drying

process is done to facilitate stripping the betel nut or to release betel nut from the flesh of the fruit. Areca nut stripping process is done by the community using the traditional way, which is cleaved by using a machete, and after drying the areca nut will be pruned by a knife. This traditional process requires particular expertise, a large workforce, long working hours, low work capacity, and a large enough chance of work accidents. However, in general, the community continues to implement this traditional method because there is still no effective mechanism or areca peeler to be used in the stripping Process of areca nut. Processing must use better technology and mechanics, including drying beans (Balai Penelitian Tanaman Palma, 2012).

Post-harvest areca nut processing machines have been widely circulating in the community, but there are still many that have not operated optimally due to the widespread of the size of the areca nuts found in each region in West Sumatra. Variation of areca nut that spreads in each region causes difficulties in the process of machine design because there is no standard size data in each area that has been measured. The objectives of this research measure the physical and mechanical properties of areca nuts (Areca catechu L.), especially for old areca nut's betel thoroughly.

MATERIALS AND METHODS

This research conducted at the Agricultural Food Processing Engineering Laboratory, Agricultural Engineering Department, Faculty of Agricultural Technology, Andalas University. The Material of this research is old areca nut, with reddish-yellow color (Fig.1). force gauge, digital scales, ovens, machetes, sample buckets, writing equipment, and computers. Force gauge, digital scales, ovens, machetes, sample buckets, writing equipment, and computers are used for this research. A sampling of old areca nut was carried out randomly in the farms of farmers with the same level of maturity.

The method used in this study is the sampling method. The sample used was old betel nut from five different regions, Padang, Pasaman Regency, West Pasaman Regency, Pesisir Selatan Regency, and Padang Pariaman Regency. The measurements taken are: GMD (Geometric Mean Diameter), includes the length, width, and thickness of the fruit, sphericity, Hardness of fruit flesh, Initial moisture content of ingredients, Fruit flesh thickness (t1, t2, t3, and t4).

Figure 1. Old areca nut with reddish-yellow color

GMD (Geometric Mean Diameter)

The geometric mean diameter can be determined by measuring the length, width, and thickness of the fruit. The old areca nut came from five different regions in West Sumatera. The length, width, and thickness were measured using a digital caliper with an accuracy of 0.01 mm. The equation of geometric mean diameter (Dg) can be seen in the formula below.

$$D_g = (d_{major} \times d_{intermediate} \times d_{minor})^{\frac{1}{3}}$$

Where GMD = Geometric Mean Diameter dmayor =lenght (mm), dintermediate= width (mm), and dminor = thickness (mm).

Sphericity

The researchers measured the shape of the fruit by finding its sphericity value. Sphericity is a comparison between Geometric mean diameter and fruit length (Santosa et al.,2017). The geometric foundation of the concept of sphericity rests up upon the iso-perimetric property of a sphere. The sphericity of the old areca nut was determined by using the following equation (Mohsenin, 1970).

$$Sp = \frac{GMD}{d_{major}}$$

Where: Sp = Sphericity (%), GMD = Geometric mean diameter (mm), dmajor = Length (mm).

Hardness

The hardness test is one measurement used to determine the strength or durability of the material. While hardness itself is one of the mechanical properties of a substance in addition to its physical and technological features. The hardness of areca nut was measured by force gauge using the following equation.

$$Hardness = \frac{F}{A}$$

Where: F = Force (N) and A = Area (cm2)

Initial Moisture Content

The moisture content of old areca nut is defined as the quantity of water per unit mass of fruit. The moisture content of the areca nut was measured by oven by using the dry method at 105°C (Shashikumar, et al., 2016). The equation of moisture content can be seen in the formula below.

$$MC = \frac{(W_1 - W_2)}{W_1}$$

Where: MC = Moisture content of arecanut (%), W1 = weight of sample (g), W2= weight of sample after drying (g)

Mesocarp thickness (t1, t2, t3, and t4)

Mesocarp thickness measured by digital calipers. t1 and t3 are the thickness of the middle of the mesocarp. While t2 and t4 are the thickness of the upper and lower mesocarp. Measurements of the thickness of t1, t2, t3, and t4 are used to measure the old areca nut blade. The thickness of the mesocarp (t1,t2, t3, and t4) can be seen in Figure 2.

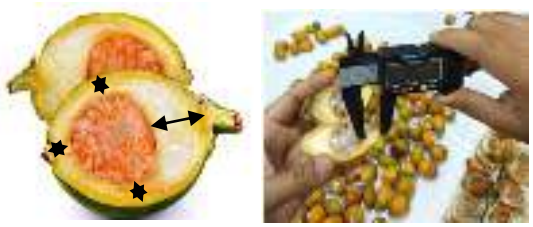

Figure 2. The thickness of areca nut mesocarp

RESULT AND DISCUSSION

The average major, intermediate, and minor dimensions and other parameters of each area can be seen in Table 1. The researchers selected 1000 (one thousand) areca nuts from five regions in West Sumatera in the same level of maturity. The data obtained were carried out by ANOVA test with Duncan's advanced test to see the differences in physical shape and dimensions of areca nut from 5 regions in West Sumatra. The cumulative probability test is carried out to determine the dimensions of fruit on the distribution of the highest number of fruits.

Table1. Measured and calculated physical properties parameters

Parameter	Average	SD	CV
Major (mm)			
Padang	57.28	5.84	10.20
Pesisir Selatan	60.43	3.55	5.87
Pasaman Barat	63.29	4.03	6.37
Pasaman Timur	57.65	5.22	9.05
Pariaman	51.85	6.56	12.64
Intermediate (mm)			
Padang	37.08	2.79	7.53
Pesisir Selatan	38.30	7.37	19.25
Pasaman Barat	40.55	4.07	10.03
Pasaman Timur	41.07	3.13	3.05

Parameter	Average	SD	CV
Pariaman	42.31	5.66	13.37
Minor (mm)			
Padang	36.44	2.71	7.44
Pesisir Selatan	37.49	7.33	19.55
Pasaman Barat	40.01	4.03	10.06
Pasaman Timur	40.04	7.62	7.61
Pariaman	41.44	5.58	13.47
Geometrik Mean Diameter			
Padang	42.41	2.95	6.97
Pesisir Selatan	43.92	5.63	12.82
Pasaman Barat	46.59	3.48	7.46
Pasaman Timur	45.37	2.88	6.35
Pariaman	44.70	0.08	9.42
Sphericity			
Padang	0.74	0.05	7.18
Pesisir Selatan	0.73	0.10	13.23
Pasaman Barat	0.74	0.05	7.27
Pasaman Timur	0.79	0.05	6.75
Pariaman	0.87	5.12	11.46
Hardness (N/cm2)			
Padang	2.74	0.43	15.83
Pesisir Selatan	2.23	0.35	15.51
Pasaman Barat	1.81	0.29	15.83
Pasaman Timur	1.36	0.56	40.97
Pariaman	2.01	0.18	9.11
Moisture content (%wb)			
Padang	76.07	5.84	7.68
Pesisir Selatan	78.11	3.24	4.15
Pasaman Barat	76.03	3.31	4.36
Pasaman Timur	76.03	3.32	4.37
Pariaman	76.11	4.11	5.40

From the measurements and calculations obtained, the areca nuts from Pasaman Barat have the most significant major diameter average. Its value is 63.29 ± 4043 mm. For the intermediate diameter, the one from Pariaman has the largest average score. Its value is 42.31 ± 5.66 mm. The largest minor diameter score is also from Pariaman, the score is 41.44 ± 5.68 mm. For the largest GMD and hardness, respectively 46.59 ± 3.48 and 2.74 ± 0.43 N / cm2. Areca nut roundness values ranged from 0.73 to 0.87 with areca nut derived from Pariaman has a greater roundness value approaching the value of 1 which is 0.87 ± 5.12. The sphericity value ranges from 0-1, the closer it is to 1, the rounder. This shows that areca nut originated from Pariaman tends to be rounder compared to areca nut from other regions.

GMD (Geometric Mean Diameter), sphericity, and hardness have different values for each region. The value is sig <0.05. Furthermore, the Duncan test is needed to see the difference. The water content of the areca nut for each region has the same value with a sig value> 0.05. Areca nut maturity level equation used as a sample. From the measurements and calculations obtained, the water content is not significantly different between each region. Based on Duncan's further tests, the GMD value of areca nut from Padang, and Pasaman Barat is different from Pasaman Timur, Pariaman and Pesisir Selatan region. While the GMD values of areca nut from Pesisir Selatan and Pariaman are the same. Areca nut from Pariaman and Pasaman Timur are the same. Areca nut's sphericity values from the Pesisir Selatan are the same as Padang, and Pasaman Timur, but has different values with areca nut from Pasaman Timur and Pariaman. For areca nut's water content for each region is the same. Areca nut hardness values are different for each region.

The thickness of mesocarp from different areca nut in West Sumatera can be seen in Table 2. The thickness value of mesocarp t1 is the same for the Pasaman Barat, Padang, and Pesisir Selatan. However, it is different from Pasaman Timur and Pariaman. Areca nut hardness values are different for each region. The thickness value of mesocarp t1 is the same for the Pasaman Barat, Padang, and Pesisir Selatan. However, it is different from Pasaman Timur and Pariaman. For the value of t2 from the Pariaman area is the same as Pasaman Timur, Pasaman Barat is the same as Pasaman Timur, Pasaman Timur is the same as the Padang and Pesisir Selatan, and Pariaman is different from Pesisir Selatan. For the value of t3 from the Pasaman Timur area is the same as the West Pasaman, Pasaman Barat is the same as the Padang and the Pesisir Selatan, Padang is the same as Pesisir Selatan and Pariaman, Pasaman Timur is different from Pariaman. For the value of the t4 Pasaman Timur region is different from Pariaman and Pasaman Barat, Padang is the same as Pesisir Selatan.

Table 2. Thickness of mesocarp from Different Areca nut in West Sumatera

Parameter	Average	SD	CV
t1 (mm)			
Padang	4.90	1.67	34.33
Pesisir Selatan	4.49	0.73	16.16
Pasaman Barat	4.60	0.87	18.82
Pasaman Timur	3.80	0.71	18.86
Pariaman	5.60	1.22	21.77
t2 (mm)			
Padang	18.90	1.74	9.21
Pesisir Selatan	17.9	1.65	9.22
Pasaman Barat	17.30	3.34	19.33
Pasaman Timur	18.60	2.65	14.28
Pariaman	16.20	3.98	24.59
t3 (mm)			
Padang	5.20	1.71	32.91
Pesisir Selatan	4.60	0.81	17.54
Pasaman Barat	4.50	0.72	16.22

Pasaman Timur	3.90	0.73	19.01
Pariaman	6.00	2.01	33.57
t4 (mm)			
Padang	10.90	0.95	8.73
Pesisir Selatan	9.85	0.64	6.54
Pasaman Barat	9.90	1.06	10.64
Pasaman Timur	7.60	1.15	15.10
Pariaman	9.10	1.87	20.55

From the information obtained to design areca nut post-harvest machines, such as sorting, grading and handling should be different according to the results of the Duncan's test from the same group. Based on the value of hardness test that to analyse and design a reduction in size or cutting areca nut should be designed with a different machine so that the design analysis is more precise and accurate. Based on the value of hardness test, that to analyse and design a reduction in size or cutting areca nut should be designed with a different machine so that the design analysis is more precise and accurate.

By conducting a cumulative probability test, areca nuts are obtained with the following details: length of 42.91 mm - 59 mm as many as 538 pieces, the size of t1 thickness 3.5 mm - 6.7 mm was obtained as many as 116 pieces, the size of t2 thickness 14.03 mm - 21.5 mm was obtained as many as 73 pieces, the thickness of t3 3.5 mm - 10 mm was obtained as many as 122 pieces, the size of t4 thickness 7.55 mm - 12.05 mm is 124 pieces.

Based on the value of grouping the size of the probability test above, in order to design a postharvest machine of areca nut in general it can take the size with the largest or dominant number or frequency.

CONCLUSION

From the results of measurements of the physical and mechanical properties of areca nut, it can be concluded that to design the areca nut processing machine, the following sizes are made: for the length, width and thickness of the fruit, the largest size is chosen, namely 72.10 mm, 54.70 mm and 53.90 mm. For the thickness of fruit skin, the dominant size is chosen, namely: t1 3.5 mm - 6.7 mm, thickness t2 14.03 mm - 21.5 mm thick t3 3.5 mm - 10 mm, thickness t4 7.55 mm -12.05 mm. For the selected compressive strength, the biggest one is 4.252 N / cm^2.

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