HAMLET-BASED NUTMEG CULTIVATION AND PRODUCTION SYSTEM IN WEST SERAM DISTRICT, MALUKU, INDONESIA

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ABSTRACT

Most of the nutmeg cultivation systems in Maluku are smallholder plantations. Agroforestry has long been developed in Maluku for generations known as dusung. Dusung can increase farmers' income continuously because the harvest is done weekly, monthly, yearly. The problems faced by farmers in Maluku regarding the productivity potential of nutmeg plants are caused by factors such as plant age, plant cultivation techniques and conventional processing. Based on these problems, a study was conducted to obtain data and information about hamlet-based nutmeg cultivation systems and productivity in Kairatu Barat District. The data and information are useful in the context of improving hamlet-based nutmeg cultivation systems in Kairatu Barat District, West Seram Regency in the future. The research uses survey methods and direct observation in the field. The selection of respondents was carried out by purposive sampling. Respondents amounted to 32 farmers. Sampling was carried out using Stratified Random Sampling, strata were determined based on the number of nutmeg plants per farmer and samples were taken randomly from each farmer. Data collected in the form of primary and secondary data. The research was carried out during the 2022 harvest season. The results of the research indicated that the cultivation system and production of nutmeg in West Kairatu District (Kamal village, Nuruwe, Lohiatala) is classified as low. Due to the number of nutmeg plants that produce began to decline. the seeds used as seeds still come from sweeping seeds. Control of Plant Destruction Organisms is carried out only when the plants start producing and fertilization is never done. Overall, the farmers in the research location cultivate hamlet-based nutmeg plants.

INTRODUCTION

Nutmeg (Myristica fragrans Houtt) is a native plant of the Maluku Province and is spread across several provinces in Indonesia. The largest exporter of nutmeg in the world market is Indonesia 66 -77% (Malda, Rusdi, & Sugianto, 2022; Kembauw et al, 2022). In the last 5 years (2017-2020) nutmeg in Maluku Province has decreased, ranging from 5,513 tons to 5,310 tons. In 2021 nutmeg production in Maluku is 5,277 tons, below North Maluku's 5,604 tons and Aceh's 6,236 tons (Ditjenbun 2022). Nutmeg has economic value, namely seeds, mace meat can be used as derivative products (Palijama, Riry, Wattimena, 2012; Sari & Agustia, 2022; Wattimena & Makaruku, 2022).

Most of the cultivation of nutmeg in Maluku is smallholder plantations, namely 88.93% (Ditjenbun, 2022). The centers of nutmeg plantations and production in Indonesia are North Maluku, Maluku, West Papua, North Sulawesi and Aceh (Ditjenbun, 2022; Kembauw et al, 2022; Nasution, 2023). Agroforestry has long been developed in Maluku for generations known as dusung (Wattimena & Makaruku, 2022; Kembauw et al, 2022). Dusung is land located 1-10 km from the village starting from the coastline to the interior of the forest with a mixed cropping pattern, agricultural crops, plantations, and forest plants (Wattiena, 2017; Wattimena & Makaruku, 2022; Hatulesila, Silaya & Nirawati, 2022). The hamlet system can increase farmers' income continuously because the harvest is done weekly, monthly, yearly (Supawarta, Indrianti, Mokoginta & Mokoolang, 2022). One type of annual plant cultivated by hamlet-based Maluku people is nutmeg.

West Seram Regency has an area of nutmeg cultivation for the last two years (2020-2010) of 2869.20 ha increasing to 2879.50 ha with nutmeg production of 253.00 tons increasing to 300.03 tons (BPS Province of Maluku, 2022) . Although the production of nutmeg has increased, but only in small quantities, because the nutmeg cultivation system in the West Seram Regency is a hamlet-based community plantation.

In general, the problems faced by farmers in Maluku for the potential productivity of nutmeg plants are caused by factors of plant age, plant cultivation techniques and conventional processing (Siwalette, 2020; Kembauw, Mahulette, Wattimena, & Senewe, 2021). Based on these problems, a study was conducted to obtain data and information about hamlet-based nutmeg cultivation systems and productivity in West Seram District, West Seram District. The data and information are useful in the context of improving hamlet-based nutmeg cultivation systems in West Seram Regency in the future.

METHOD

The research was carried out in the West Kairatu District area (Kamal village, Nuruwe village, Lohiatala village) during the 2022 harvest season. The research used survey methods and direct field observations. Respondents were selected by purposive sampling of 10% with the criterion of the total number of heads of households cultivating nutmeg in each village. Respondents who were selected from the three sample villages totaled 32 farmers. Sampling was carried out using stratified random sampling, strata were determined based on the number of nutmeg plants per farmer and samples were taken randomly from each farmer. Data collected in the form of primary and secondary data.

Primary data collection was carried out using structured interviews (questionnaires) to nutmeg farmers. Secondary data were obtained from written sources at relevant agencies and relevant literature. Primary data collected included: land description (altitude, topographical form, vegetation condition, land ownership status, land area), cultivation system (seed source, pest control, spacing, type of nutmeg, number of plants), post-harvest (harvest time, harvesting method) nutmeg production (number of fruits per tree). Secondary data includes site conditions, climate, soil). The research data was tabulated and then analyzed descriptively qualitatively.

RESULTS AND DISCUSSION

General Conditions of Research Locations

West Seram Regency is geographically located between: 1°, 19' - 7°, 16' South Latitude and 127°, 20' - 129°,1' East Longitude. It is bounded by the Seram Sea to the north, the Banda Sea to the south, the Buru Sea to the west, and Central Maluku Regency to the east. West Seram Regency is a maritime district with a total of 53 islands and an area of 6948.40 square kilometers and is divided into 11 sub-districts including Kairatu Barat sub-district. Geographically, West Kairatu District is bordered to the east by Kairatu and Inamosol Districts, to the west by West Seram District, to the north by West Seram and Inamosol Districts, to the south by the Seram Sea. Administratively, Kairatu Barat District consists of 6 villages, namely Waisamu Village, Waihatu Village, Lohiatala Village, Nuruwe Village, Kamal Village, and Waisarisa Village, with a total area of 132.25 km2.

The climate in West Seram Regency is a tropical marine climate and seasonal climate, due to the location of the West Seram region near the equator and surrounded by a wide sea. Therefore, the climate is strongly influenced by the ocean and takes place simultaneously with the seasonal climate, namely the West or North season and the East or Southeast season. The change of seasons is always interspersed with the transition season. The Transitional Season is a transition from the two seasons.

Based on climate data from the Kairatu Meteorological Station for the last 10 years (2012 – 2021 period) it shows that Kairatu sub-district has an average annual rainfall of 2261 mm/year, air temperature 26.8oC, humidity 85.9% and irradiation time 56% (Table 1).

Table 1
Climate in Kairatu Barat District, West Seram Regency

Month	Air Temp (C°)			Air Humidity (%)	Irradiation time (%)	Rainfall (mm)
	Rate.	Max.	Min.			
January	27,4	33,1	23,0	84	59	139
February	27,3	33,0	23,0	83	63	124
March	27,3	32,8	22,6	84	60	160
April	27,1	32,6	22,9	86	61	157
May	27,0	32,3	23,0	87	55	234
June	26,1	31,1	22,5	89	36	351
July	25,6	30,4	22,0	90	35	306
August	25,5	30,8	21,5	88	47	244
September	26,0	31,2	21,2	86	53	168
October	26,8	32,2	21,9	85	66	149
November	27,7	33,1	22,6	83	72	96
December	27,8	33,1	22,4	84	65	133
Annual	**26,8**	**32,1**	**22,4**	**85,9**	**56**	**2261**

Source: Kairatu Climatology Station

Based on monthly climate data for a 10 year period, the study location has 7 humid months (January - April, September, Octoiber, December), 4 wet months (May - August), 1 dry month (November). Nutmeg plants require rainfall for growth and productivity, namely 2000 – 3500 mm per year (Wattiena et al, 2021; Wattimena & Makaruku 2022). Determination of climate change and climate suitability for nutmeg plants, Kairatu District is suitable for the growth and productivity of nutmeg plants (Laimeheriwa, Madubun & Rarsina, 2019; Ririhena, Wattimena & Tuanaya, 2023).

Nutmeg plants can grow in various types of soil. However, for optimum growth and production, nutmeg plants

require fertile and loose soil, textured sand to loam, especially volcanic soil with good aeration and drainage conditions, fertile and having a pH of 5.5 – 7.0 (Wattimena, 2017; Khaliq & Sudiatmika, 2021) The growth of nutmeg plants is affected by the level of soil acidity (pH) directly or indirectly (Hakim et al, 1986 ; Wattimena, 2017). Table 2.

Table 2. Distribution of the Dominant Soil Types in the West Seram District

No	Type of soil	Acidity Level (pH)
1.	Kambisol	5,0
2.	Renzina	7,5 – 8,5
3.	Podsolik Merah Kuning	4,0 – 5,0
4.	Latosol	4,5 – 6,5
5.	Regosol	6,0 – 7,0
6.	Mediteran	> 7,0

Source: Maluku Agricultural Technology Study Center

Acidic soils have constraints for plant growth whereas soils with a neutral pH of 6.6 – 7.5 are healthy soils (Irundu, 2018; Kahliq & Sudiatmika, 2021)

Land Description

The results showed that the total number of farmers who planted nutmeg was 80.96 percent at an altitude of 0-100 m above sea level, Kamal village 33.34 percent, Nuruwe village and Lohiatala village 23.81 percent. Altitude 100 – 300 m above sea level, namely 19.04 percent of Nuruwe Village and Lohiatala Village, respectively 9.52 percent. Nutmeg plants can grow and produce well in lowland areas up to an altitude of 700 m above sea level. However, nutmeg plantations in areas with elevations above 700 m above sea level are considered unproductive.

51.28 percent of farmers have a flat topography (Kamal village 15.38 percent, Nuruwe village and Lohiatala village 17.95 percent). 12.82 percent of farmers own land with a sloping topography, while 35.9 percent of farmers own land with undulating topography (Table 3).

Table 3. Land Description (Altitude, Topography, Condition of Vegetation)

Village	Height above sea level					Topographical form					Vegetation circumstances				
	0-100	100 -300	350-500	500-700	> 700	Flat 0-3 %	Ramps 3-8 %	Corrugated 8-15 %	Steep 30-45 %	Steep > 45 %	Grass + Forest Trees	Reeds	Leafless	Mixed Food Crops	Plantation Plant Mix
Kamal	33,34	-	-	-	-	15,38	-	15,38	-	-	11,67	-	-	11,67	11,67
Nuruwe	23,81	9,52	-	-	-	17,95	7,69	7,69	-	-	11,67	-	-	10	11,67
Lohiatala	23,81	9,52	-	-	-	17,95	5,13	12,83	-	-	11,67	-	-	8,31	11,67
Total	**80,96**	**19,04**	**-**	**-**	**-**	**51,28**	**12,82**	**35,9**	**-**	**-**	**35,01**	**-**	**-**	**29,98**	**35,01**

Sumber : Data Primer

Topography is an aspect related to the suitability of plant species for altitude, soil and humidity in the local area. Based on years of experience cultivating nutmeg, farmers say that nutmeg is very suitable for flat to undulating topographic conditions. The biophysical conditions of West Kairatu sub-district (Kamal, Nuruwe, Lohiatala villages) are very suitable for the growth and development of nutmeg. This is in line with the statement of Norgrove & Hauser, (2016); Nyagumbo, Mkuhlani, Mupangwa, & Rodriguez (2017) that farmers have biophysical criteria that are adapted to the planting system being carried out. Slope areas with steep and steep topography are not used by farmers to cultivate nutmeg because it is

very risky for farmers in the harvesting process.

The condition of the vegetation found in the nutmeg plantations was dominated by a mixture of grass, forest trees and a mixture of plantation crops each 35.01 percent, for the value of each village 11.67 percent. The condition of the land vegetation for mixed food crops is 29.98 percent. The use of appropriate cropping patterns can increase production, and can contribute to improving the standard of living of farmers, as well as to support the economy. Farmers from Kamal village, Nuruwe village, Lohiatala village, most of the other types of annual crops in the hamlet are coconut, cloves and cocoa.
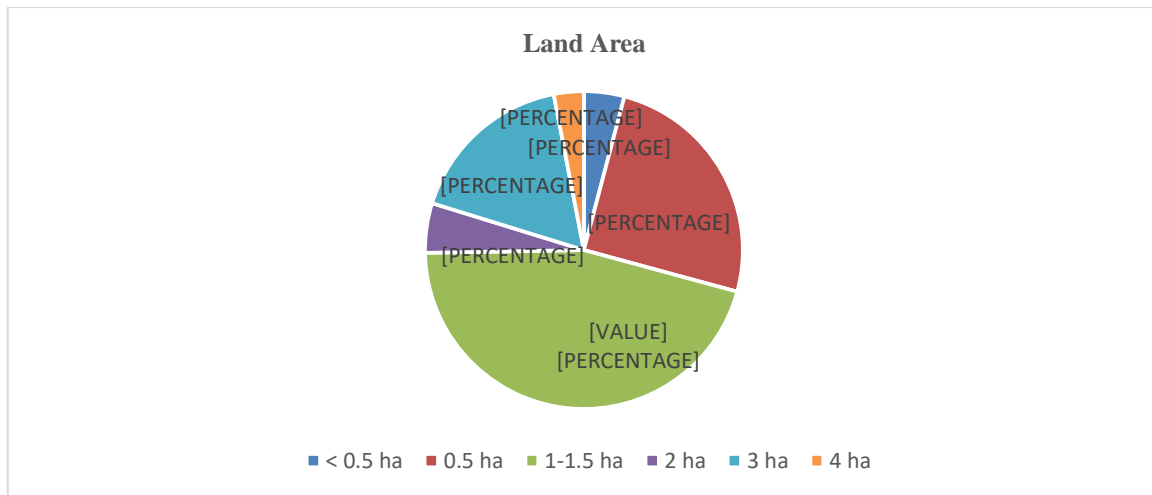
Land Area

[PERCENTAGE]
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■ < 0.5 ha ■ 0.5 ha ■ 1-1.5 ha ■ 2 ha ■ 3 ha ■ 4 ha

Figure 1. Farmers' Land Area Percentage

Figure 1 displays the area of land owned by various farmers in the three villages. The percentage of land area owned by farmers in sample villages is <0.5 Ha (4.%), 0.5 Ha (25%), 1 - 1.5 Ha (46%), 2 Ha (5%), 3 Ha (17%), and 4 Ha (3%). Land area is one of the important production factors and when used optimally can increase farm production. The area of land owned by farmers is managed based on ability and level of education (Table 4).

Variations in age and education level of respondents who cultivate nutmeg plants with the hamlet system are 57.13% aged 36 - 65 years with an elementary education level of 66.67%. The farmer's age and education level show experience and knowledge about how to cultivate the plant and the condition of the nutmeg land they have. Farmers with an elementary education level manage plants up to the production level by learning from their own experiences. The nutmeg plants that are managed are inherited from their parents.

Table 4. Age Category and Education Level of Nutmeg Farmers Respondents

Village	Age variant (%)			Education Level (%)			
	≤ 35 thn	≥ 36 – 65 thn	≥ 66 thn	SD	SLTP	SMU	S1
Kamal	-	14,28	19,05	23,81	-	-	9,52
Nuruwe	-	28,57	4,77	19,05	4,77	9,52	-
Lohiatala	-	14,28	19,05	23,81	-	-	9,52
Total	**-**	**57,13**	**42,87**	**66,67**	**4,77**	**9,52**	**19,04**

Source: Primary data

Nutmeg Cultivation System and Productivity

The nutmeg cultivation system in West Kairatu sub-district is hamlet-based. According to Salampessy, Febryano & Bone, (2017) the function of the dusung is a diversity of results and sources of money income that are earned every week, month or even yearly. The productivity of nutmeg plants can be increased by selecting the right seeds. The results showed that 70.38% of the farmers produced their own seeds. Many farmers have not followed the recommendations from the agriculture service for the selection of nutmeg seeds. Seeds used for seeds must come from selected seeds, namely from mother trees that grow healthy, produce high, free from pests and diseases, grow close to trees with male flowers. Apart from that it is taken from fully ripe fruit, the seeds must be large, slightly round in shape and symmetrical. Farmers in the

study location used seeds for nurseries derived from sweeping seeds, namely seeds that were simply collected without knowing the correct mother plant (Table 5).

Table 5. Percentage of Seed Origin for Nutmeg Plant Productivity

Village	Origin of Seeds			
	Own Seed Production	Buying Seeds	Agricultural Service Assistance/ NGO	Barter With Other Farmers
Kamal	18,52	3,7	7,41	-
Nuruwe	25,93	3,7	7,41	-
Lohiatala	25,93	3,7	3,7	-
Total	**70,38**	**11,1**	**18,52**	**-**

Source : Primary Data

Table 6. Average Productivity of Nutmeg Planted (Kg/Ha)

Village	Productivity (Kg/Ha)
Kamal	25,29
Nuruwe	14,05
Lohiatala	20,05
Rerata	**19,79**

Source: Primary Data

In order to obtain good nutmeg production, it is necessary to pay attention to the spacing, the number of plants, the distribution of the sex ratio of the plants. Production of nutmeg per tree is determined by plant spacing and sex ratio. Spacing that is too close to produce small nutmeg fruit. Farmers from Kamal village, Nuruwe village, Lohiatala village plant nutmeg among other crops in the hamlet. As a result, the production of nutmeg varies according to the spacing. The spacing used in Kamal village, Nuruwe village, Lohiatala village starts from 4x4, 6x6 m, 7x7m, 8x8m, 10x10 m.

The number of nutmeg plants produced varied for the sample villages. The number of nutmeg plants in Kamal village is 370/tree, Nuruwe village is 278/tree. Lohiatala village 323/tree. Overall, West Kairatu Sub-District, the number of immature nutmeg plants with a plant age ranging from 2 to 4 years is more than that of productive nutmeg plants. The level of awareness of farmers about cultivating nutmeg plants began to increase so that many farmers started cultivating nutmeg plants. Nutmeg plants that have produced are inherited from parents.

The types of nutmeg cultivated in Kamal village are banda nutmeg (Myristica fragran Houtt) and Papuan nutmeg (Myristica argentea Ware). Nuruwe village and Lohiatala village cultivate banda nutmeg. Other plantation crops that are protective trees for nutmeg in the three villages are dominated by coconut, cloves, cocoa and durian.

Figure 2. (a) (b) Banda Nutmeg (Myristica fragrans Houtt), (c) (d) Papuan Nutmeg (Myristica argentea Ware)

Fertilization aims to meet nutrient needs, replace nutrients that have been taken up by plants so that crop production increases. Fertilization was never applied to nutmeg plants in Kamal village, Nuruwe village, Lohiatala village. The habit of

farmers in clearing their nutmeg plantations only when nutmeg is in production or harvest season makes the land conditions for producing nutmeg plants dirty and results in the emergence of pests and diseases and weeds that can affect crop productivity.

To increase the productivity of nutmeg, controlling pests, diseases and weeds is an important part of nutmeg cultivation. Control of pests, diseases and weeds can reduce crop losses and increase crop production. West Kairatu Sub-District, pest, disease and weed control measures are carried out by farmers manually without the use of pesticides. On average, the West Kairatu sub-district (Kamal village, Nuruwe, Lohiatala) nutmeg plants are attacked by pests and diseases such as stem borer, wet fruit rot, dry fruit rot, unripe fruit cracking and white splitting. Weeds are disturbing plants that suppress plant growth and production (Tanasale, Goo, Makaruku & Wattimena, 2022). Weed control needs to be done because it is one of the inhibiting factors and reduces production by 28 percent (Onarely, Riry, & Wattimena, 2016; Tanasale & Goo, 2023). Farmers in West Kairatu sub-district weed control was limited to conventional land clearing when the nutmeg plants were harvested.

The nutmeg cultivation system includes seed selection, control of plant-disturbing organisms, spacing, number of plants in one area will affect the production of nutmeg plants. The average production of nutmeg in West Kairatu sub-district (Kamal village, Nuruwe, Lohiatala) per year is 700 to 1300 fresh fruit/tree/year (5-11 kg of raw nuts/tree/year). Parliansyah et al (2019) stated that nutmeg production at HKM Rangai Sejahtera KPH Rajabasa was the highest, reaching 60 kg of wet nutmeg/tree/year because farmers cultivated nutmeg according to the correct nutmeg cultivation system.

Proper post-harvest handling can produce good quality and quality of nutmeg seeds. Based on interviews with farmers, the harvest of nutmeg in West Kairatu sub-district is carried out 2 times a year with a fruit age of approximately 6 months from flowering. Post-harvest handling includes drying the nutmeg seeds and mace. Seed drying is carried out by farmers in West Kairatu sub-district (Kamal village, Nuruwe, Lohiatala) in the traditional way, namely drying it under full sun for 4-5 days for seeds, 1-2 days for mace. During the rainy season, drying is done by smoking for 6-7 days for seeds, 3-4 days for mace for nutmeg.

Sorting is done after drying the nutmeg seeds based on quality class. The quality classes understood by farmers in West Kairatu sub-district are super and simple nutmeg. Super nutmeg seeds are good nutmeg seeds where the size of the nutmeg seeds is not uniform but the seeds are relatively heavy and smooth, the shape is not wrinkled, not attacked by pests, not broken and mechanically damaged. Rimple nutmeg seeds are wrinkled nutmeg seeds and are attacked by pests and diseases. Fuli is not sorted.

Packing of nutmeg seeds and mace is done simply. Sorted nutmeg seeds are packed in double-layered plastic sacks without fumigation. Mace packing is done by packing in a plastic bag without fumigation. Marketing of production results for dry nutmeg kernels that have been released from the shell and nutmeg mace released from the seeds is sold directly to collectors. Because the distance between the regency cities and the provincial capital (Ambon) is far apart, they incur hundreds of thousands of transportation costs. For nutmeg farming, farmers make the decision to sell directly to traders in West Kairatu District or to traders who come directly to the village. The price range for selling nutmeg varies according to category. Super nutmeg is sold by collectors with a price range of Rp. 90,000/kg to Rp. 100,000/kg for banda nutmeg. Papuan nutmeg is sold at a price range of Rp. 70,000/kg to Rp. 80,000/kg. Rimple nutmeg is sold at around Rp. 45,000/kg to Rp. 50,000/kg for banda nutmeg and Papuan nutmeg. The nutmeg mace is sold at a price range of Rp. 200,000/kg for banda nutmeg and Rp. 250,000/kg for Papuan nutmeg.

CONCLUSION

The cultivation system and production of nutmeg in West Kairatu District (Kamal village, Nuruwe, Lohiatala) is classified as low. This is because the number of producing nutmeg plants began to decline. the seeds used as seeds still come from sweeping seeds. Control of Plant Destruction Organisms is carried out only when the plants start producing and fertilization is never done. Overall, the farmers in the research location cultivate hamlet-based nutmeg plants

REFERENCES

Badan Pusat Statistik Maluku (2022). *Kabupaten Seram bagian Barat dalam angka*. BPS Provinsi Maluku

Ditjenbun. (2022). Statistical of National Leading Estate Crops Commodity 2019-2021. (D. Gartina & R. L. L. Sukriya, Eds.). Jakarta (ID): Secretariate of Directorate General of Estate Crops, Ministry of Agriculture

Hatulesila, J. W., Silaya, T. M., & Nirawati, N. (2022). Pendampingan Kelompok Usahatani Pola Dusung Dalam Menyikapi Dampak Perubahan Iklim Terhadap Produksi Tanaman Pala Di Negeri Mamala Kecamatan Leihitu Kabupaten Maluku Tengah. Bakira: Jurnal Pengabdian Kepada Masyarakat, 3(2), 94-103.

Irundu, D., Arafat, A., & Rahmania, R. (2018). Nilai Ekonomi Langsung Berbagai Sistem Pengelolaan Hutan Rakyat di Desa Mirring, Kab. Polewali, Sulawesi Barat. Jurnal Hutan dan Masyarakat, 185-191.

Khaliq, M. A., & Sudiatmika, I. W. (2021). Analisis Beberapa Sifat Kimiatanah Pada Areal Pertanaman Pala (Myristica Fragrans) Di Desa Air Panas Kecamatan Parigi Barat, Kabupaten Parigi Moutong. Agrotekbis: E-Jurnal Ilmu Pertanian, 9(4), 847-855.

Kembauw, E., Mahulette, A. S., Wattimena, A. Y., & Senewe, R. E. (2021). Analisis Rantai Pasok Komoditas Cengkih Hutan di Maluku. Journal of Agricultural Socio-Economics (JASE), 2(2), 81-87.

Kembauw, E., Mahulette, A. S., Senewe, R. E., Wattimena, A. Y., Kastanya, A., Lailossa, A. A., ... & Samal, R. (2022). Cultivation System and Marketing Chain of Nutmeg in East Seram District, Maluku Province, Indonesia.

International Journal of Multidisciplinary Sciences and Arts, 1(2), 134-139.

Laimeheriwa, S., Madubun, E. L., & Rarsina, E. D. (2019). Analisis Tren Perubahan Curah Hujan dan Pemetaan Klasifikasi Iklim Schmidt-Ferguson untuk Penentuan Kesesuaian Iklim Tanaman Pala (Myristica fragrans) di Pulau Seram. Agrologia, 8(2), 71-81.

Malda, S. A., Rusdi, M., & Sugianto, S. (2022). The distribution density of nutmeg plant using visual on screen classification. Jurnal Ilmiah Mahasiswa Pertanian, 7(3), 477–480.

Norgrove, L., & Hauser, S. (2016). Biophysical criteria used by farmers for fallow selection in West and Central Africa. Ecological indicators, 61, 141-147. https://doi.org/10.1016/j.ecolind.2015.06.013

Nyagumbo, I., Mkuhlani, S., Mupangwa, W., & Rodriguez, D. (2017). Planting date and yield benefits from conservation agriculture practices across Southern Africa. Agricultural Systems, 150, 21-33. https://doi.org/10.1016/j.agsy.2016.09.016

Nasution, A. (2023). Analysis Of The Sustainability Of Main Commodities Of Nutmeg In South Aceh Regency (Case Study Of Sama Dua District). Morfai Journal, 2(4), 718-729.

Onarely, A., Riry, J., & Wattimena, A. Y. (2016). Studi komunitas gulma di areal pertanaman pala (Mirystica fragrans Houtt) pada stadium tanaman belum menghasilkan dan menghasilkan di Desa Rutong Kecamatan Leitimur Selatan Kota Ambon. Jurnal Budidaya Pertanian, 12(2), 80-88.

Palijama, W., Riry, J., & Wattimena, A. Y. (2012). Komunitas gulma pada pertanaman pala (Myristica fragrans H) belum menghasilkan dan menghasilkan di Desa Hutumuri Kota Ambon. Agrologia, 1(2), 288792.

Parliansyah, R., Riniarti, M., & Duryat, D. (2019). Kajian Produksi Tanaman Pala Di Hkm Rangai Sejahtera Kph Rajabasa. Gorontalo Journal Of Forestry Research, 2(2), 120-129.

Ririhena, R. E., Wattimena, A. Y., & Tuanaya, A. F. (2023). The Impact of Climate Change on the Productivity of Nutmeg (Myristica fragrans Houtt.) in Kamal Village, West Kairatu District. JURNAL AGRIKAN (Agribisnis Perikanan), 16(1), 43-49.

Salampessy, M. L. (2017). Local Community's Ecological Knowledge In The Selection Of Shading Treesfor Traditional Agroforestry System (Nutmeg "Dusung") In Ambon. Jurnal Penelitian Sosial dan Ekonomi Kehutanan, 14(2), 135-142.

Siwalette, J. D. (2020, November). Potensi Produksi Dan Rancangan Sistem Agribisnis Pala Di Provinsi Maluku. In Prosiding Seminar Nasional Agribisnis (Vol. 1, No. 1).

Sari, S. I., & Agustia, D. (2022). Analisis Faktor-Faktor Yang Memengaruhi Produksi Pala Di Kecamatan Meukek Kabupaten Aceh Selatan. Jurnal Pertanian Agros, 24(1), 275-287.

Suparwata, D. O., Indrianti, M. A., Mokoginta, M. M., & Mokoolang, S. (2022, November). Agroforestry Farming System: Measuring Its Development In Financial Feasibility Aspects. In Iop Conference Series: Earth And Environmental Science (Vol. 1104, No. 1, P. 012007). Iop Publishing.

Tanasale, V. L., Goo, N., Makaruku, M. H., & Wattimena, A. Y. (2022, November). Identifikasi Jenis Gulma Pada Areal Pertanaman Kelapa Di Desa Hative Besar. In Pattimura Proceeding: Conference of Science and Technology (pp. 28-35).

Tanasale, V. L., & Goo, N. (2023). Inventory of Potential Weeds Under Stands of Immature Nutmeg Plants in Allang Country, West Leihitu District Central Maluku Regency. Agrologia, 12(1), 88-98.

Wattimena, A. Y. (2017). Analisis Korelasi Variabel Jumlah Buah Yang Mempengaruhi Produktivitas Tanaman Pala (Myristica sp.) Pada Dua Kabupaten Di Provinsi Maluku. Jurnal Agroekoteknologi dan Agribisnis, 1(2), 1-8.

Wattimena, A. Y., Makaruku, M. H., Kembauw, E., & Mahulette, A. S. (2021, October). Nutmeg Cultivation Intensity (Myristica fragrans Houtt) in Banda District. In IOP Conference Series: Earth and Environmental Science (Vol. 883, No. 1, p. 012046). IOP Publishing.

Wattimena, A. Y., & Makaruku, M. H. (2022). Karakteristik Budidaya Tanaman Pala (Myristica fragran Houtt) Pola Dusung di Kecamatan Leihitu dan Leihitu Barat Kabupaten Maluku Tengah. Agrinimal Jurnal Ilmu Ternak dan Tanaman, 10(1), 38-44.