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High Yielding Coconut of Nui Sua Tall from Sula Islands, North Maluku

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ABSTRACT
The superior coconut seednuts resources is one main problem to develop coconut programs in Indonesia, include North Maluku. Sula Islands Regency is one of the largest coconut distribution areas in North Maluku Province, Indonesia. The purpose of this research was to study the character, production potential and superiority of coconut from the Sula Islands Regency as a material for coconut development in North Maluku. Research activities carried out in the Naflou village, East Mangoli, Sula Islands Regency, North Maluku Province from 2017 to 2019 by the observation method. Observations were made on the morphological character, production and fruit components, oil content of copra, superiority and stability of coconut and the potential of seednuts. The result of observation showed that Nui Sua coconut is categorized as Tall type and has high productivity and adaptive advantage in limited rainfall and dry months for more than three months (5-9 months). Copra production of Nui Sua Tall coconut is 3.0-4.0 tons per ha per year with a copra oil content of 61.42%. Potential seednuts are available as many as 30,400 nuts per year from 317 Mother palms.
Keywords: *coconut, character, superiority, production, seednut*

I. INTRODUCTION
Coconut is one of the important plantation commodities used for food and non-food products. In Indonesia, coconut plants are widely distributed throughout the region and have a role in the economy and culture of the community. The availability of various types of coconuts is a very significant capital in supporting the coconut breeding program to obtain coconut varieties according to the needs of farmers and the market.

In general, coconuts cultivated by farmers are Tall coconut which is now over 60 years old. This condition is one of the causes of decreasing national coconut productivity. Based on this, efforts should be made to rejuvenate and develop coconut. The rejuvenation and development of course requires quality seeds in sufficient quantities to replace less productive plants, but the superior coconut seednuts resources is one main problem to develop coconut program in Indonesia, include North Maluku.

North Maluku Province is one of the most widely spread areas of coconut and is a center for diversity of coconut germplasm in Indonesia. The total coconut area in North Maluku is 217,141 hectares with copra production of 232,277 tons in 2016 [2]. Sula Islands Regency is one of the largest copra suppliers in Maluku but is currently in decline. One reason is that many coconuts are old and rejuvenation is very slow. While the availability of superior seeds is also limited, far and expensive if introduced from other regions. To meet the needs of coconut seeds in the Sula Islands Regency, in 2017 the Agriculture Departement of Sula Islands Regency in collaboration with the Indonesian Palm Crops Research Institute conducted local superior coconut exploration activities in several districts, for the assessment and determination of the Coconut High Producing Block as a source of seeds. The use of local superior coconut in the area is important because in addition to minimizing the cost of transportation of seeds due to the geographical conditions of the Sula Islands Regency which must use sea transportation, the adaptability of local seeds is also higher than seeds originating from outside the Sula Islands.

The activity continued with the selection and designation of mother palms. The results of the evaluation found that the population of coconut in which has high production potential in environmental conditions with a long dry month. Observations carried out from 2017-2019. The purpose of this research was to study the character, production potential and superiority of coconut from the Sula Islands Regency as a material for coconut development in North Maluku.

II. METHODS
The material used in this reseach was the population of coconuts planted in the 1980s in the Village of Naflou, East Mangoli District, Sula Islands Regency, North Maluku Province. The research was conducted for three years (2017-2019) using the observation method. Observations were made based on Stantech COGENT [4]. Variables observed included morphological characters, fruit production, fruit components and oilcontent of copra.

a. *Observation of Morphological Characters, Production and Fruit Components*

Observation of the morphological character, production and components of coconut fruit was carried out on 30 selected trees in the observation block. Observed characters include:

a. Stem: consists of the circumference of the stem at 20 cm, the circumference of the stem at 1.5 m, the length of the stem at 11 leaves,
b. Leaves: color of petiole, lamina length, petiole length, petiole width, petiole thickness, number of leaflets, leaf length, and leaf width,
c. Flowers: number of bunches/tree, peduncle length, length of flower arrangements, peduncle thickness, peduncle width, number of spikelet and number of female flowers,
d. Fruits: number of fruits/bunch, fruit color, shape and size ofwhole fruit and shape and size of a nut,
e. Fruit components: fruit weight, nut weight, weight of fruit without water and weight of coconut meat.

b. *Other Supported Data*

Other supporting data observed are:
1. Oil content of NuiSua Tall coconut
Analysis of fat content of Nui Sua Tall coconut were carried out at the Laboratory of PT.Saraswati Indo Genetech, Bogor, using test / technique methods; SNI 01-2891-1992, item 8.2 with GC tools (MU / INST / 1).
2. Rainfall in the last five years (2014-2018),
Rainfall data for five years (2014-208), taken from the Emalamo Sula Meteorological.

c. *Data Analysis*

Data on morphological characters, production and fruit components were analyzed for average values, standard deviations and coefficient of variance (CV).

III. RESULTS AND DISCUSSION

Figure 1.Nui Sua Tall Coconut in Naflou, a good crown and plenty of nuts

Coconut trees in Naflou Village in the block observed (Figure 1) are the result of positive mass selection by farmers based on the large number of fruits per tree. The coconut has been registered with the name of Nui Sua Tall Coconut at the Center of Plant Variety Protection and Agricultural Licensing.

a. *Morphological characters, fruit components and oil content of copra*

Some of the morphological characters of plants are associated with crop production, thus the morphological characters (vegetative and generative) play an important role in crop production. The morphological observations of the Nui Sua coconut are presented in Table 1.

Table 1. Morphological characters of Nui Sua Tall coconut

Characters	Average	Standart deviation	Coefficient of variance
Girth measurement at 20 cm above soil level (cm)	150.34	19.17	12.75
Girth measurement at 150 cm height (cm)	92.57	9.36	10.11
Length of stem with 11 leaf scars (cm)	98.77	19.80	20.05
Number of leaflets	112.80	6.26	5.55
Leaflets width (cm)	5.97	0.35	5.88
Leaflet length s (cm)	129.76	11.26	8.68
Petiole length (cm)	127.02	12.45	9.80
Petiole width (cm)	7.60	0.55	7.18
Petiole thickness (cm)	2.85	0.51	17.95
Colour of petiole	Yellowish green		
Rachis length (cm)	420.45	51.74	12.31
Lamina length (cm)	597.39	62.21	10.41
Length of peduncle (cm)	44.36	9.19	20.71
Peduncle width (cm)	3.86	0.73	18.90
Peduncle thickness (cm)	2.18	0.25	11.45
length of flower arrangements (cm)	65.08	8.57	13.17
Number of spikelet	36.64	5.47	14.93
Number of female flowers	13.07	7.10	54.32
Number of bunch per tree	14.50	1.50	10.34
Number of fruits per bunch (nuts)	9.70	1.40	14.40

The results of observations of coconut morphology showed that in general the vegetative character of Nui Sua

Tall coconut was observed to be fairly uniform, which was seen in the value of coefficient of varians (CV) less than 20% except for the length of stem with 11 leaf scars which is 20.05%. The generative characters have high diversity, namely the number of female flowers 54.32%. The number of bunches per trees per year is quite high at 14.50 with CV value 10.34% and the number of fruits per bunches 9.70 with CV value 14.40% which indicates that the production component of coconut is observed uniformly. The results of this analysis indicate that selection can be done on the character of the number of female flowers and the length of 11 leaf scars. Female flowers are one of the characters that correlate with the number of fruit, the more flowers formed, the higher the chance of producing fruit [3]. While the length of the 11 leaf scars shows the fast growing stems. The shorter the length of the 11 leaf scars indicates the increase in stem height is slower.

The results of observations of production, fruit components and oil content of copra of Nui Sua Tall coconut are presented in Table 2. The size of coconut fruit in Nui Sua is classified as medium with a variety of fruit

Table 2. Production and fruit components of Nui Sua Tall coconut

Characters	Average	Standart deviation	Coefficient of variant
Number of bunch per tree	14.50	1.50	10.34
Number of fruits per bunch (nuts)	9.70	1.40	14.40
Number of fruit/ per ree per year			140.65
Colour of fruit	green, yellowish green, reddish brown		
Fruit weight (g)	1,449.67	246.11	16.98
Fruit polar circumference (cm)	58.27	3.63	6.23
Fruit equatorial circumference (cm)	55.50	3.05	5.50
Nut weight (g)	866.66	187.94	21.69
Nut polar circumference (cm)	37.73	2.38	6.31
Nut equatorial circumference (cm)	39.17	3.03	7.75
Weight of nut without water (g)	630.00	116.59	18.51
Meat weight (g)	422.33	58.97	13.96
Endosperm thickness (cm)	1.25	0.10	7.64
Copra weight (g)	211.00		
Oil content of copra (%)	61.42		
The potencial of copra per tree per year (kg)	29.54		

colors namely green, yellowish green, and reddish brown due to the nature of the type of coconut in which cross-pollinates. Fruit components of Nui Sua Tall coconut are uniform, this can be seen in value of CV less than 20% except for the weight of nut 21.69%.

Meat weight of Nui Sula Tall coconut above 400 g per nut. In general, coconut plants which have a weight of meat above 400 g per nut are classified as good coconut, and as one of the requirements can be selected as a mother palma if the population of the coconut trees qualifies as a Coconut High Producing Block. Based on the comparison of the length of the polar and equatorial of whole fruit and nut, it shows that the whole coconut fruit and nut are round and almost round. Round fruit on coconut is one of the characteristics of domesticated coconuts [6].

Weight of meat Nui Sua Tall obtained an average of 422.33 g per nut. If the Nui Sua Tall coconut is processed into copra, then the weight of copra will be around 211 g per nut, based on these data it can be calculated that the production potential of copra per tree per year is fruit per tree per year production times the weight of copra per nut (140.65 x 211 = 29,670 g or 29.67 kg per tree per year. These results indicate that the potential for copra production of Nui Sua Tall coconut is high.

The copra oil content of Nui Sua Tall coconut is 61.42%. Oil content of NuiSua Tall coconut is comparable to the oil content of superior varieties of Tall coconut in the range of 59-69% [5].

b. Potential and Stability of Production of Nui Sua Tall Coconut

The results of observations of production of Nui SuaTall coconut for three years (Table 3) show that the production of Nui Sua Tall coconut is stable. The decrease and increase in production is relatively small. The average number of bunches per year is 13.98 and average number of fruits per bunch is 9.50 nuts. The average potential fruit production per tree per year is 132 nuts. This data shows the potential production of Nui Sua Tall coconut without optimum maintenance, meaning that the potential of production can still be increased if it is maintained optimally.

Fruit production is a quantitative trait that is influenced by the environment. Climatic conditions that have a number of dry months more than three months will have an impact on the growth and production of the number of fruits per bunch. Normally coconut plants require large amounts of water and evenly distributed throughout the year ie 1500 - 4000 mm per year with a dry month no more than 3 months in a row [8]. The cumulative rainfall can affect the components of the coconut during the fruit formation period [9]. The process of developing coconut from flower initiation to maturation requires more than two years. Basically the coconut flower is a hermaphrodite flower. The formation of a single androgynous flower in the bisexual meristem is influenced by genetics and the

environment. One environmental factor that greatly influences the formation of flowers is the availability of water. Generally, the number of female flowers formed on one spikelet is zero to six while the male flowers are quite a lot and cover along the spikelet [7]. Naturally, ripe fruit harvest can reach 35-45% of the number of female flowers per bunch [5].

Table 3. Production and fruit components of Nui Sua Tall coconut in 2017-2019

Characters	2017	2018	2019	Average
Number of bunch per tree per year	14.60	14.50	12.86	13.98
Number of fruit per bunch	9.06	9.70	9.58	9.44
Number of fruit per tree per year	132.27	140.65	123.19	132.00
Meat weight (g)	426.67	422.33	435.33	428.11
Endosperm thickness (cm)	1.13	1.25	1.03	1.13
Copra weight (g)	213.00	211.00	217.00	213.66
The potencial of fruit per hectare per year	18.914	20.112	17.616	18.880
The potencial of copra per tree/perear (ton)	4.02	4.24	3.82	4.02

Rainfall data at the observation site for five years (Table 4) shows that rainfall from 2014 to 2018 ranges from 300 - 2,000 mm per year and the average rainfall per month less than 130 mm except in 2017. One of the optimum conditions for growing coconut is the number of dry months less than three months. If the number of dry months is more than three months, the problem of drought will be a limiting factor in the growth of coconut plants [1]. Associated with the distribution and amount of rainfall each year at the location of Nui Sula Tall coconut plantations, it is seen that in general every dry month is above five months even in 2014 throughout the year.

This fact shows that in dry climatic conditions and without optimum maintenance, production of Nui Sua Tall coconut remains high. So that the fruit production of Nui Sua Tall coconut can be improved if it is carried out optimally.

Based on the results of the evaluation, it was found that the Nui Sua Tall coconut is adaptive in areas with low rainfall with long dry months and has the potential advantage of high fruit and copra production. Thus the Nui Sua Tall coconut can be developed not only in the place of origin of the Nui Sua Tall coconut, but can also be developed in other regions that have the same climate as the Sula Islands Regency.

Table 4. Five years of rainfall in the Sula Islands Regency

Month	Rainfall (mm)				
	2014	2015	2016	2017	2018
January	-	91.8	29.2	90.5	130.5
February	-	110.3	54.9	67.2	255.5
March	-	-	45.8	130.4	94.5
April	-	167.5	251.1	149.7	167.8
May	-	253.2	30.7	221.0	239.5
June	85	211.5	237.1	611.0	235.4
July	45.4	20.1	228.0	344.9	165.7
August	56.1	9.9	60.1	180.5	22.6
September	3.4	-	79.0	104.1	11.1
October	-	21.2	98.1	97.4	3.3
November	3.2	17.0	125.0	68.7	2.0
December	136	73.8	128.3	113.0	163.1
Total	**329.1**	**975,3**	**1,367.3**	**2,178.4**	**1,491.0**

c. Selected Mother Palms Of Nui Sua Tall Coconut

As a source of seeds, 317 mother palms has been selected based on the assessment criteria of the selected mother palms of Tall Coconut. The total potential for coconut production Nui Sua Tall coconut is 38,040 nuts and the potential for seednut production is 80% of fruit production, which is 30,432 nuts. The number of seednuts can be used to meet the needs of seednuts in the area of plantation covering an area of 152 ha per year using a spacing of 9 x 9 triangle. If using spacing and planting 6 x 16 m fence system, can be developed for a land area of 202 ha per year.

IV. CONCLUSION

Nui Sua Tall coconut originated from Naflou Village, East Mangoli District, Sula Islands Regency, North Maluku Province, which has been selected and cultivated in Naflou Village and its surroundings. Nui Sua Tall Coconut has high production and adaptive advantages in limited rainfall and dry months for more than three months (5-9 months). The copra production of Nui Sua Tall coconut is 3.0-4.0 tons per hectare per year and Nui Sua's coconut copra oil content is 61.42%. There are 30,432seednuts potentials available from 317 Selected mother palms. The number of

seednuts can be used to meet the needs of seeds in the area of plantations covering an area of 152-202 ha / year.

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