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Physical Characterization of Coconut Fruit (*Cocos nucifera* L) in the Region of Jember Regency

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Abstract. The study aimed to characterize coconut in a different region. Jember is known as the region that produces the source of coconut in abundant yet it is not utilized optimally in processing. The research was carried out in May to November 2020 at Jember: 1) in the lowland Wuluhan and Puger subdistrict with a height of 10-100 m above sea level; 2) in Medium region in Arjasa and Silo Subdistrict with an altitude of 100-350 m above sea level and 3) High region in Sumberjambe and Panti subdistrict, with an altitude 400 m above sea level. The measurement of the fruit was analyzed by using a ruler and digital weighing, involved 1) the weight of coconut, 2) fiber of the coconut, 3) water, 4) shell, 5) flesh coconut, and 6) Copra. Data of research are by description. Physical characteristics include the weight of the coconut fruit, the weight of coconut water, the weight of coconut *flesh*, the weight of the coconut shell, the weight of the *copra* and the thickness of the coconut flesh. The coconut showed optimally physical characteristics in the medium region (100-350 m above sea level).

1. Introduction

Coconut is known as a strategic commodity that has social, cultural, and economic significance for the community in Indonesia, especially in the region of Jember Regency [1]. Coconut is a multifunctional resource, it can be utilized not only as any kind of food or food ingredient yet it is usually used for construction material, pharmacy, handcraft material any many else moreover it has been used for the cosmetic in the industry [2].

Coconut consists of any compositions, such as seed or the fruit, which botanically is a dupe, not a nut, coconut husk 35%, shell 12%, and water 25%. All mentioned compositions in coconut are important characters as it sources from the original plant [3]. The seed of coconut is the most important part as it is as a source of producing cooking oil and any procced oil products. It contains proximate compositions such as fat, protein, and completed essential amino acids [4]. The protein contained in coconut is rich in lysine, methionine, and tryptophan. Besides, the protein of coconut does not contain anti-nutrition which is usually found in nuts [5].

The compatibility of coconut terrain is based on the horizon area, the character of soil physic, the capability of soil in holding water and soil water that influences on the size of coconut leaf and the ability of stem in loading water that both influence on the rate of transpiration which will give effect on the level grade of coconut [6].

Coconut has a different character from any region, the grade of coconut is influenced by some factors such as environment, preservation, and chemical-physical character of coconut composition that all of them are based on the variety and age of coconut [7-8]. Terrain compatibility and proper preservation will influence on the grade of coconut to be utilized forward [9]. The initial quality of coconut will affect the quality of the procced product of coconut material-based [10].

It is not only the quality of the initial coconut that influences the final product coconut-based yet the quality of the processing [11]. Therefore, it is good for choosing the coconut of good quality and how to process properly until it is obtained final product with a good product.

Jember is known as the region that produces the source of coconut in abundant yet it is not utilized optimally in processing. It is caused of lack understanding of the processor to identify the initial quality

of coconut. Therefore, it is needed research to seek information regarding the physical characteristic of coconut obtained from any region in Jember.

4 2. Methods

The study was conducted from May to November 2020, located in any region of Jember. Samples were obtained from six regions in Jember, each region represents a different height, those are low region, medium region, and high region in Jember. The lowland was represented by the region of Wuluhan, and Puger while the medium region was represented by Arjasa and Silo, and the high region was represented by Sumber Jambe and Panti.

The coconut plants of the age of 10 years were planted in plantation distance of 7 x 7 square system. For avoiding bias on component characteristics of fruit as cross-pollination, it was analyzed the coconut as a sample of the age 12 months at the 3 lines of the plant in the center area. Each area is available four plants of coconut, hence it would be twelve plants in a population.

Flesh fruit of coconut was taken of coconut in the age of more than 10 years. Observed parameters were involved in the physic characteristic of fruit flash. The measurement of fruit weight was observed by straight observation on the whole of the fruit. The measurement of the fruit was analyzed by using a ruler and digital weighing, involved 1) the weight of coconut, 2) fiber of the coconut, 3) water, 4) shell, 5) flesh coconut, and 6) Copra.

Analysis of the sample is conducted at Agricultural Crop Product Processing Laboratory and Food Analysis Laboratory at State Polytechnic of Jember. The tools used in the physical characterization stage of coconut fruit include digital weight, ruler, caliper, hole saw, machete, measuring tube, digital scales, machetes, knives, container spoons, and pan.

This study was conducted using Completely Randomized Design with one factor, consists of six treatments involving different sampling locations in 3 repetitions. Analysis of data Data of research are by description.

3. Result and Discussion

It is obtained that the data of the physic characteristic of the coconut fruit, the data is involved the weight of coconut, fiber shell of the coconut, water coconut, weight of coconut shell, weight of coconut flesh, the weight of copra.

The study was conducted by categorizing three regions of low land, medium land, and high land in Jember regency. The height of those categories can be seen in Table 1. Before the characterizing of fruit physic of coconut, it was measured the diameter of coconut fruit from three regions. The data of diameter obtained were in the range of 60.8 – 73.78 cm, while the biggest was 72.78 cm from Sumber Jambe and the shortest was 60.8 from Wuluhan as overall data can be seen in Table 1 and Figure 1.

Table 1. The height of plantation and diameter of coconut in Jember regency

Region	Height (mdpl)	Soil Ecology	Diameter (cm)
Wuluhan	19	Low	60,80
Puger	30	Low	63,51
Arjasa	219	Medium	68,42
Silo	297	Medium	64,46
Sumber Jambe	430	High	72,78
Panti	535	High	65,35

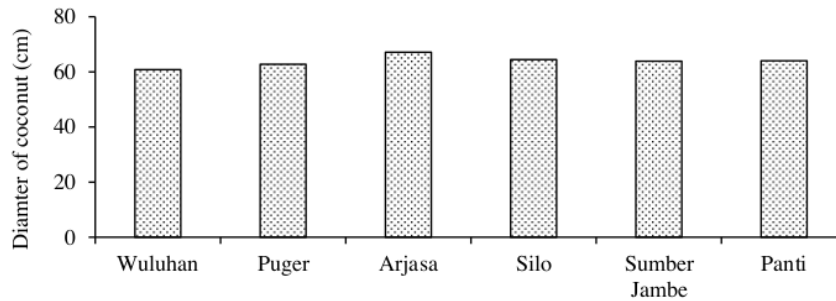


Figure 1. The height of plantation and diameter of coconut in Jember regency

The weight of coconut fruit

The weight of the coconut range is between 2369 – 3328 grams, the weighest was obtained from the coconut planted in medium land (3328 gram) while the lightest in weight was obtained from the coconut from lowland (2369 gram). The coconut from the highland has ranged between 2698-2729 gram as it can be seen in Table 2 and Figure 2.

Table 2. The weight of coconut

Region	Soil Ecology	Average of coconut fruit weight (gram)
Wuluhan	Low	2369
Puger	Low	2454
Arjasa	Medium	3328
Silo	Medium	3091
Sumber Jambe	High	2729
Panti	High	2698

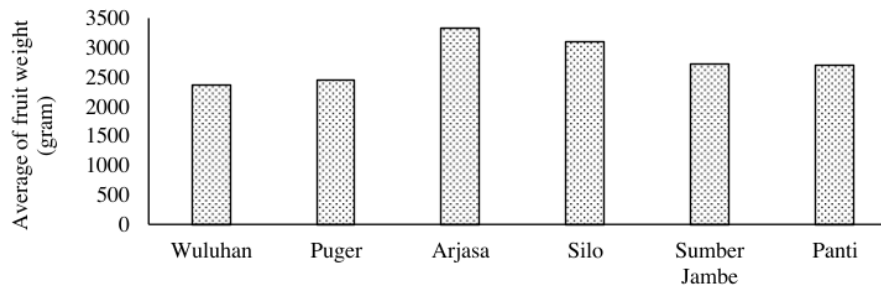


Figure 2. The weight of coconut

Several research results indicate differences in production due to differences in land conditions. Differences in the weight of oil palm fresh fruit bunches due to the slope of the land [12]. The tilted the land, the lower the fresh fruit bunch weight. The more sloping land the lower the fresh fruit weight, this is influenced by radiation intensity and temperature around the plant. The effect of low temperatures causes the metabolic activity of coconut plants in the highlands to be inhibited due to the slowing activity of the catalase enzyme, inhibited metabolism causes the length of time for plants to form new cells and tissues so that the number of fruit will be lower.

The weight of coconut fiber

The weight of the fiber was in the range of 1283,89 – 1717,5 grams. The most weight of coconut fiber was obtained from the low land (1717,5 gram), while the lightest was from the medium land (1283,89 gram), it can be seen in Table 3 and Figure 3. The coconut planted in the highland weights between 1292,5 – 1353,33 grams. The utilization of coconut fiber is used in carpet production, seat car, and any other related industries.

Table 3. The weight of coconut fiber

Region	Soil Ecology	Average of coconut fiber weight (gram)
Wuluhan	Low	1717,50
Puger	Low	1459,67
Arjasa	Medium	1336,88
Silo	Medium	1283,89
Sumber Jambe	High	1353,33
Panti	High	1292,50

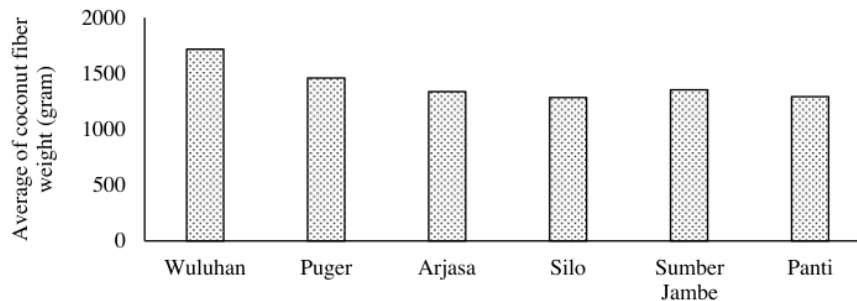


Figure 3. The weight of coconut fiber

The difference in the fiber of the coconut thickness is thought to be related to the form of adaptation to environmental conditions. Lowland coconut fiber tends to be thicker because if a coconut falls it will be directly exposed to water, then this thick fiber will protect the coconut embryo to inhibit the process of decay.

The weight of coconut water

The water of coconut was in the range between 392 – 693 grams. The highest weight water was obtained from the coconut origin from medium land (639 gram) while the lowest water content of coconut was obtained from highland (517 – 539 grams) as it is showed in Table 4 and Figure 4. Coconut water is characterized by acid, so that it can increase the acidity of soil yet It is able processed as a soft drink and nata de coco.

Table 4. The weight of coconut water

Region	Soil Ecology	Average of coconut water weight (gram)
Wuluhan	Low	392
Puger	Low	459
Arjasa	Medium	639
Silo	Medium	577
Sumber Jambe	High	539
Panti	High	517

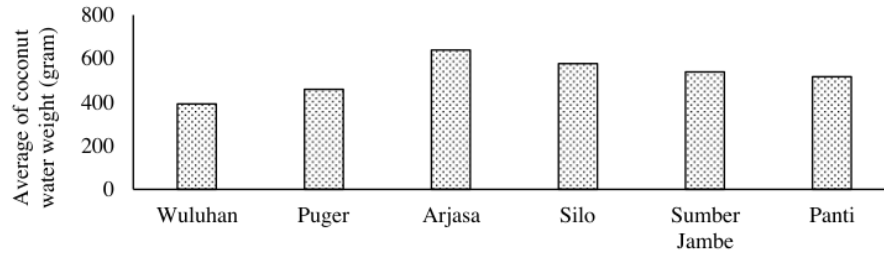


Figure 4. The weight of coconut water

More photosynthate produced from the photosynthesis process of coconut plants in the highlands is compared to coconut plants in the highlands because of the availability of light and soil pH which is good for plant growth so that plant growth in the plains is more optimal.

The weight of coconut flesh

Different origins of coconut will vary the weight of coconut flesh. The range of coconut weight was in a range between 346.21 – 573,56 grams. The most weight of coconut flesh was obtained from medium land (573,56 grams) while the lightest was from lowland (346.21 grams). The weight of coconut flesh of highland was in a range between 443.27 – 446.39 gram as it is showed in Table 5 and Figure 5. The coconut flesh is the main part of the coconut that has benefits for food processing industries such as coconut oil, coconut squeezed, coconut flour, and many others.

Table 5. The weight of coconut flesh

Region	Soil Ecology	Average of coconut flesh weight (gram)
Wuluhan	Low	346,21
Puger	Low	411,19
Arjasa	Medium	573,56
Silo	Medium	523,50
Sumber Jambe	High	443,27
Panti	High	446,39

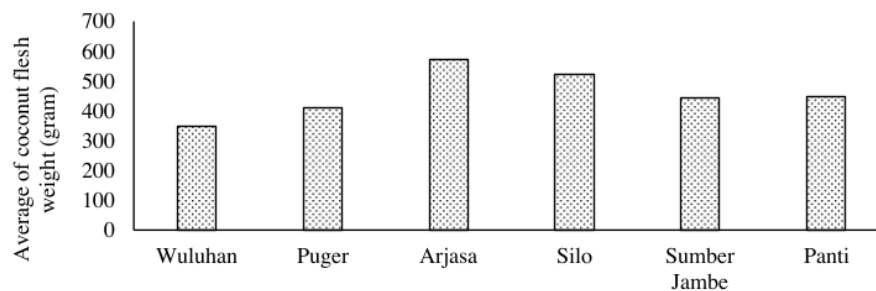


Figure 5. The weight of coconut flesh

More photosynthate produced from the photosynthesis process of coconut plants in the highlands is compared to coconut plants in the highlands because of the availability of light and soil pH which is good for plant growth so that plant growth in the plains is more optimal. Frond length growth leaves and

the number of fruits in each bunch is influenced by the amount of photosynthate produced. Plants that can produce a lot of photosynthates, plant growth, and reproductive cell development will be good and if The photosynthate produced by plants is low, so plant growth and reproduction will be hampered.

The low photosynthetic activity of coconut plants in the highlands causes low photosynthate and energy for coconut fruit development. Slow fruit development causes fruit circumference and fruit weight with coconut husks in the highlands to be smaller and lighter than coconuts in lowland and medium plains. Although the development of coconut fruit in the highlands is slower than in the lowlands, the weight of coconut flesh in the highlands is not significantly different from the weight of the seeds or fruit, not from the coir in other areas because the food reserves of coconut plants in the highlands are stored in the seeds, so even though they are small but had a hard time.

The weight of the coconut shell

The weight of coconut shell planted in the different heights varied, it was in the range between 293.79 – 493.57 gram. The highest was obtained from highland, it was (493.57 gram) and the lowest was (293.79 gram) from lowland, while the weight of coconut shell was obtained from the coconut planted in medium land (381.6 – 416.85 gram) as it is showed on Table 6 and Figure 6. The coconut shell is generally utilized as the material for burning seen briquet. Besides, the coconut shell can also be utilized as the material for souvenir and active carbon.

Table 6. The weight of the coconut shell

Region	Soil Ecology	Average of coconut shell weight (gram)
Wuluhan	Low	293,79
Puger	Low	300,47
Arjasa	Medium	381,86
Silo	Medium	416,85
Sumber Jambe	High	453,69
Panti	High	493,57

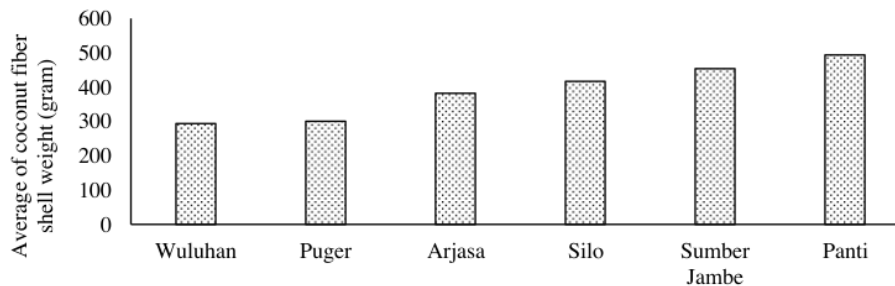


Figure 6. The weight of the coconut shell

In addition to solar radiation and lower light intensity, the highlands have lower temperatures than other areas. Low temperature and little sunlight cause the formation of mesophyll tissue on the leaves of coconut plants in the highlands so that the leaves of coconut plants in the highlands are thicker than those of coconut plants in other areas. in coconut, this affects the weight of the coconut shell produced.

The weight of copra

The weight of copra was obtained from the coconut planted from different land was in a range between 191.88 – 312.50 gram. The highest of the weight of copra was obtained from the coconut planted in medium land (312.50 gram) and the lowest weight of copra was obtained from lowland

coconut (191.88 gram). The weight of copra obtained from the highland was in a range between (243.2 – 246.17 gram) as it is showed in Table 7 and Figure 7. Copra is the basic material for producing the coconut oil and its derivatives. While another coconut oil was obtained and utilized as the basic material for cosmetics, soap, shampoo, pharmacy, and many others.

Table 7. The weight of copra

Region	Soil Ecology	Average of copra weight (gram)
Wuluhan	Low	346,21
Puger	Low	411,19
Arjasa	Medium	573,56
Silo	Medium	523,50
Sumber Jambe	High	443,27
Panti	High	446,39

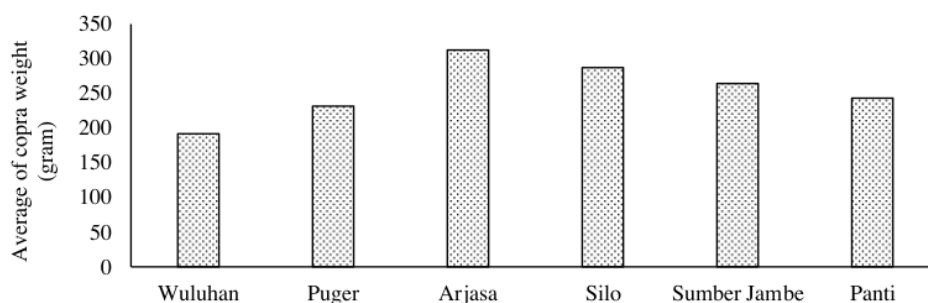


Figure 7. The weight of copra

Compatibility environment will bring up genetic potential, especially production. Ecology will affect the climate and will directly affect the growing environment plant. The growing environment plays an important role in the phenotype of plants. As well as with coconut, the difference in copra produced is thought to be due to ecological differences land.

The thickness of coconut flesh

The thickness of coconut flesh of coconut from different regions was in the range of 10.14 – 13.14 mm. The thickness of coconut flesh was obtained from the highland (13.14 mm) while the thinnest was from the lowland (10.14 mm). The thickness of the coconut flesh of medium land was 12.04 – 12.23 mm as it is shown in Table 8 and Figure 8.

Table 8. The thickness of coconut flesh

Region	Soil Ecology	Average flesh of thickness (mm)
Wuluhan	Low	10,14
Puger	Low	11,34
Arjasa	Medium	12,04
Silo	Medium	12,23
Sumber Jambe	High	12,63
Panti	High	13,14

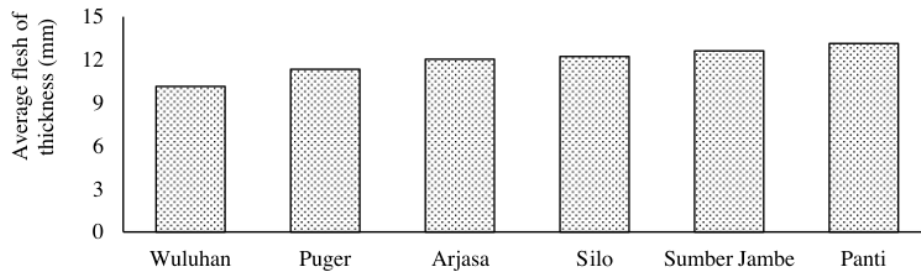


Figure 7. The thickness of coconut flesh

Ecology also has an impact on the light intensity, wherein the highland sky there are many clouds which will reduce the light intensity received by plants. The effect of light does not only depend on the light intensity, but other factors are present in light, which is related to its wavelength. This better physical character is due to the highland coconut plants having the opportunity to get more nutrients than the low and highlands. Plants that can produce a lot of photosynthates, plant growth, and reproductive cell development will be good and if the photosynthate produced by plants is low, plant growth and reproduction will be hampered.

4. Conclusion

The physical characteristics of coconut are influenced by the region based on its height which is divided into low, medium and high. These physical characteristics include the weight of the coconut fruit, the weight of coconut water, the weight of coconut flesh, the weight of the coconut shell, the weight of the copra and the thickness of the coconut flesh.

5. ¹ Acknowledgment

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