# Smallholder Plantations Palm Oil Productivity: a Comparative Study in Two Sub-district Areas in Aceh Province and North Sumatera Province

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**Abstract.** This study was conducted on smallholder plantations in two locations: in Sub-district of Kuta Makmur, District of Aceh Utara, Province of Aceh and Sub-district of Kualuh Hulu, District of Labuhanbatu Utara Province of Sumatera Utara in January to March 2017. This study aims to analyze palm oil productivity differences of the smallholder plantations in both districts based on the age group of plant and location. The analytical method used is the analysis of variance (ANOVA). The results of analysis shows that there are differences in palm oil productivity significant smallholder plantations based on research locations. Furthermore, the results describes, palm oil productivity based on age group of plants only in Sub-district of Kualuh Hulu showing the significant, whereas in Sub-district of Kuta Makmur did not significant. This is due to the differences in the level of application of technology in managing palm oil cultivation by smallholders at both sites.

## 1 Introduction

Palm oil is a very pledge trading commodity. In the future, palm oil will believe not only for producing the downstream industries needed by humans such as cooking oil, butter, soap, cosmetics and others, but it can also be a substitution of petroleum fuels that are currently mostly filled with petroleum. Moreover, petroleum source is not renewable (non-renewable), while palm oil is a source of vegetable oil that can be updated (renewable). The development and expansion of Indonesian palm oil plantation by both large plantations and the community from year to year continues to increase rapidly even very astonishing. The expansion of plantation area the production of palm oil in the form fresh fruit bunch or in the form of Crude Palm Oil (CPO) also significantly increase. Undertaking increase production through area expansion are still necessary as long as the available potential and feasible. However, the most important is increasing productivity and quality of production.

The largest area of palm oil development in Indonesia is in the Island of Sumatera, especially Province of Riau and Sumatera Utara. Palm oil plantations also developed almost in various other provinces in Indonesia, one of the several province is province of Aceh.

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Sumatera Utara Province and Aceh Province the two provinces contiguous to natural conditions, such as climate and soil fertility are also not much different. The different types of cultivated plants are common including palm oil. Although the development of palm oil production in Sumatera Utara Province faster than the province of Aceh, but the average productivity of palm oil in both these areas is still relatively low, both at the provincial level and at the district level even at the sub-district level.

The low productivity of palm oil overall is due to the low productivity of palm oil by smallholder plantations. In fact, under optimum conditions, palm oil production can reach 20-25 ton TBS/hectare/year or about 5-6 ton palm oil/hectare/year [1]. Furthermore, [3] added that the production of palm oil crops with seeds from plant isolation method reached between 7 to 9 ton/hectare /year or 32 to 40 ton TBS/hectare/year. The data obtained from related officials in both regions shows that the average productivity in District of Labuhanbatu Utara is 13.03 tons of TBS hectare/ year and Sub-district of Kualuh Hulu, District of Labuhanbatu Utara, Sumatera Utara Province is 12.45 tons TBS/hectare/year [1]. Meanwhile, the average productivity in District of Aceh Utara is 9.50 tons of TBS/hectare/year and Kuta Makmur Sub-district, Aceh Utara District, Aceh Province is 4.59 tons TBS/hectare/year [2].

The result shows that the average productivity of palm oil smallholder plantations in Sub-district of Kuta Makmur, Aceh Province is lower compared to Sub-district of Kualuh Hulu, Sumatera Utara Province. The high and low production of palm oil in research areas are depends on maintenance including the application of technology to different age groups of plants. This is due to the differences productivity of palm oil in different age groups of plants. The research results of [5] showed that at 3-7 years plants are the average production of TBS per hectare continued to increase, and at the age of 8-13 years plants average production was stable and highest while the age crops above 13 years there is a decrease in the production of TBS at various levels of land suitability. The reality in the research locations shows that there are various composition of plant age in palm oil smallholder plantations in both Aceh Province and Sumatera Utara Province. The purpose of this research is to compare the gap of palm oil productivity of smallholder plantations based on research location and age group of plants.

## 2  Methodology

This research was conducted by using survey method. The population of this research is all farmers of palm oil smallholder plantations in research area. The location of this research is purposive, in Kuta Makmur Sub-district, Aceh Utara District, Aceh Province and Sub-district of Kualuh Hulu, Labuhanbatu Utara District, Sumatera Utara Province with consideration of both districts have the composition of palm oil plantations with various age groups. Sampling was done by grouping the palm oil farmers based on the age of the plants in each selected clusters as the sampling frame. The sample was selected by proportionally in age group of plants. The number of sample in this study were 84 respondents from Sub-district of Kuta Makmur and 95 respondents from Sub-district of Kualuh Hulu. Overall, there were 179 farmers as sample.

The analysis technique used Analysis Of Variance (Anova), that is to test the differences of productivity based on location and age group of plants with general model as follows:

$$Y_{ij} = \mu + t_i + \varepsilon_{ij}$$

Description: Y = TBS Productivity, $\mu$ = overall average, $t_i$ = the mean of the i group, I = the i-th group, j = jth sample, $\varepsilon_{ij}$ = Error term

## 3  Result and discussion

### 3.1 Productivity of palm oil smallholder plantations based on research location

The results show the average productivity of palm oil plantations based on location are presented in Table 1.

**Table 1**. Productivity of palm oil  (ton tbs / hectare) based on research location year 2016.

| Size | Sub-district of Kuta Makmur, District of Aceh Utara, Aceh Province | Sub-district of Kualuh Hulu Utara, Labuhanbatu District, Sumatera Utara Province |
|---|---|---|
| Average value | 9.241,70 | 16.764,76 |
| Maximum Value | 13.900,00 | 29.408,00 |
| Minimum Value | 4.000,00 | 6.344,00 |
| Standard Deviation | 1.813,37 | 6.098,43 |

Table 2 shows the differences of average productivity of palm oil smallholder plantations in the research location. The average productivity of palm oil in Sub-district of Kualuh Hulu is higher than Sub-district of Kuta Makmur. The result of *analysis of variance* (Anova) shows the value of F-test 118.495 with probability (sig.) 0.000. This means that there is a significant difference in productivity between Kuta Makmur Sub-district, Aceh Utara District, Aceh Province with Kualu Hulu Sub-district, Labuhanbatu Utara District, Sumatera Utara Province. In other words, the productivity of palm oil in Sub-district of Kualuh Hulu is higher compared to Kuta Makmur Subdistrict, statistically also has significant result.

The low productivity of palm oil in Sub-district of Kuta Makmur is related to plant treatment or treatment of plant technical cultivate such as the utilization of production factors and application of technology under the Kualuh Hulu Sub-district. In addition, the productivity of palm oil crops is also determined by different land characteristics in each area of development. The productivity of each area is different according to the land suitability class [4].

### 3.2 Productivity by total age group and total productivity

According to [5] the average weight of TBS respondents to the age of the plant and the suitability class of the land. In the plant age 3 to 7 years the average production of TBS per hectare continues to increase, and at 8 to 13 years of age the average production is stable and achieves the highest productivity whereas the age of the plant above 13 years decreases the production of TBS at various levels of conformity land. The high productivity of palm oil in the form of TBS in a location iare influenced by the composition of plant age in the area. More on palm oil productivity by plant age and total productivity in the study area is shown in Table 2.

**Table 2**. Productivity of palm oil at various age group of plants in sub-district of Kuta Makmur, Aceh Province, year 2017.

| Size | Productivity of TBS (ton / hectare) Age 3 -7 yr | Productivity of TBS (ton /hectare) Age 8-13 yr | Productivity of TBS (ton / hectare) Age> 13 yr |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Average value | 9,17 | 9,33 | 8,89 |
| Maximum Value | 12,00 | 12,63 | 15,00 |
| Minimum Value | 7,20 | 7,50 | 4,00 |
| Standard Deviation | 1,36 | 1,23 | 2,29 |

Table 2 shows that the average productivity for the 8-13 year age group is much lower than that of [5] that in the lowest grade of land suitability the average productivity of TBS in the plant age group of 8-13 years can reach an average of 22 ton TBS/hectare/year. This shows that the productivity of palm oil in research area is still very low, not only in the age group of young plants and old plants but also occurs in the age group of adult plants.

Table 2 also shows that although there is a differences in average productivity between plant age groups, there is no high variation. The results of the analysis of the productivity differences between age groups of plants by using *analysis of variance* (ANOVA) F-test values obtained at 0 .460 with probability (sig.) of 0, 633 . There is no significant differences in productivity between age groups of plants in various age groups of plants in Sub-district of Kuta Makmur Aceh Utara District Aceh Province.

The non-productivity of palm oil according to the age group of plants in the study area may be caused by plant maintenance/ maintenance factors, including the application of technology and the knowledge level of farmers. The low knowledge of farmers on palm oil cultivation techniques is the most dominant factor, because it impacts on its ability in plant maintenance [6].

In addition, the significance of productivity by age group is also due to the high productivity differences within the same age group. The high differences in productivity within the group, statistically causing non-significant productivity between age groups of plants.

According to [7] the dosage of fertilization on oil palm plants yields different according to plant age. However, based on observations and interviews with farmers found that most of the respondents did not know how many fertilizer doses should be given according to the age of their palm oil crops. According to the pruning of leaves/ repletion, although some of the farmers respondents do this method, but generally they do not understand exactly how many optimal leaves that should be left in the trees that correspond to the age of their plants. Overall, productivity of palm oil in the study area is also low.

**Table 3.** Average productivity of palm oil at various age group of plants in sub-district Kualuh Hulu, Sumatera Utara Province, year 2017.

| Size | Productivity of TBS (ton / hectare) Age 4-7 yr | Productivity of TBS (ton / hectare) Age 8-13 yr | Productivity of TBS (ton / hectare) Age> 13 yr |
|---|---|---|---|
| Average value | 9,84 | 15,99 | 21,00 |
| Maximum Value | 14,91 | 26,95 | 29,41 |
| Minimum Value | 6,34 | 6,94 | 11,50 |
| Standard Deviation | 5,59 | 3,87 | 7,34 |

Table 3 shows that the average productivity with the highest plant age with the highest productivity is found in the age group> 13 years. In addition, there is a high productivity variation between the highest productivity with the lowest productivity and between the age groups of the plant. This condition is also reinforced by the result of analysis of differences of average productivity between age group of plant with value of F-test equal to 29,22 with probability (sig.) Equal to 0, 000 . This shows that there are significant differences in palm

oil productivity between plant age groups in smallholder plantations in Sub-district of Kualuh Hulu, Labuhanbatu Utara District, Sumatera Utara Province.

Theoretically, differences in plant age group will cause different productivity of *fresh fruit bunch* from palm oil crops. However, these result are not fully consistent with the findings of [5] which conclude in addition to the differences in productivity between the age groups of oil palm trees, the highest productivity was found in the age group of 8-13 years.

Based on the results of the analysis on the two research areas showed that the average productivity of palm oil in Sub-district of Kualuh Hulu, Sumatera Utara Province is higher than the average productivity of palm oil in Sub-district of Kuta Makmur, Aceh Province. Nevertheless, the average productivity is still below the average of optimum productivity.

## 4 Conclusion

There is significant difference of average productivity of palm oil plantation between Kuta Makmur Sub-district, Aceh Utara District, Aceh Province and Sub-district of Kualuh Hulu, Labuhanbatu Utara District, Sumatera Utara Province. Overall, the average of palm oil productivity in Sub-district of Kualuh Hulu, Sumatera Utara Province is higher than Kuta Makmur Sub-district, Aceh Province. There is an average difference of productivity based on plant age group in Sub-district of Kualuh Hulu, Sumatera Utara Province. While in Kuta Makmur Sub-district of Aceh Province. Besides the lower average productivity there is also no significant difference based on the age group of the plants caused by the lack of knowledge and ability of farmers in the treatment of crops, especially the level of application of technology in various age groups of palm oil crops.

The maximum productivity of palm oil plantations overall is strongly influenced by maximum productivity in each age group. To achieve the maximum productivity as much as possible local government especially related offices in order to improve the ability of farmers through counseling and cultivation techniques, especially the application of appropriate technology advice for each age group of plants. Further research is needed to find out more about the cause of productivity gaps either based on age group of plants or by region / location by including soil type factor and climate factor in analysis.

## References

1. Directorate General of Plantation. Land Area, Production, and Productivity Smallholder Plantations. Sumatera Utara Province. Jakarta (2015)

2. BPS. *Aceh Utara Dalam Angka.* Biro Pusat Statistik Kabupaten Aceh Utara (2015)

3. Fauzi, Y, Yustina E.W, Iman. S Rudi. H. *Kelapa Sawit. Budidaya Pemanfaaatan Hasil dan Limbah, Analisis Usaha dan Pemasaran*. (Penebar Swadaya. Jakarta, 2003)

4. Harahap, I. Y, Pangaribuan, Y and Listia, E. Initial Gaze Growth and Productivity Potential Various Varieties of Palm Oil Planted with High Population. *Jurnal Penelitian Kelapa Sawit* **14**(1) : 1-10 (2006)

5. Mangoensoekarjo.S and Semangun.H. *Manajemen Agrobisnis Kelapa Sawit*. (Gadjah Mada University Press, Yogyakarta, 2005)

6. Mawardati. *Dibalik Rimbunnya Kelapa Sawit Rakyat.* (Unpad Press, Bandun, 2010)

7. Pahan. I, *Panduan Lengkap Kalapa Sawit. Manajemen Agribisnis dari Hulu Hingga Hili*r. (PT. Penebar Swadaya, Jakarta, 2006)