Level of Application of Fertilization Technology in Oil Palm (*Elaeis guineensis* Jacq.) Farming: A Case Study in Tajur Village, Long Ikis District, Paser Regency

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Fertilization is an effort to provide enough nutrients to encourage maximum and economic generative growth of plants, produce fresh fruit bunches, and resist pests and diseases. The unavailability of macro and micronutrients can cause obstacles to the growth and development of oil palm plants. Adding nutrients can correct the lack of macro and micro plant nutrients, or it can be called fertilization in the soil. The purpose of this study was to determine the level of application of technology to oil palm farming. This research was conducted in Tajur Village from May to June 2022. The data collection method was purposive sampling with a total of 34 respondents. The data were analyzed descriptively and qualitatively. Likert scale measurements measured the data. The results of a study stated that the application level of fertilization technology was in the high category, with an average score of 30.88. The conclusion was based on the accurate indicator of obtaining an average score of 4.47 with the low category, the right dose received an average score

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of 8.94 with the high category, on time obtained an average score of 8.62 with the high category, and the right way of getting an average score of 8.85 with the medium category.

1. INTRODUCTION

The oil palm development in East Kalimantan began in 1982 and was initiated through the People's Nucleus Plantation Project (PIR) managed by PTP VI. Oil palm plantations are excellent as the community feels the positive benefits of economic growth. Until 2020 the area of oil palm reaches 1,374,543 ha, consisting of 373,479 ha as plasma/community plantations, 14,402 ha belonging to state-owned enterprises as the nucleus, and 986,662 ha belonging to large private plantations. Production of FFB (Fresh Fruit Bunches) processed in 2020 amounted to 17,721,970 tons of Crude Palm Oil (CPO) from several sizeable private plantation companies that have obtained temporary reserve permits (location permits) that have been operating to build plantations on a large scale. as many as approximately 393 companies. This large area of oil palm plantations is concentrated in East Kutai, Kutai Kartanegara, North Penajam Paser, and Paser Regencies. In comparison, several other districts and cities are still in a limited area.

Long Ikis sub-district is one of the sub-districts with the potential for oil palm plantations, namely having a plantation area of 28,308.62 ha in 2020. Oil palm plantations in the Long Ikis sub-district have been operating since 1985. Tajur Village is one of the largest oil palm plantation villages. Area the area of oil palm plantations in Tajur Village is 1,446 ha. They were recorded in 29 farmer groups [1].

In the agricultural sector, especially oil palm farmers, ideas and knowledge are needed to increase the yield of oil palm commodities, especially the role of oil palm farmers adopting fertilization technology. However, it is generally challenging for farmers to accept innovations that change habits or methods that have been used before.

To start a farming business, farmers must know about the technical instructions for fertilizing oil palm, which in the technical instructions cover the right type, the right recommended dosage, the proper method, and the right time; namely, it is recommended to apply fertilization. After understanding the technical instructions for fertilization, it is also necessary to understand the intensity of the application of fertilization, classified as high, medium, or low. After all the stages have been carried out, then we can assess whether the farmer has implemented fertilization technology according to the technical instructions to increase the production yield of his farming business and also what farmers face obstacles in implementing the fertilization technology system.

Oil palm farmers in Tajur Village, Long Ikis District, had difficulty getting the type of fertilizer recommended by the extension workers. In addition to the problems in obtaining the kind of fertilizer recommended by the extension workers, starting from June 2022, the government has abolished fertilizer subsidies which have caused difficulties for farmers to meet their fertilizer needs.

The research objective was to determine the application level of fertilization technology in oil palm farming in Tajur Village, Long Ikis District, Paser Regency.

2. METHODOLOGY

2.1 Time and Place

This research was carried out from May to July 2022 with the research location in Tajur Village, Long Ikis District, Paser Regency.

2.2 Data Collection Methods

Data collection consists of (1) primary data is data obtained through direct observation of the object under study or through interviews with respondents; and (2) secondary data is data obtained from related agencies and institutions such as the Tajur Village Office, Village Unit Cooperative (KUD) Bhenika Tunggal Ika Tajur Village, and the Paser Regency Central Bureau of Statistics.

2.3 Sampling Technique

This study used a purposive sampling technique. According to Nadeak, et al. [2], taking respondents in the study used a purposive sampling technique, namely, taking samples of respondents not randomly or intentionally

adjusted to the study's objectives. The calculation results obtained 34 respondents, namely two from each group, totaling 17 farmer groups.

2.4 Data Analysis Methods

In this study, a measuring instrument was used as a Likert scale to measure the level of application of fertilization technology in oil palm farming. According to Sugiyono [3], the Likert scale is used to measure attitudes, opinions, and perceptions of a person or group of people regarding social phenomena; in social phenomenon research, it has been precisely determined by researchers, which are called research variables.

There are three types of answers, including answer A, given a score of 3; answer B, given a score of 2; and answer C, given a score of 1. Table 1 details the minimum and maximum scores used in measuring the application level of fertilization technology in oil palm farming in the Village Tajur, Paser Regency.

The Number of categories determined in this study are three classes, including high, medium, and low application levels. In determining the class interval, use the following formula:

$$C = (Xn-Xi)/K$$

Description:

C: class interval; Xn = Maximum score; Xi = Minimum score and K = Number of classes

Based on this formula, class intervals are obtained: for the application level of fertilization technology, the right type, the right dose, the right time, and the right method, as presented in Table 2.

Table 1. Minimum and maximum scores of fertilizer technology application indicators

No	Fertilizer technology application indicators	Minimum score	Maximum score
1	Right Type	3	9
2	Right Dose	3	9
3	Right Time	3	9
4	Right Way	4	12
	Amount	13	39

Source: Primary Data (processed), 2022

Table 2. Class intervals for application of fertilization technology, right type, right dosage, right time, and right method

Nomor	Class Interval	Category
Class interval for fertilization technology application level		
1	13,00 - 21,66	Low
2	21,67 - 30,33	Medium
3	30,34 - 39,00	High
Class interval for right type of fertilizer		
1	3,00 - 5,00	Low
2	5,01 - 7,01	Medium
3	7,02 - 9,00	High
Class interval for right dose of fertilizer		
1	3,00 - 5,00	Low
2	5,01 - 7,01	Medium
3	7,02 - 9,00	High
Class interval for right time of fertilizer		
1	3,00 - 5,00	Low
2	5,01 - 7,01	Medium
3	7,02 - 9,00	High
Class interval for right way of fertilizer		
1	4,00 – 6,66	Low
2	6,67 - 9,33	Medium
3	9,34 - 12,00	High

Source: Primary Data (processed), 2022

3. RESULTS AND DISCUSSION

3.1 Profile of Oil Palm Farming in Research Locations

Based on the results of observations and interviews, oil palm farming is not a new thing for farmers in the study area because since the community transmigrated from Java to the research location in 1985 and 1986, they immediately opened the land for plantations through the PTPN 13 Persero program until now. Tajur Village is the village that became the research area because the town is one of the villages that has a large area of oil palm plantations in Long Ikis District.

The initial activity carried out by farmers before carrying out oil palm planting activities is land preparation activities starting from land clearing and land processing activities, both using heavy equipment mechanisms and manually using improvised tools. On average, oil palm farming in Tajur Village, Long Ikis District, uses a 9x9 spacing that local farmers have long applied. According to information obtained from farmers, the years when oil palm was planted in Tajur Village were 1985 and 1988 until now; the age of oil palm plantations in Tajur Village is 37 years and 34 years.

In December 2019, the Paser District Government held discussions regarding the oil palm rejuvenation or replanting program funded by the Paser District Government through grants. The productive age of oil palm plants is a maximum of 25 years, while those in Tajur Village are, on average, 35 years old. This is what makes it necessary to carry out replanting or replanting activities. Replanting or rejuvenating plants is one of the efforts to maintain oil palm production in Indonesia. Plant rejuvenation is carried out so that the production of oil palm plantations does not decrease drastically.

In 2020 the Regional Government of Paser Regency will carry out the People's Oil Palm Rejuvenation (PSR) program in several villages in Kuaro District and Long Ikis District, one of which is Tajur Village. Replanting activities were held in 2020 with grants through Village Unit Cooperative (KUD). The grant funds are given in the amount of 50 million per plot. Village Unit Cooperative manages these funds and coordinates with farmers, from logging using an excavator, digging planting holes, and preparing seeds, to fertilizer and grass poisoning activities. The grant funds are valid only for one planting year. After the budget is used up, the government will no longer provide a budget for the following year. Stage 2 replanting activities are planned to be carried out in 2023. Phase 1 replanting plants have entered the age of 2 years, from January 2020 to December 2022.

Farmers are having problems getting subsidized fertilizers because since 2022, in June, subsidized fertilizers have been abolished. Farmers have difficulty buying expensive non-subsidized fertilizers, making it difficult for farmers to meet their fertilizer needs. Fertilizers used by farmers include a single fertilizer, namely Urea. For P and K fertilizers which are currently difficult to obtain, so to replace these fertilizers, compound fertilizers are used, namely the types of Phonska and Kebomas.

In terms of existing technology, the farming system in the research area has developed yearly, especially the use of heavy equipment for replanting oil palm and agricultural machinery (alsintan), which has become an empowerment program from the government to achieve maximum production. Some of the technologies used in oil palm farming in Tajur Village, Long Ikis Subdistrict, are lawn machines as a tool for cleaning weeds, motorbike washing machines used for chemical weed cleaning activities, and motorbikes used for fruit collection activities from trees to the Yield Collection Site (TPH). These tools can help save working time, labor, and labor costs.

Oil palm cultivation activities in Tajur Village, Long Ikis District, are as follows: (1) seed selection, (2) land preparation or processing, (3) weeding, (4) fertilizing, (5) planting, (6) maintenance which includes: embroidery, supplementary fertilization, and pest and disease control, (7) harvesting and (8) post-harvest.

3.2 Characteristics of Respondents

Age and experience will influence the state of farming; the condition of respondents based on age is 15-64 years old as many as 32 people (94.12%) and over 64 years old as many as 2 people (5.88%).

The condition of the respondents based on the level of education, namely: Elementary School totaling 11 people (32.35%); Junior High School with 7 people (20.59%); 13 high school students (38.24%) and 3 undergraduate students (8.82%).

The respondents' condition is based on land ownership: land area of 1-3 hectares for as many as 10 people (29.41%), land area of more than 3 Ha as many as 24 people (70.59%).

The condition of the respondents based on the Number of dependents, namely: the Number of dependents 0-2 people, as many as 11 people (32.35%); the Number of dependents of 3-5 people is 20 people (58.82%), and the Number of dependents of more than 5 people is 3 people (8.83%).

3.3 Level of Application of Palm Oil Fertilization Technology

Applying fertilization technology in oil palm farming in Tajur Village uses four indicators: the right type, dose, and time and in the right way. The overall research results can be seen in Table 3.

Based on Table 3, the precise type indicator has a total of 152 with an average score of 4.47, which is included in the low category. The correct dose indicator has a total of 304 with an average score of 8.94, which is included in the high category. The timely hand has a total of 293 with an average score of 8.62, which is in the high category. The correct method indicator has a total of 301 with an average score of 8.85, so it is in the medium category. In general, details of the application level of fertilization technology in Tajur Village, Paser Regency, are presented in Table 4.

Table 3. Indicators of right type, right dose, right time, and right method

Indicator right type of fertilizer				
No	Number of Respondents	Percentage	Total Score	Category
1	29	85,2	121	Low
2	5	14,8	31	Medium
3	-	-	-	High
Amount	34	100,00	152	Low
Indicator right dose of fertilizer				
No	Number of Respondents	Percentage	Total Score	Category
1	-	-	-	Low
2	-	-	-	Medium
3	34	100,00	304	High
Amount	34	100,00	**304**	High
Indicator right time of fertilizer				
No	Number of Respondents	Percentage	Total Score	Category
1	-	-	-	Low
2	-	-	-	Medium
3	34	100,00	293	High
Amount	34	100,00	293	High
Indicator right way of fertilizer				
No	Number of Respondents	Percentage	Total Score	Category
1	-	-	-	Low
2	34	100,00	301	Medium
3	-	-	-	High
Amount	34	100,00	301	Medium

Source: Primary Data (processed), 2022

Table 4. Indicators of the level of application of fertilization technology

No	Indicator	Total score	Score average	Category
1	Right Type of Fertilizer	152	4,47	Low
2	Right Dose of Fertilizer	304	8,94	High
3	Right Time of Fertilizer	293	8,62	High
4	Right Way of Fertilizer	301	8,85	Medium
Amount		1050	30,88	Tinggi

Source: Primary Data (processed), 2022

3.3.1 Right type of fertilizer

Based on the results of the study, there were 29 respondents, or 85.2%, with a score of 121, stating that the level of application of fertilization technology in oil palm plants regarding the right type of indicator was included in the low category. As many as 5 respondents, or 14.8% with a score of 31, stated that the level of application fertilization technology in oil palm plants regarding the right species indicator is included in the medium category.

The fertilizers used by oil palm farmers are Phonska and Kebomas types. It is still difficult for farmers to obtain the kind of fertilizer according to the styles suggested by agricultural extension workers, namely KCl and SP-36 fertilizers. Farmers cannot buy non-subsidized fertilizers at increasingly higher prices, so many are switching to using Phonska and Urea fertilizers. Oil palm farmers have not used organic fertilizers apart from using non-organic fertilizers. Farmers have difficulty buying subsidized fertilizers because subsidized fertilizers starting in June 2022 until now have been abolished by the government, and the price of non-subsidized fertilizers is relatively high compared to the cost of subsidized fertilizers. This causes difficulties for farmers in meeting the need for fertilizer.

According to research Budiargo, et al. [4], the type of fertilizer applied in the West Kalimantan Oil Palm Plantation is that obtained from the head office. The fertilizer used is a single fertilizer with the primary nutrients N, P, K, Mg, and Ca. Meanwhile, borate fertilizer is used to meet the needs of micro-nutrient B. Each type and amount of fertilizer applied must comply with the recommendations issued by the Agronomy Support Department. The type of fertilizer used in the garden in 2013/2014 was a single fertilizer with the consideration that the price is lower and the dosage accuracy in the application is higher so that the nutrient needs of the plants will be fulfilled.

3.3.2 Right dose of fertilizer

Based on the results of the study, there were 34 respondents, or 100%, with a score of 304, stating that the level of application of fertilization technology in oil palm plants regarding the proper dose indicator was included in the high category. Oil palm farmers in Tajur Village apply fertilization technology to oil palm per agricultural extension workers' recommendations. Farmers also make observations on soil conditions before

fertilizing to adjust the dose of fertilizer given and determine the amount of fertilizer according to the age of the plant.

According to research Junedi, et al. [4], from the observations made, the Number of plants was obtained according to the dose of fertilizer per plant (1.5 kg/plant). Comments were made on three blocks, each showing a different dose accuracy. The Number of plants that were dose-appropriate in the first block was 76 of the 90 trees observed (84.4%), the Number of plants that were dose-appropriate in the second block was 78 of the 90 trees marked (86.6%), and the Number of plants that were dose-appropriate in the blocking third, namely 73 of the 90 observed (81.1%). The results of this observation indicate that the second block is the block with the highest dose accuracy compared to the other blocks, while the third block is the block with the lowest dose accuracy. According to [5], the absorption of FFB from oil palm for 25 tons/ha, absorbing N kg/tree is 0.49 kg, P is 0.08 kg/tree, K is 0.63 kg/tree, Mg is 0.14 kg/tree and Ca 0.13 kg/tree.

3.3.3 Right time of fertilizer

Based on the research that has been done, there are 34 respondents, or 100%, with a score of 293, stating that the level of application of fertilization technology in oil palm plants regarding timely indicators is included in the high category. Oil palm farmers usually apply fertilization every 6 months or twice a year. Fertilization is done in the morning at the start of the rainy season and the beginning of the dry season. Farmers also pay attention to weather conditions when fertilizing on time. Research Natalia, et al. [6] showed that the application of fertilization at Tanjung Jati Gardens Semester I was carried out 3 times in 2014, namely in February, March, and April for NPK fertilizer, while dolomite fertilizer was applied once in February. The application of dolomite fertilizer does not meet the standard because it is carried out when rainfall = 0 mm/month. In comparison, the application of NPK fertilizer meets the norm because it is applied in March with precipitation between 60-200 mm/month, even though it is also carried out in February and April with rainfall = 0 mm/month which should not be suitable for applying fertilizer.

3.3.4 Right way of fertilizer

Based on the results of the study, there were 34 respondents, or 100%, with a score of 301,

stating that the level of application of fertilization technology in oil palm plants regarding appropriate indicators was included in the moderate category. The method of fertilization applied by farmers is not by the results obtained. Smallholders carry out some fertilization by spreading it; the other part is done by immersing it. Farmers clear weeds before fertilizing. Before fertilizing, it is necessary to carry out disc-cleaning activities to maximize fertilizer absorption into the soil. Several farmers have side jobs besides doing oil palm farming, including teachers, drivers, and farm laborers, and several farmers have paddy rice farming.

Research Nunyai, et al. [7] shows that the application of SBHE garden fertilizer consists of spreading and immersing methods. The scattering method was applied to all macro fertilizers, while the immersion method was used to micro fertilizers.

According to research Natalia et al. and Sudarjat [6,8], for plants that are < 8 years old, N fertilizer is sown 50-100 cm from the base of the stem and 125-150 cm for other types of fertilizer. For plants that are > 8 years old, N fertilizer is sown with a radius of 150-200 cm from the base of the stem, and 200-250 cm for other types of fertilizer. Fertilizer should be sown at a distance of 1.5 m from the bottom of the stem because it is suspected that at this distance, the active plant roots (feeding roots) are more effective in absorbing nutrients. The fertilizer sowing at a distance of 2.5 from the base of the stem aims to stimulate root development towards the surface to obtain nutrients.

4. CONCLUSIONS AND RECOMMENDA-TIONS

4.1 Conclusion

Based on the results of research and discussion, it can be concluded that the right type of fertilizer gets an average score of 4.47 in the low category. The right dose of fertilizer gets an average score of 8.94 in the high category. The right time of fertilizer gets an average score of 8.62 in the high category. The right way of fertilizer gets an average score 8.85 in the moderate category.

4.2 Suggestion

The level of application of fertilization technology based on the technical instructions for fertilizing

oil palm farming is in the high category. Therefore the role of agricultural extension agents regarding the right type, correct dose, right time, and proper method is to remain consistent in providing further knowledge so that the results obtained by oil palm farmers can be maximum.

1. Right type of fertilizer into the low category. Farmers can use organic fertilizers to replace non-subsidized fertilizers at higher prices.
2. The right dose of fertilizer is included in the high category. Farmers make observations of soil conditions before fertilizing to determine the appropriate amount according to the age of the plant.
3. Timely entry into the high category. Farmers still pay attention to weather conditions when fertilizing, which is done in the morning at the start of the rainy season and the beginning of the dry season.
4. Exactly how to enter into the medium category. Farmers can carry out fertilization by spreading it by paying attention to the right way so that the active roots of plants are more effective.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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