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YIELD ACHIEVEMENT AND GAP COMPLIANCE AMONG THE PARTICIPANTS OF OIL PALM REPLANTING (TSSPK) & NEW PLANTING (TBSPK) SCHEME

Rahmahwati Rasuddin[1*], Norkaspi Khasim[2], Mohd Noor Izuddin[3], Humaira M.T[4], Mohd Haidhar[5], Ainul Shazwin Sahidan[6], Mohd Ridzuan Sohimi[7]

[1] Malaysian Palm Oil Board
Email: rahmahwati@mpob.gov.my
[2] Malaysian Palm Oil Board
Email: kaspi@mpob.ov.my
[3] Malaysian Palm Oil Board
Email: izuddin@mpob.gov.my
[4] Malaysian Palm Oil Board
Email: humaira@mpob.gov.my
[5] Malaysian Palm Oil Board
Email: mohd.haidhar@mpob.gov.my
[6] Malaysian Palm Oil Board
Email: ainul.shazwin@mpob.gov.my
[7] Malaysian Palm Oil Board
Email: ridzuan@mpob.gov.my
[*] Corresponding Author

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Abstract:

The Malaysian government has set up various incentives to help farmers, including the Oil Palm Replanting (TSSPK) and New Planting Schemes (TBSPK) for oil palm independent smallholders (OPISH) which were implemented in 2011 under the 10th Malaysia Plan. It is an Entry Point Project 1 (EPP1) under the National Key Economic Area (NKEA) of oil palm commodities. The schemes provided farmers with high-quality seedlings, agricultural inputs such as fertilizers and chemicals, as well as a cash fund for the preparation of land and planting of the seedlings. The farmers who participated in the scheme were also given advisory services on various aspects of the management of oil palm by the extension officers of MPOB (TUNAS). A total of 400 participants were involved and responded to the survey, with the proportion of respondents from Peninsular, Sabah, and Sarawak. The study found that the average age of the participants is mostly above 59 years old (37.3%) and 44.3% of the participants were owners of oil palm farms. The main objectives of the study were to determine the current yields achieved by the participants in the scheme and their compliance with the GAP guidelines. This is a quantitative study, which applied the questionnaire approach in gathering

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data. It was found that 61.0% of farmers categorized as medium yield of FFB production who produced 21.5 - 28.9 ton/ha/year with average income received RM1500 - RM3000 per month, while 32.5% of farmers produced in a lower category (< 21 ton/ha/year), and there were 6.5% farmers produced more than 29 ton/ha/year that was considered as the higher yield of FFB production. This study also showed that most of the respondents complied with Good Agriculture Practice (GAP) after joining the scheme. Participants responded well to the services given by the TUNAS officers. Most of the participants were satisfied with the implementation of the schemes and services provided by TUNAS officers. As a recommendation, several improvements were suggested, such as agriculture input distribution, clustering of the farmers into cooperatives, and continuity of GAP implementation.

Keywords:

Oil Palm, Replanting, GAP, FFB yield, Smallholders

Introduction

Palm oil is a vegetable oil obtained from oil palms and is used in many consumer goods, from processed food to biofuel. In recent years, oil palm is crucial to the economies of many countries, especially Indonesia and Malaysia, from which large quantities of its products are exported in the form of oil, meal and other derivatives. More widely, oil palm is now cultivated in plantations across the humid tropics of Asia, Africa and the Americas, from where its products are exported to global markets (Murphy and Peterson, 2021). In Malaysia, oil palm plantations have made a notable impact and contributed to Malaysia's economy. According to Department of Statistics Malaysia in 2021, the agriculture sector contributed 7.1% to the country's Gross Domestic Product (GDP). Additionally, from the value of 7.1%, the palm oil industry made a significant contribution to it, which was around 35.2%. Thus, it can be seen that palm oil has made a significant contribution, especially in the economic aspect. This economic contribution leads to the improvement in the livelihood of many Malaysians, especially those who stay in rural areas. In the Malaysian palm oil industry, it is highlighted that OPISH made a 16.3% landholding from 5.86 million hectares of oil palm planted area (MPOB, 2020). Therefore, there is a suitable and sustainable option for the Malaysian palm oil industry to increase its competitiveness in this industry, which is the acceleration of replanting oil palm

In 2010, the government launched a total of eight Entry Point Projects (EPP) to increase Gross Domestic Product (GDP) revenue, which was overseen by NKEA Oil Palm (Pemandu, 2010). Thus, in this case, the oil palm industry is expected to contribute a total of RM 178 billion to the national income, which is three times higher than the year 2009, at RM 53 billion. According to the 10th Malaysian Plan, the government has allocated a total of RM1.03 billion as an assistance scheme to OPISH. This scheme is part of the eight Entry Point Projects (EPP), also known as EPP1, which are under the authority of the National Key Economic Area (NKEA). According to PEMANDU (2010), the fundamental objective of EPP1 is to replant old oil palm trees that are unproductive and have low yields, this scheme known as *Oil Palm Replanting (TSSPK)*. In addition, EPP1 also includes the New Planting (TBSPK) of oil palm trees for the farmers. The implementation of these two projects in EPP1 is targeted to increase the productivity of oil palm fresh fruit bunches (FFB) yield, the acreage of oil palm plantation, as well as the income of OPISH (MPOB, 2014).

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Replanting old oil palm trees that have reached the age of 25 years and above needs to be done with high-quality seedlings that are in accordance with the 'Code of Good Nursery Practice for Oil Palm Nurseries (CoPN)' standard. Through the CoPN standard, the seedlings have to go through a stringent culling process before proceeding with delivery. MPOB, through its team of extension agents known as TUNAS (Tunjuk Ajar Nasihat Sawit) officers, is on site to provide advisory services as well as to educate smallholders on the advantages of adopting oil palm related technologies for better productivity through sustainable oil palm management. Table 1 shows the scope and value of assistance under Replanting (*Tanam Semula Sawit Pekebun Kecil – TSSPK*) and the New Planting Scheme for OPISH (*Tanam Baru Sawit Pekebun Kecil – TBSPK)*. The scope of assistance under this scheme includes a fund for land preparation, oil palm seedlings, rock phosphate fertiliser, and other agricultural inputs for years 1 and 2 after planting. The assistance scheme is worth RM 7,500 hectare-1 in Peninsular Malaysia and RM9,000 hectare-1 in Sabah and Sarawak. Due to the higher cost of land preparation, RM 4,000 hectare-1, the values of the assistance scheme for Sabah and Sarawak are 20% higher than for the Peninsular.

Table 1: Scope And Value Of Assistance Schemes

Scope	RM hectare^{-1}	
	Peninsular	**Sabah/Sarawak**
1. Fund for Land preparation	2,500	4,000
2. Agricultural inputs;	5,000	5,000
- Oil palm seedlings and phosphate fertiliser, inputs for control of weed, pest and disease, and compound fertilisers for year 1 and year 2.		
Total	**7,500**	**9,000**

Source: SPPII (2016)

Literature Review

An early impact study has been done by Zulkifli *et al*. (2018), whereby it was found that the average yield of FFB harvested for the first year improved by 30% to 6.55t/ha/yr, which contributed to the increment in participants' monthly income. There is no research that has been done regarding the outcome of the scheme at the mature stage of the palm, thus this project is done to propose an evaluation of the outcome of these schemes. In addition, other information related to the implementation of the schemes is also obtained through the survey, which includes the Good Agricultural Practices (GAP) compliance and assessment of customer satisfaction levels towards the schemes and services provided by the TUNAS officers.

There are two factors that can determine oil palm yield, which is biological and non-biological factors. Biological factors include crop genetics and incidents of pests as well as diseases, while non-biological factors include climate, soil types, and the effectiveness of crop management systems (Murphy *et al.*, 2021). These factors have been identified, and therefore actions can be taken to overcome them. However, there is still a fundamental obstacle that needs to be overcome in the future, which is to increase yield per hectare more sustainably. Oil palm trees have promising potential for the economy to produce viable volumes of FFB. Figure 1 illustrates the life expectancy of over 30 years, whereby palm trees are more likely to yield an amount of FFB that is efficient to incur profit when it is promoted commercially. A palm tree reaches a yielding peak period between the ages of 8 and 18, whereby the tree experiences a gradual decline in the palm tree's yielding capacity during this stage (Ferdous et al., 2015).

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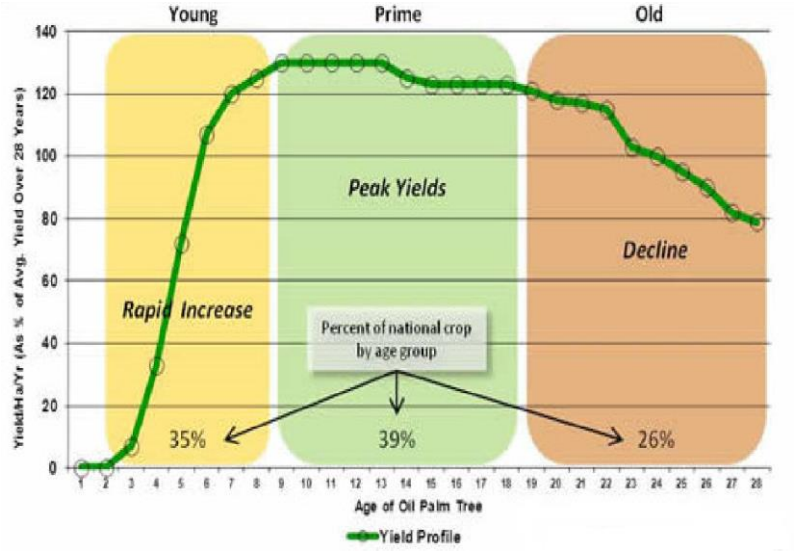

Figure 1: Oil Palm Age & Profile

Source: Ferdous at al., 2015

Generally, after three years of planting, oil palm trees reach maturity. Prior to the oil palm trees' maturity, significant capital expenses will be borne by the manufacturer, which includes the non-recurrent costs, upkeep, cultivation, and fertilizers application. However, there is a challenge that occurs, which is to diminish the gap between the national average of farmers' yield and the yield potential. The approach to overcoming this gap is through improving crops and their management. Nonetheless, there can be discrepancies between oil palm sites due to variations in soil physical conditions, and water supply, which can be affected by drought or flooding, imbalances or shortages of nutrient supply, as well as the occurrence of weeds, pests, and diseases. Therefore, in order to determine the attainable yields, the effectiveness of minimizing or preventing these restricting factors that occur on oil palm sites needs to be recognized. Table 2 shows the estimate of FFB yield from the first year of harvest, which is after three years of cultivation, until eighteen years of harvest (Kushairi, 2013). At this stage, the FFB yield is estimated to be between 21.4 and 33.5 t/ha/year.

Table 2: Profile Of Estimated Oil Palm FFB Yield

Age of oil palm tree	FFB yield (t/ha/year)		
	Low	Medium	High
3	4.6	8	10.5
4	8.8	12	15.5
5	13.1	18	22.0
6	17.1	22	26.0
7	20.4	26	31.0
8	21.4	27	32.5
9	22.4	28	33.5
10	22.4	28	33.5
11	21.4	27	32.5
12	19.5	25	31.0
13	19.5	25	31.0
14	19.5	25	31.0

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15	19.5	25	31.1
16	18.5	23	28.0
17	18.5	23	28.0
18	18.5	23	28.0

Source: Kushairi, 2013

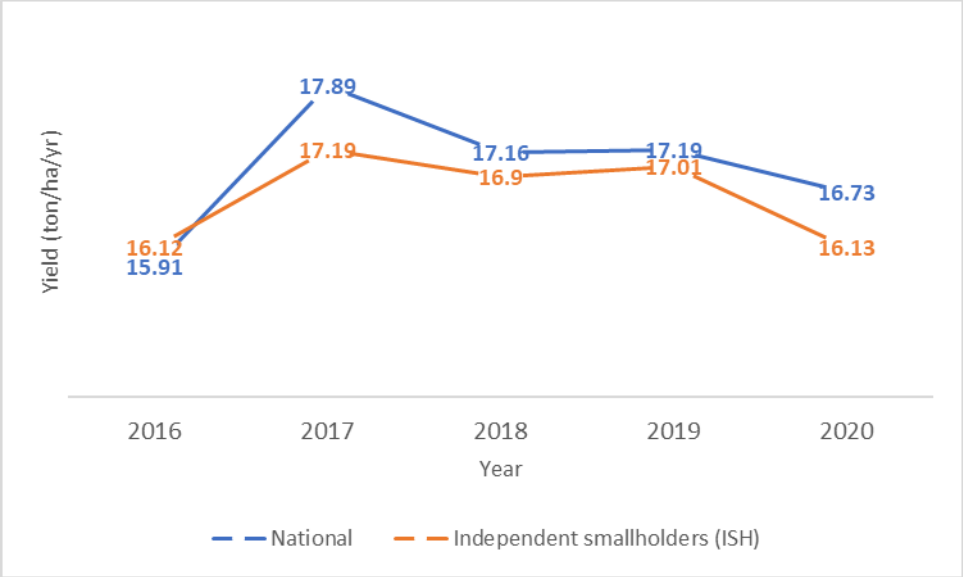

Figure 2: Comparison of National and Malaysian Oil Palm Independent Farmers FFB Yield (2016-2020)

Figure 2 shows that the phenomenon of El-Nino in 2016 affected the Malaysian oil palm industry's production. It can be noted from Figure 2 that Malaysia's FFB yield was stable from 2017 until 2019. In 2017, Malaysia's FFB yield had a significant surge to 17.89 tonnes per hectare, which is 12.4% more than the previous year. There was a bit of a downfall in Malaysia's FFB yield during 2018, approximately by 4.1%, from 17.89 tonnes per hectare to 17.16 tonnes per hectare. In 2019, the Malaysian oil palm industry shows an improved performance from 2018 whereby there is an increment of 0.2% to 17.19 tonnes per hectare. However, there is a quite significant decline in Malaysia's FFB yield during 2020 due to the global outbreak of the COVID-19 pandemic, which has become a very challenging period for every country. The national FFB yield decreased by 2.7% to 16.73 tonnes per hectare in 2020. The state that is most affected by the decline of FFB yields is Sabah, whereby it declines around 4.1% to 16.84 tonnes per hectare, followed by Sarawak with 3.7% to 14.99 tonnes per hectare, whereas in Peninsular Malaysia, there is a 1.1% decrement to 17.76 tonnes per hectare. In general, Figure 2 illustrates that the FFB yield among OPISH is marginally lower compared to the national FFB yield from 2017 to 2020.

There are several elements that can affect the productivity of oil palms, such as agricultural extension services, farming practices, types of soil, climate, and others. Additionally, there are four factors that significantly affect the production of FFB by the recipients of quality oil palm seedlings, which are the management of fertilizers, farm size, harvesting, and services provided by TUNAS (MPOB) officers (Rahmahwati *et al.*, 2019). The technology used in the oil palm industry has improved a lot compared to how it was 25 years ago. A standard guideline for using the new and suitable technology has been adopted and documented for the farmers to

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adhere to in order to ensure the high productivity of their oil palms. There is a long-term solution to ensuring high yields, which is to establish best practice guidelines for the farmers. This is supported by research that has been conducted in Nigeria by Gere S.O *et al.* (2020). This research proved that adoption of improved oil palm technologies had positive impact on the farmers' livelihood at household and farm levels. Perceived farmers' impact showed that there was increases in farm income, increased FFB yields and improvement general farmers well-being in health care contribution to children education and feeding of households:

Zulkifli *et al.* (2015) conducted a study to determine the yield performance among 200 participants of the Quality Oil Palm Seedlings Assistance Scheme in Sabah and Sarawak. It is found from this study that the FFB yields of the participants were relatively higher than those of the non-participants who were in the same states. There were a total of 114 participants out of 200 participants who produced more than 10 tonnes/ha/year of FFB yield. The average FFB yield produced among the participants was 7.29 tonnes/ha/year, which was higher than the average of non-participants, at 3.42 tonnes/ha/year. Thus, it is concluded from the study that the participants of the Quality Oil Palm Seedlings Assistance Scheme were relatively better managed than the non-participants.

FFB yield will be produced optimally by healthy oil palms, which can be achieved by manuring or the application of fertilizers. However, a lot of nutrients that are needed for a healthy oil palm are supplied by the soil or fertilizers. Unfortunately, in most oil palm sites, the soils have low fertility, so mineral fertilizers are essential to attain and sustain good palm nutritional status and high yield. However, it is difficult to overcome these problems due to the increment in fertilizer prices. In truth, 60% of the total production cost of oil palm in Malaysia is comprised of fertilizers (Ali, 2017). Over the years, the oil palm production costs have been rising and affecting mostly the farmers due to the limited capital, which has discouraged them from applying for the required fertilizers for their farms. MPOB conducted a survey which showed that, on average, farmers applied less than 4 kg/palm/year of fertilizers for both mature and immature oil palm, which is much lower than the recommended rates of 7-9 kg/palm/year and 3.6–6.9 kg/palm/year for the respective oil palm. This will affect the growth of oil palm trees and fresh fruit development (Ali, 2017).

There are a few farmers who failed to distinguish between unripe and under-ripe fruits, leading them to harvest the unripe fruit. This is concerning as, according to Roseleena *et al.* (2011), it was found that harvesting unripe fruit significantly lowers yield production. This occurs amongst farmers due to the method used to determine the ripeness; some farmers use colour to indicate ripeness instead of loose fruit. Some farmers tended to harvest orange fruit bunches without checking whether the fruitlets in the inner part of the bunch were ripe or not. The colour of the fruit bunch differs depending on the location of the fruitlet in the bunch, which could not truly determine the ripeness of the fruit bunch. It has been demonstrated that the fruit bunches do not ripen uniformly, whereby when 85% of the fruitlet is ripe and has a similar degree of maturity, the other 15% of the inner part of the bunch will be unripe. It is recommended to determine the fruit's ripeness based on the number of detached fruitlets from the bunch, also called loose fruit. A fully ripened fruit bunch has 1 to 10 fruitlets that are detached from the bunch.

MPOB introduced the MPOB Good Agricultural Practices (GAP) certification programme as an initiative to realize the concept and practice of sustainable palm oil for farmers. GAP is a paramount element in the principles of the Roundtable on Sustainable Palm Oil (RSPO) and in

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Malaysian Sustainable Palm Oil (MSPO) certification. It has been reported that the adoption of GAP by farmers is one of the pivotal factors in increasing productivity. Nur Hanani *et al*. (2016) found that the application of GAP covers sustainable agricultural methods such as integrated pest management (IPM), integrated fertiliser management, and agricultural conservation. Moreover, a new study by Nur Hanani *et al*. (2021) demonstrated that 58% of OPISH who partially comply by receiving the GAP certificate, while the remaining 26% are eligible for GAP certification as they fulfilled the requirements. There are two aspects that affect the GAP compliance among the OPISH, which are the respondents' education level and the age of the oil palm plantation. The outcome of this study suggested that the GAP on fertilizer application and record-keeping that were adopted by OPISH significantly affected the level of compliance with MPOB GAP Certification among the OPISH.

Methodology

The study was conducted from 2019 until 2020 in Peninsular, Sabah and Sarawak, and involved participants of the Oil Palm Replanting (TSSPK) & New Planting (TBSPK) Scheme. The sample population comprised 8,901 participants who had completed planting their oil palm seedlings in 2011 and 2012. Proportionate sampling was conducted to ensure that the entire population of samples had equal chances of being selected to be part of the study. The G-Power analysis was employed to determine the appropriate number of the required samples. The analysis recommended sample size of 400 respondents.

This study applied the structured questionnaire approach to gather data from the participants. The questionnaire comprised five sections, which consisted of a total of 30 types of information covering participant demographic profiles and their farms, management of major routine activities, such as fertilizer application, weeding, pest and disease control, harvesting of FFB and also the perception towards MPOB implementation. The study has adapted its questionnaire from previous researchers. Cross Tabulation Analysis between the demographic, farm profiles and GAP compliance of the farmers against yield was performed to identify factors contributing to yield and subsequently the income of the farmers.

Result and Discussion

Respondent Profile

Table 3 summarizes nine (9) demographic features of farmers who are engaged under the TSSPK and TBSPK schemes. From the table, the majority of farmers were aged between 59 and 69 years old, while most of them (39.5%) had education up to secondary school. It is also reported that 14.3% of farmers have attained university/college level, while 17.5% of the population have not attained any formal education. The finding shows nearly half of the population, or 48.3%, have been experiencing oil palm cultivation for less than 10 years, while 34.2% have had more experience for 21–30 years, which refers to TSSPK participants. For ethnicity, it was found that the dominant ethnic group is Malay farmers who came from family sizes of 1–4 dependents, followed by Chinese (20%), Bumiputera's Sarawak (18%), and Sabah (17.5%). The study also analyses the main reason why these scheme participants are involved in oil palm cultivation, and the result shows that 82.5% of the population have oil palm as their source of income, which means they are full-time farmers. Even though they are categorized as full-time farmers, they still received another income source (32%), while 68.0% of farmers depend mainly on oil palm cultivation only. In managing farms, it was found that 44.3% of the farmers are self-employed, while 55.7% hire third parties to conduct some operational activities due to advancing age. The most popular activities conducted by third parties are land

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preparation (85.5%), followed by harvesting (83.4%), and planting activities (81.3%). Meanwhile, manuring and weeding activities recorded 62.0% and 60.3%, respectively. The factor that leads more than 80% of farmers to outsource the land preparation until the planting stage is the cost and time consumption. Other than that, knowledge and age factors also lead to this situation, which is supported by Sheilyza *et al.* (2020).

Table 3: Demographic Profile of The Respondents

Features	Class	Frequency	Percentage (%)
Age (Years)	26 - 36	34	8.5
	37 - 47	62	15.5
	48 - 58	106	26.5
	59 - 69	149	37.3
	70 - 80	31	7.8
	81 - 90	18	4.5
Race	Malay	164	41.0
	Chinese	80	20.0
	Indian	5	1.3
	Bumiputera Sabah	70	17.5
	Bumiputera Sarawak	72	18.0
	Others	9	2.3
Education level	University/College	57	14.3
	Secondary School	158	39.5
	Primary School	115	28.8
	No formal education level	70	17.5
Source of income	Self-employed	86	21.5
	Government Servant	20	5.0
	Private Sector Employee	22	5.5
	None	272	68.0
Years of experience	1 -10	193	48.3
	11 – 20	121	30.3
	21 – 30	35	8.8
	31 – 40	31	7.8
	> 40	18	4.5
	None	2	0.5
****Reason for culivating Oil Palm**	Interest	118	29.5
	Occupy spare time	47	11.8
	Hereditary heritage	103	25.8
	Source of income	330	82.5
Farm management	Self Employed	177	44.3
	Outsource	86	21.5
	Both	137	34.2
****Hired works**	Land Preparation	342	85.5
	Planting	325	81.3
	Manuring	248	62.0
	Weeding	241	60.3
	Harvesting	335	83.4
	FFB selling	237	59.3
Dependent (Person)	1 - 4	304	76.0
	5 - 7	79	19.8

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8 – 10	8	2.0
> 10	2	0.5
None	7	1.8

Farm's Profile & Fresh Fruit Bunches (FFB) Yield of Scheme Participants

For the farm's profile (Table 4), the majority of the farmers owned 1.59 ha – 2.45 ha of oil palm cultivation, and there were 1.5% of farmers cultivating oil palm for less than 1.58 ha. From this figure, it can be concluded that the farm size in the study is considered small. The standard planting density used by farmers in this scheme is 148 palms/ha on the inland soil, which is considered the best practice for optimizing FFB production. In terms of soil types, it is reported that 72.3% and 19.0% of farms are located in inland soil and peat areas, respectively, while 8.8% of farmers planted oil palms in alluvial land. For topographic features, 0.3% of farmers operate their farms in hilly areas. This finding is supported by the GAP compliance in the next section. Therefore, nearly 60.0% of the population choose flat areas to ease their operating costs, especially in transporting FFB. This finding is similar to Tan *et al.* (2019), where the farmers mainly cultivated oil palms on inland soil and avoided peat soil as the drainage required for palm oil cultivation causes peat oxidation, and makes the soil susceptible to fires and floods. This study also addresses the typical problems faced by farmers, in which only 42.8% have problems in operating their farms, and it was noticed that majority of them have problems associated with farm road facilities that lead to difficulty in transporting FFB to the collection centre or mill. Besides that, some farmers also reported flooding incidents as one of the common problems they faced. From these problems, it is clear that the best farm should have good soil quality, topography, and accessibility as these factors affect FFB transportation as well as the quality and price of their FFB.

In terms of FFB yield production, it was grouped into three categories, namely low, medium, and high, following the Oil Palm Biology Facts & Figures (Khushairi *et al.*, 2013). It was found that more than half, or 61.0%, of farmers, were categorized as medium yield, producing 21.5 - 28.9 ton/ha/year with an average monthly income of RM1500 - RM3000 per month, while 32.5% of farmers produced in lower yield class (< 21 ton/ha/year) and there were 6.5% farmers produced more than 29 ton/ha/year, indicating a higher yield of FFB production. Overall, the average FFB yield production in the study area is 21.8 ton/ha/year, which is considered in the medium category at this prime or mature stage (8–9 years old). This may be due to Movement Control Order (MCO) restrictions in controlling the spread of the COVID-19 pandemic, whereby the mobility and morbidity of people were affected in a way that exacerbated the distribution of input factors, harvesting process, and transporting activities. However, this average FFB yield production is slightly higher than the national independent farmers yield that was recorded in 2019 and 2020, which was 17.01 ton/ha/year and 16.13 ton/ha/year respectively (MPOB, 2021). Lastly, for the income status, there is a significant improvement in their income after farmers joined this scheme. Clearly, there is a reduced number of farmers who received an income of less than RM1,500/month, from 83.8% to 39.5% after joining the scheme, and the result is also supported by Sheilyza *et al.* (2020), who claimed the income of farmers increased after joining the TSSPK and TBSPK schemes. The number of farmers under the middle (RM1500-RM3000) and higher (>RM3000) income also rose by 53.3% and 7.2%, respectively, after joining the schemes.

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Table 4: Farm's Profile & FFB Yield Of Scheme Participants

Items	Class	Frequency	Percentage (%)
Farm Sizes (Hectare)	0.74 - 1.58	6	1.5
	1.59 - 2.45	180	45.0
	2.46 - 3.32	75	18.8
	3.33 - 4.19	44	11.0
	4.20 - 5.06	95	23.8
Planting Density (Palm/Ha)	136	35	8.8
	148	315	78.8
	160	44	11.0
	>161	6	1.5
Types of soil	Coastal	35	8.8
	Inland	289	72.3
	Peat	76	19.0
Types of Topography	Flat	240	60.0
	Undulating	159	39.8
	Hilly	1	0.3
Problems Existence	Yes	171	42.8
	No	229	57.2
Types of problem faced by farmers	Farm road	109	63.74
	Land condition	31	7.8
	Flooding	31	7.8
Yield/Ha/Year (Tons)	< 21.4 (low)	130	32.5
	21.5 – 28.9 (medium)	244	61.0
	>29 (High)	26	6.5
Income Before Joined Scheme (RM) – Year 2010	< 1500	335	83.8
	1500 - 3000	16	15.3
	>3000	4	1.0
Income After Joined Scheme (8 years after planting) (RM) – Year 2020	< 1500	158	39.5
	1500 - 3000	213	53.3
	>3000	29	7.2

Good Agricultural Practices (GAP) of Scheme Participants

The main objective of this study is to address the GAP compliance by the farmers after joining the scheme. Therefore, 12 criteria related to the adoption of Good Agricultural Practices (GAP) were asked of the participants and the result was presented in Table 5. Generally, it was found that farmers in this study were complying with 10 out of 12 criteria included in GAP. The result shows that 372 of the population complies with the first criteria, indicating that the majority of their farms are located on flat or undulating land with slopes of less than 25 degrees. The second criterion discussed fertilization activity for mature palms. The farmers should apply fertilizer on the pruned frond heap to maximize fertilizer absorption, and the finding shows that 387 farmers comply with these criteria. The third criterion mainly focused on the weeding task, and nearly 100%, or 398 of the farmers, claimed their farms were free from weeds. In terms of pest and disease infestation, it was found that 382 farmers had performed pest and disease control on their farms. Pruning task becomes the fifth criterion in GAP and cited that farmers should not over-pruned to avoid low-rate bunch formation and the result show only 10 farmers have over-pruned their palm. According to the GAP guidelines, it is recommended to apply the triangular planting system to maximize root and frond growth, which will lead to increased

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FFB production, and the finding reported that 100% of the farmers in this study comply with these criteria. As we know, fertilizer is the main input in palm oil cultivation and has the highest production cost. However, the majority of farmers decided to reduce the application rate of fertilizer in order to minimize their **costs.** The same goes for this study, where the finding reported only 83 farmers complied with these criteria and applied at least 9 kg of fertilizer **per** palm per year, while more than half of them applied less than the standard. Although they reduce the quantity of fertilizer applied per year, however, 365 of the population conduct 2–3 times the amount of manuring activity in a year. This survey also addresses whether the farmers monitor nutrient deficiencies and disease infestations, whereby 376 and 381 farmers conducted this routine on their farms, respectively. This study also indicated that 324 farmers harvested FFB twice per month. The last criterion measured whether farmers collect all loose fruits, and the result shows that 91.3% of the population collects all their loose fruits.

Table 5: Good Agricultural Practices (GAP) of Scheme Participants

No.	Items	GAP Compliance	
		Yes	No
1	No cultivation in area >25°	372	28
2	Apply fertiliser on the pruned frond heap for matured palm.	387	13
3	Around the palm is free of weeds	398	2
4	Control pest & disease infestation	382	18
5	No over pruning	390	10
6	Application of triangular cultivation system.	400	-
7	Adequate fertilization (at least 9kg/palm/year)	83	317
8	Fertilizer application 2 to 3 times per year	365	35
9	Monitor nutrient deficiencies	376	24
10	Monitor if any disease infestation	381	19
11	Harvesting (every 15 days)	324	76
12	Collect loose fruits	365	35

Extension Services by the TUNAS Officers

Jasmin *et al.* (2013) found that the effectiveness of the extension services is highly dependent on the roles and knowledge of the extension agents. This is due to the fact that these extension agents have to convey the knowledge to the farmers during the extension process. This finding is aligned with the findings found by Syarifudin *et al.* (2021), as it is suggested that independent farmers' productivity can be influenced by agricultural extension services. Thus, it can be seen here that there is a correlation between the productivity of independent farmers and the extension services provided by the extension agents. Table 6 shows that 89.5% of farmers have engaged with TUNAS officers, while 87.5% claimed to have attended at least one course or seminar organized by TUNAS officers. Besides this, extension agents have an active role in improving the farmers' knowledge regarding the operation of their farms (Tan *et al.*, 2019), which will directly boost farm production and farmers' income.

Table 6: Extension Services by Tunas

TUNAS Services	Received/ Attended	Scheme Participants	
		Freq	%
Extension services	Yes	358	89.5%
	No	42	10.5%
Courses	Yes	350	87.5%

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No	50	12.5%

Evaluation Implementation of Scheme by MPOB as Executor

Table 7 represents the result of participants' evaluation of the scheme and MPOB as the executor agency. This information is important for MPOB in order to assess the efficiency of their schemes' implementation, which includes the allocation, quality, and distribution as well as services and policies that have been devised. Overall, the respondents were pleased with the statement that this scheme could help them to reduce the cost of inputs and provide benefits to the farmers, with a mean score of 4.47 and 4.65, respectively. The respondents also agreed that this scheme is able to generate or raise their income, with a mean score of 4.55.

In addition, the respondents were also satisfied with the services provided by MPOB as the executor agency. The respondents acknowledged that they are confident in MPOB's ability to assist them, with a mean score of 4.58. The other services that the respondents were pleased with were: the efficiency and fast distribution of the input (3.75 scores), the simplicity of the application process (4.41 scores), the quality of agricultural input they received (4.47 scores), and the punctuality in getting the agricultural inputs (3.65 scores). From Table 7, it can be seen that, in general, the respondents were also satisfied with the services provided by the TUNAS Region Officers. On average, the respondents acknowledged the positive comments regarding TUNAS services.

Table 7: Evaluation Implementation of Scheme by MPOB as Executor

Satisfaction towards the scheme	**Mean Score**
1. EPP1 scheme is able to reduce the cost of purchasing inputs.	4.47
2. This scheme provides benefits to farmers.	4.65
3. This scheme is able to generate/increase income for farmers	4.55
Assessment towards MPOB as executor	**Mean Score**
4. I am confident in the ability of MPOB in assisting farmers through the EPP1 scheme.	4.58
5. The distribution of agricultural input is efficient.	3.75
6. The application process is easy	4.41
7. The scheme provided quality seedlings, fertilisers and chemical pesticides.	4.47
8. Participants receive agricultural inputs on time.	3.65
Evaluation towards TUNAS as an extension agent	**Mean Score**
9. TUNAS officer was helpful in the application process and distribution of inputs.	4.43
10. TUNAS officer has good and well experience in the field of oil palm cultivation	4.41
11. I am satisfied with the guidance and extension services provided by TUNAS Officers.	4.41

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12.	TUNAS officers have regularly organized related courses to disseminate information on oil palm management	4.35

Cross Tabulation Analysis Between Demographic and Farm Profiles of Farmers against FFB Yield.

A crosstabulation between farmers' profiles and FFB yield production was conducted, and the result is illustrated in Table 8. From the table, it was found that 26 farmers produced FFB yields of more than 29 tons/ha/year, and 11 of them came from ages between 59 and 69 years old. The same goes for the medium FFB yield category, whereby 104 farmers are from this age class. In terms of education level, 158 farmers attained secondary school education, where 11 of them claimed higher FFB yield production, 98 of them were categorized as medium FFB yield production, and the rest were recorded in the lower FFB yield category. For ethnicity, the majority of farmers in this study group are Malay and followed by Chinese, but the highest number of recorded ethnic achievements is 29 tons/ha/years, which has come from Chinese farmers (11.25%), while only 3.6% of Malay farmers are categorized in higher FFB yield production. This study indicated that 180 farmers in this study owned farm sizes of around 1.59–2.45 ha, and 113 of them were categorized as medium FFB yield production. It was found that the majority of farmers, or 315 farmers, used to cultivate 148 palms/ha since most of their farms were inland soil and 228 of them produced more than 22.5 tons/ha/yr of FFB yield. The crosstabulation between soil type and soil topography was also conducted, and the finding stated that 289 farmers cultivated on inland soil and the FFB yield proportion found 24 farmers who recorded a higher FFB yield, 196 of them as medium FFB yield production, and 69 farmers produced less than 21.4 tons/ha/year, which is considered low FFB yield production. Even though 240 farms were located on flat land and followed by undulating topography, in terms of FFB yield distribution, farmers who cultivated oil palm in the undulating areas (71.0%) produced more than 21.5 tons/ha/year rather than farms located on flat areas (65.4%).

Table 8: Cross Tabulation Analysis Between Demographic and Farm Profiles of Farmers Against FFB Yield.

Items	**Class**	**Yield Class**			**Total**
		Low < 21.4 tons/ha/yr	***Medium 21.5-28.9 tons/ha/yr***	***High >29 tons/ha/yr***	
Age of farmer (Years)	26 - 36	8	23	3	34
	37 - 47	25	34	3	62
	48 - 58	45	53	8	106
	59 - 69	34	104	11	149
	70 - 80	11	19	1	31
	81 - 91	7	11	0	18
Education Level	No formal education	21	42	7	70
	Primary School	43	66	6	115
	Secondary School	49	98	11	158
	University/College	17	38	2	57
Ethnicity	Malay	74	84	6	164

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	Chinese	17	54	9	80
	Indian	0	5	0	5
	Bumiputera Sabah	26	40	4	70
	Bumiputera Sarawak	11	54	7	72
	Others	2	7	0	9
Farm Size (Ha)	0.74 - 1.58	4	2	0	6
	1.59 - 2.45	54	113	13	180
	2.46 - 3.32	33	39	3	75
	3.33 - 4.19	14	28	2	44
	4.20 - 5.06	25	62	8	95
Types of Soil	Alluvial	22	13	0	35
	Inland	69	196	24	289
	Peat	39	35	2	76
Soil Topography	Flat	83	147	10	240
	Undulating	46	97	16	159
	Hilly	1	0	0	1
Palm Density (Palm/Ha)	136	15	20	0	35
	148	87	203	25	315
	160	23	20	1	44
	>161	5	1	0	6

Cross Tabulation Analysis Between Criteria on GAP Compliance of Farmers against FFB Yield

A crosstabulation between the criteria on GAP compliance and FFB yield was performed, and the result is presented in Table 9. It was found that 100% of the farmers were practising the triangular cultivation system. Tan *et al.* (2019) stated that farmers who applied GAP such as triangular cultivation systems benefited from the best fertiliser management. However, the finding of this study contradicts the statement. The fertilizer application recorded the lowest percentage of compliance among farmers in this study, while the other criterion was nearly complied with by all of the population. The researcher used FFB yield production to evaluate the smallholder's performance, and clearly, 26 farmers were able to produce an FFB yield of above 29 tons/ha/year, while 244 farmers claimed to have achieved an FFB yield of between 21.5 and 28.9 tons/ha/year, and the rest (130 farmers) produced below 21 tons/ha/year. It is well known that the amount of fertiliser applied has a positive effect on the production of FFB yield. This study found that 26 farmers who fertilised their palms using 9 kg/palm of fertiliser a year produced higher yields. This finding shows that the majority (79.2%) of farmers from low and medium yield categories applied less than 9 kg of fertiliser to each palm in a year. 99.5% of farmers are aware of the need to ensure that the area around the palm is free from weeds. Harvesting conducted twice a month is good for avoiding under-ripe and over-ripe fruit. In the low yield group, a large number of farmers (76 farmers) did not practise this harvesting frequency. Overall, the cross-tabulation analysis on farm management showed that the farmers who practised GAP effectively tended to produce higher yields than those farmers who did not perform efficient farm operations, such as manuring, pruning, harvesting, and others.

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Table 9: Cross Tabulation Analysis Between Criteria On Gap Compliance of Farmers Against FFB Yield.

No	Items	Class	Yield Category			Total
			Low <21.4 tons/ha/yr	Medium 21.5-28.9 tons/ha/yr	High >29 tons/ha/yr	
1	No cultivation in area >25°	Not Comply	18	10	0	28
		Comply	112	234	26	372
2	Apply fertiliser on the pruned frond heap for matured palm.	Not Comply	9	4	0	13
		Comply	121	240	26	387
3	Around the tree is free weeds	Not Comply	2	0	0	2
		Comply	128	244	26	398
4	Control pest & disease infestation	Not Comply	13	5	0	18
		Comply	117	239	26	382
5	No over pruning	Not Comply	10	0	0	10
		Comply	120	244	26	390
6	Application of triangular cultivation system	Not Comply	-	-	-	-
		Comply	130	244	26	400
7	Adequate fertilization (9kg/palm/year)	Not Comply	130	187	0	317
		Comply	0	57	26	83
8	Fertilizer application 2 to 3 times per year	Not Comply	27	8	0	35
		Comply	103	236	26	365
9	Monitor nutrient deficiencies	Not Comply	21	3	0	24
		Comply	109	241	26	376
10	Monitor if any disease infestation	Not Comply	13	6	0	19
		Comply	117	238	26	381
11	Harvesting (every 15days)	Not Comply	76	-	-	76
		Comply	54	244	26	324
12	Collect loose fruits	Not Comply	29	6	-	35
		Comply	101	238	26	365

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Conclusion

Overall, these government schemes significantly benefited farmers who participated even though they are mostly older as they claimed their income increased to RM1,500- RM3,000 per month after joining these schemes. From the results, it appeared that most of the participants owned an oil palm farm below the economic size of 4 ha. In general, the average FFB yield production for this study is 21.8 ton/ha/year which is categorized as a medium yield for oil palms in the mature stage, 8-9 years. This mostly happened due to the inadequate fertilizer application as well as the Movement Control Order (MCO) restrictions that took place to control the spread of the COVID-19 pandemic, whereby the exacerbated distribution of input factors, harvesting process, and transport activities.

It can also be seen from this study that most of the participants adopted GAP after joining the schemes, where they received extension services and attended courses planned by MPOB. Most of the participants were satisfied with the schemes implemented by MPOB as well as with the extension services provided by the TUNAS Officers. The result also illustrated that the farmers agreed with the relevancy of the scheme as well as recommended the schemes be implemented in the future with several improvements. Few recommendations were suggested, such as improve the agriculture input distribution, clustering of the farmers into cooperatives, and continuity of GAP implementation. One of the policy thrusts in the 10th Malaysia Plan is enhancing the income of farmers. Therefore, it is suggested to do further study on the socio-economic factors that gauge the status of the farmers who participated in these government schemes.

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