Smallholder farmers’ perception on oil palm agroforestry

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Abstract. Oil palm has become a prominent agricultural commodity in Indonesia. It is widely adopted mainly as monoculture plantations both by smallholders and large scale companies. Evidence shows that these massive monoculture practices have led to adverse impacts to environmental and social systems as well as unsustainable growth of the producing regions. Particularly, smallholder farmers have encountered difficulties to cope with the fluctuating oil palm price. We argue that adding perennial trees and other agricultural crops or combining with livestock breeding in the form of agroforestry could become an alternative for smallholder farmers to deal with this problem. Oil palm agroforestry (OPAF) has been voluntarily adopted by smallholder farmers at limited scales. This article aims at analysing smallholder farmers’ perception on oil palm agroforestry in terms of production and potential contribution to improve environment. Intensive fieldworks were conducted in Jambi and Central Kalimantan to investigate smallholder farmers’ perception on oil palm agroforestry. This research reveals that the relatively large proportion of smallholder farmers perceived that (a) oil OPAF produces less of oil palm fresh bunch fruits and demands more complex management compared to those with monoculture system, (b) OPAF helps smallholder farmers to cope with the FFB price fluctuation and improves household food security, and (c) OPAF improves environmental quality in general. From these results, we learned that smallholder farmers have various perceptions on OPAF which are ranged from very positive to very negative. These smallholder farmers’ perceptions could become important factors which determine their decisions in adopting or not adopting OPAF. Therefore, more efforts are needed to improve farmers’ confidence in adopting oil palm agroforestry. Furthermore, we need more evidence on how oil palm agroforestry system could provide a socially, economically and environmentally feasible alternative to monoculture system.

Keywords: oil palm agroforestry, Indonesia, smallholder farmers, perception

1. Introduction

Oil palm has been increasingly discussed by various actors such as scientists, policy makers and practitioners from all over the world. The discussion has been mainly related to the links between oil palm production and its adverse impacts on social and environmental systems. Many studies have been done to analyse the expansion of oil palm plantations. These include the relation of oil palm expansion to tropical deforestation [1][2] and biodiversity loss [3][4], food security [5], social segregation [6],
displacement [7] and unsustainable growth [8]. These evidences indicated that the monoculture practices which have been widely adopted in oil palm production both by smallholder farmers and large scale companies have led to adverse impacts to environmental and social systems.

According to the national statistics agency or BPS [9], the area of oil palm plantations has been steadily increasing with average annual growth around 5% in the last five years. It is estimated that in 2016 the total area of oil palm plantations in Indonesia was 11.12 million hectares with total CPO production 31.02 million tons. Within the oil palm plantations area, around 6.21% was managed by state-owned companies, 50.56% was managed by large scale private companies and 41.91% was managed by smallholder farmers. By CPO production, state-owned companies contributed around 6.08%, large scale private companies contributed 58.88% and smallholder farmers contributed around 35.02%. Looking at the area of plantations and its associated CPO production it is clear that there are quite large yield gaps among oil palm plantations managed by smallholder farmers, state-owned companies and large scale private companies.

Despite these yield gaps, there is increasing number of smallholder farmers who adopt oil palm production in their livelihood strategies [10]. This is mainly because of the potential financial benefits offered by oil palm production [11]. However, smallholder farmers have often encountered difficulties to cope with the fluctuating oil palm price. This is mainly because most of the oil palm products especially CPO has been serving export market [9]. Therefore, the CPO price in global commodity market has been influenced by international policies such as EU policies on biofuels [12]. Small decline in CPO price could lead to severe impacts on smallholder farmers’ household income. This is especially when smallholder farmers have adopted monoculture oil palm production and rely their household income mainly on this monoculture oil palm production [8].

We argue that adding perennial trees and other agricultural crops or combining with livestock breeding in the form of agroforestry could become an alternative for smallholder farmers to deal with these problems. Recent research showed that adding trees species into oil palm plantations have increased yields of oil palm fruits, improved biodiversity and soil nutrients [13]. The addition of tree species and other agricultural crops will form an oil palm agroforestry. Agroforestry system has been widely recognized of having potential in contributing to climate change mitigation because of its capacity in carbon storage and sequestration [14][15]. This oil palm agroforestry could also potentially stimulate the diversification of household income sources and therefore reduce dependency on oil palm as the main source of income. In addition, the integration of farmers into forest such as within the social forestry schemes could become an alternative to resolve or mitigate tenure problems in relation to agricultural expansion into forest areas [16].

Despite of many potential advantages of agroforestry for environmental, social and economic especially for smallholder farmers oil palm agroforestry (OPAF) has been voluntarily adopted by smallholder farmers at limited only scales. Smallholder farmers’ perception on OPAF could play important roles in determining their decision in adopting oil palm agroforestry. This is especially important for smallholder farmers who hold or in the process of applying social forestry licenses. By regulation, smallholder farmers who hold social forestry licenses could retain their monoculture oil palm plantation only for 12 years and should manage at least 100 trees per ha (Minstry of forestry and environment regulation No. 83/2016 article 65h). Adopting oil palm agroforestry could become one of the entry points to negotiate on the revision of this particular article. Therefore, this article aims at analyzing smallholder farmers’ perception on OPAF in terms of production and potential contribution to household incomes and environment.

2. Method

Intensive fieldworks were conducted in May 2019 in Jambi and Central Kalimantan provinces to investigate smallholder farmers’ perception on oil palm agroforestry. We visited Tebo regency of Jambi and Kotawaringin Timur and Pulang Pisau regencies in Central Kalimantan. We overlaid oil palm land cover, land allocation for social forestry and village maps. This resulted in a list of villages with oil palm land cover and land allocation for social forestry. We did focus group discussions (FGDs) with
stakeholders, namely local government, forest management units (FMUs), NGOs who work in the associated regions and experts to select the villages for study. With the support of the stakeholders we visited the selected villages. In each village we did FGD with village leader to select the respondents. The selection criteria are (a) smallholder farmer and (b) live in the associated village.

A perception survey was conducted to investigate smallholder farmers’ perception on oil palm agroforestry. The questions include (a) perception on the productivity and management of OPAF, (b) perception on the potential contribution of OPAF to household income and (c) perception on the potential contribution of OPAF to environment. The investigations were conducted around 10 days for each village by two groups of surveyors. We specifically asked the respondents about their consents in participating in this research.

3. Results

3.1 Profile of respondents

We interviewed 205 respondents in five villages in three regencies of two provinces such as Bukit Bamba and Pamarunan villages in Pulang Pisau regency, Karangsari and Parenggean villages in Kotawaringin Timur regency, Central Kalimantan province, and Sungai Jernih village in Tebo Regency, Jambi province. The summary of the respondents’ characteristics is depicted in Table 1. Table 1 shows that our respondents are mainly smallholder farmers with more than ten years of experience although there are also young farmers who just started. These young farmers are migrants who just arrived and worked as casual labour in the farms or local young people who have to continue managing their family farms. Farmers who fall in the first category are often landless or managed vary small size of farm while farmers who fall in the second category are often managed relatively large size of farms.

Table 1. Characteristics of respondents

| Village | No. of respondents | Age (year) | No. of family member | Size of landholding (ha) | No. Of OP farmers | Size of OP farm |
|---------|--------------------|-----------|----------------------|-------------------------|------------------|----------------|
|         |                    | µ         | σ                    | µ                       | σ                | µ              | σ              |
| 1       | 29                 | 49.97     | 11.53                | 4.76                    | 2.13             | 4.72           | 3.23           | 18             | 2.13            | 1.69           |
| 2       | 22                 | 44.27     | 12.90                | 3.41                    | 1.18             | 2.93           | 2.88           | 9              | 2.56            | 1.87           |
| 3       | 31                 | 49.35     | 11.43                | 2.81                    | 1.17             | 4.45           | 6.53           | 28             | 4.67            | 5.26           |
| 4       | 28                 | 43.43     | 6.78                 | 3.50                    | 1.73             | 4.43           | 4.41           | 20             | 5.00            | 3.85           |
| 5       | 95                 | 44.58     | 10.33                | 2.83                    | 0.86             | 2.99           | 1.31           | 95             | 2.96            | 1.26           |
| Total   | 205                | 45.87     | 10.77                | 3.25                    | 1.47             | 3.65           | 3.54           | 170            | 3.05            | 2.88           |

Note: village 1= Bukit Bamba, village 2= Pamarunan, village 3= Karangsari, village 4= Parenggean, village 5= Sungai Jernih, µ = average, σ = standard deviation, OP = Oil Palm

They have in average more than three family members except the farmers from village 3 and 5. Those two villages are transmigration villages have relatively good road access and well connected to other villages and even bigger towns or cities. With these, farmers could easily find workers such as casual labours to work in their farms and depend less on their family labours.

The average landholding in village 2 and 5 is relatively small compared to other villages. This is because agriculture is not the main source of income for farmers in those two villages. They have more diversified income sources such as working as labour in the mining sectors, having small shops in the local market or providing services such as transportation services.
Table 1 also indicates that less oil palm farmers in village 1 and 2. This might be explained by the fact that village 1 and 2 are later adopters of oil palm. The farmers in village 1 and 2 have been cultivating rubber as their main commodity. Recently, with the establishment of wood chip mill for bio-energy in the capital of the regency, more and more farmers have been converting their rubber plantations into sengon (*Falcataria molucana*) plantations. In addition, peatland is a dominant soil type in those two villages and farmers consider higher costs for the establishment of oil palm plantations on peatlands. These have led to differences in size of oil palm farms varied among villages and among farmers within village. All of the smallholder oil palm farmers cultivate oil palm as monoculture plantations.

### 3.2 Perception on production and management of OPAF

The perception of smallholder farmers on production and management of OPAF is summarized in Table 2. Table 2 shows that around one third of the farmers have neutral opinion about the production and management of OPAF which could indicate that they have very limited information about OPAF. The reason could be (a) there is no example of OPAF in their region or (b) there is example of OPAF but the respondents have no information about the OPAF practices in their region.

| Statement                                           | Agree | Neutral | Disagree | No answer | Total |
|-----------------------------------------------------|-------|---------|----------|-----------|-------|
| OPAF produces less Fresh Fruit Bunches (FFB)        | 59%   | 29%     | 12%      | 0%        | 100%  |
| OPAF reduces risks of failed harvest                | 43%   | 31%     | 26%      | 0%        | 100%  |
| OPAF reduces costs on fertilizers and herbicides    | 27%   | 31%     | 40%      | 2%        | 100%  |
| OPAF provides fodder for livestocks                 | 37%   | 35%     | 27%      | 1%        | 100%  |
| OPAF demands more complex farm management           | 62%   | 28%     | 10%      | 0%        | 100%  |

Table 2 indicates that most of smallholder farmers perceived that OPAF produces less Fresh Fruit Bunches (FFB) per hectare. This is mainly because farmers think that within OPAF scheme the number of oil palm trees should be reduced to give spaces to other species in each unit of land. However, some farmers have perceived that the adoption of OPAF will unnecessarily reduce the production of FFB in each unit of land. These farmers might see that the addition of trees species could potentially improve soil conditions and lead to the increasing production of FFB.

Although quite many smallholder farmers agree that OPAF could reduce risks of failed harvest, there are smallholders farmers disagree. This is because failed harvest involves not only management aspect such as the quality of planting materials and the use of fertilizers but also climate/ weather especially related to drought.

Some smallholder farmers agree that OPAF could reduce costs on fertilizers and herbicides but more smallholder farmers disagree on this statement. This could be the similar case with the failed harvest or smallholder farmers have limited information about other alternative practices than the use of chemical fertilizers and pesticides.

More smallholder farmers give neutral opinion about the potential contribution of OPAF in providing fodder for livestock. This could be explained by the limited number of farmer who integrates their farm and livestock breeding. Chicken, duck and fish are typical livestock which are managed by smallholders.

In general, the addition of other species and the integration of livestock in the OPAF are perceived as additional tasks for the smallholder farmers. This is indicated by the fact that the majority of smallholder farmers have perceived that the OPAF demands more complex farm management compared to the monoculture oil palm plantation.
3.3 Perceived OPAF contribution to household income
The smallholder perception on OPAF contribution to household income is summarized in Table 3. Table 3 indicates that around one third of the smallholder farmers agree that OPAF could be potentially more profitable compared to monoculture oil palm plantations but more smallholder farmers disagree on this statement. However, more smallholder farmers agree that OPAF increases land-based household income than those who disagree. Smallholder farmers might see that the additional income from OPAF is insufficient to increase their profit because OPAF also demands more complex management which could imply on additional costs.

| Statement                        | Agree | Neutral | Disagree | No answer | Total |
|----------------------------------|-------|---------|----------|-----------|-------|
| OPAF is more profitable          | 33%   | 27%     | 40%      | 0%        | 100%  |
| OPAF increases land-based income | 41%   | 28%     | 30%      | 0%        | 100%  |
| OPAF improves household income   | 35%   | 30%     | 34%      | 1%        | 100%  |
| OPAF helps farmers cope with price fluctuation | 46% | 28% | 25% | 0% | 100% |
| OPAF improves household food security | 45% | 25% | 30% | 0% | 100% |

Table 3 also shows that more farmers agree that OPAF improves household income stability and helps farmers to cope with FFB price fluctuation. This indicates that smallholder farmers have seen the potential diversification of their sources of income from OPAF such as timber, fruits, spices, and tubers. These products could also become sources of food for the households and therefore smallholder farmers could improve their food self-sufficient. Improving food sufficient level at the household level is perceived as improvement of household food security. This is clearly indicated by the number of smallholder farmers who agree with the statement that OPAF improves household food security.

3.4 Perception on OPAF contribution to environment
Table 4 summarizes the smallholder farmers’ perception on OPAF contribution to environment. Most of the smallholder farmers agree that OPAF could potentially contribute to improve environmental quality in general. The contributions would be particularly in improving the soil fertility, water retention and wildlife. Despite of the monoculture system which is widely practiced by smallholder farmers in oil palm production, smallholder farmers acknowledge the important roles of diversity and multifunctionality of landscape as the supporting system for livelihood. This knowledge and perception could be further explored in promoting more sustainable oil palm production.

| Statement                        | Agree | Neutral | Disagree | No answer | Total |
|----------------------------------|-------|---------|----------|-----------|-------|
| OPAF improves environmental quality in general | 53%   | 21%     | 25%      | 1%        | 100%  |
| OPAF improves soil fertility     | 50%   | 12%     | 37%      | 1%        | 100%  |
| OPAF improves soil water retention | 61%   | 13%     | 24%      | 1%        | 100%  |
| OPAF has positive impacts on wildlife | 54%   | 28%     | 18%      | 0%        | 100%  |

4. Discussions
The results of the perception survey shows that smallholder farmers various perception on production and management of OPAF. Agro-forest is often perceived as productive farming and monoculture plantations is associated with a progress and connection to the modern world [17]. In this case, perceived
economic benefits from trees could become important factor which influences smallholder farmers’ perceptions on agroforestry. This perception could be shaped by complex factors such as market and risks [18].

Introducing high quality planting materials, appropriate species selection and spacing could become alternatives to increase the productivity of agro-forest farm. In addition, knowledge and skills on silviculture and conservation could also influence smallholder farmers’ decisions to incorporate trees into their farms [19]. In the community with strong conservation belief which is operated under social norms, agro-forest could become the most preferred land use [20]. The fact that the majority of the respondents perceived that OPAF could potentially contributed to the improvement of environmental quality indicates that respondents have knowledge on conservation. This could become an entry point to promote OPAF besides fulfilling the requirements of the social forestry licenses.

In addition, supports from external could also influence the decision of the smallholder farmers to participate or not in forestry programme [21]. This could include the available technical assistance from the nearby Forest Management Units (FMUs), involvement of NGOs and Universities in the programmes. An extension programme could provide tailored recommendation about certain norms and values creating perceptions on agroforestry as well as give perspectives on how agroforestry could be widely adopted [18].

5. Conclusion

From these results, we learned that smallholder farmers have various perceptions on OPAF which are ranged from very positive to very negative. These smallholder farmers perceptions could become important factors which determine their decisions in adopting or not adopting OPAF. Therefore, more efforts are needed to improve farmers’ confidence in adopting oil palm agroforestry. Furthermore, we need more evidence on how oil palm agroforestry system could provide a socially, economically and environmentally feasible alternative to monoculture system.

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