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Research Article

The Corn Development Strategy in Peat Soil With No Burning and Traditional Methods

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ABSTRACT

The study aims to analyze the differences in the development of corn cultivation in peat soils between no-burning and traditional methods or with burning in Rasau Jaya District, Kubu Raya District. The fact that currently clearing forests is still using burning on agricultural land in general and especially on peat soil that is feared to experience underground burning is difficult to overcome and cause many losses. The development of corn on land without burning on peat soil is a solution for the community in maintaining ecosystem sustainability. The explanatory research is directed at testing hypotheses and following research objectives. Data collection by interview and questionnaire to 60 respondents were corn farmers on peat soil. The average difference test is used in explaining the difference in yield between the two methods of planting on peat soil. The results found that there were significant differences in the application of corn cultivation on peat soil without burning compared to the traditional method on the variables fertilizer, pesticide, business costs, and yields. In contrast, the planting area variable had no significant difference.

Keywords: Corn cultivation; Peat soil; Tillage without burning.

1. Introduction

Peat soil is land that originates from peat formation and the vegetation above it, formed in areas with low topography, high rainfall or in areas where the temperature is very low. As a natural resource, peat has uses for the cultivation of agricultural and forestry plants, as aquaculture, it can be used as fuel, nursery media, soil amelioration, and to absorb environmental pollutants (Osaki and Tsuji 2016). The use of peat soil for agriculture initially requires a large investment (Ruuskanen 2015; Kenney-Lazar and Ishikawa 2019; Wulandari and Yanti 2019).Peat soil farming productivity at the farm level, with low to moderate inputs, is different from peat soil productivity with a high level of management that is usually applied by private or large companies.However, peat soil development in one area does not guarantee that other places will succeed (Connolly *et al.* 2015; Barrow 2016).

Farmers' knowledge of peat soil is very limited, so conservation efforts to maintain peat soil productivity are also limited. In relation to land conservation, the application of cultivation techniques in land preparation with the slash-burn system is still largely adopted by farmers. Burning ash from peat that is practically obtained from the top layer of land is considered to be fertilizer material for soil fertility, but gradually without control will result in the depletion of the organic layer which is essential. This has been going on for a long time with inappropriate patterns so that peat needs to be conserved. It is feared that exploitation of peat will cause peat to reduce from its base because of the isostation style. Peat soil managed without a clear plan and designation will cause peat to become dry and flammable (Sagiman *et al.* 2015; Irma *et al.* 2018). Peat soil problems can be overcome by following various strategies, namely land preparation, water management, commodity selection, and cropping patterns, which follow the

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characteristics of peat soil (Dariah *et al.* 2015; Safrida *et al.* 2018).

One effort to spur the production of agricultural products is the peat soil extensification program (Indraningsih 2016). Peat soils are natural resources that complement the diversity of Indonesia's natural wealth. The potential of Indonesia's peat soil has an area of around 20 million hectares (Rosmalinda and Susanto 2018). West Kalimantan is a province that has the largest peat soil in Indonesia. The existing condition of peat soil area in West Kalimantan is 1.68 million ha or 11.4 percent of West Kalimantan's area of 14.68 million ha and it is estimated that around 15 percent (299,028 ha) can be used for agricultural land (Malta 2011). While the area of peat soil in Kubu Raya Regency is 48,763 ha (Putri 2017). However, the management of peat soil is not as easy as imagined. In its journey various problems were encountered in utilizing peat soil. This happens because peat soil have characteristics that are far different from rice fields and dry fields that are commonly found in Indonesia. It takes a long time to be able to change peat soil into productive land and suitable for agricultural activities. Needs various improvements and treatments so that plants can flourish in peat soil areas, which certainly requires high costs.

Efforts to alleviate poverty for communities in peat soil must begin with efforts to restore peat ecosystems and prevent peat destruction. The development of farming without the recovery of ecosystems will prolong people's suffering and environmental damage will be increasingly widespread. Based on experience since 1997 that every year there are always peat soil fires, according to data (Karhutla Monitoring System, 2019) forest fires in West Kalimantan since the last 4 years: (1) in 2016 covering an area of 9,174.19 ha; (2) in 2017 covering an area of 7,467.33 ha); (3) in 2018 with an area of 68,311.06 ha; and (4) from 2019 to April, covering an area of 2,273.97 ha. Then considering the difficulty of prevention and mitigation is a safe action if the peat is not managed for agriculture and not even crossed, especially the thick peat layer. This means leaving peat let natural success, thus the chances of a fire decreasing and the smog will not be repeated (Limin *et al.* 2003). One alternative agriculture on peat soil in a more intensive way is the method of processing peat without burning (Surahman *et al.* 2019).

Research from Subiksa et al (2009) shows that farmers in West Kalimantan always burn land before planting food crops, especially corn. Every season, a layer of peat burns about 3-5 cm. From peat burning twice a year, it can be estimated that carbon emissions are around 110.1 t CO_2 ha^{-1} $year^{-1}$ (assuming carbon peat density is around 50 kgm^{-3} or 0.05 tm^{-3}). The burning activity carried out by farmers in a sustainable manner shows that the burning activity for land clearing is still the people's choice. Spatial analysis results show that approximately 92,804.54 ha (11.18%) of the Kubu Raya Regency area has the potential for danger of forest and land fires with hazardous levels, around an area of 349,681.47 ha (42.13%) with the level of danger high fires and around 339,352.39 ha (40.8%) with a moderate level of fire hazard (Jawad *et al.* 2015). Stakeholders in this case the government generally through the Kubu Raya Agriculture Office and related agencies, see a fairly serious impact with the opening of land especially peat soil in the traditional way. Various methods used by the government to limit these activities, such as socialization activities, various policies and laws and regulations and punishments, but the results are still not optimal (Turjaman and Hidayat 2017)

Limin *et al.* (2003) states that the depth of the burned peat layer is on average 22.03 cm (variation between 0 - 42.3 cm) but at a certain point the layer can burn up to 100 cm. Land clearing using mulcher or bio-harvester, use of sludge, use of biochar and others is a good alternative, but the tool is still relatively expensive (Turjaman and Hidayat 2017). Another alternative developed by farmers in Kubu Raya District, especially in Rasau Jaya District, is to open new land on peat soils using the non-burning method (slash and slash method, spraying herbicides, soil rotary and liming and spreading compost and planting). Kubu Raya Regency Government through the Department of Agriculture has a grand strategy in developing agribusiness. The grand strategy is to develop commodities and agribusiness activities that are in accordance with the potential of land and people in an area. Regarding the grand strategy, the Kubu Raya Regency Government established Rasau Jaya Village and its surroundings as a corn production center. One strategy is the development of corn planting on peat soil without burning (Jawad *et al.* 2015; Mawardi 2019)

Based on this background, the problem in this study is to analyze the differences in the development of corn, especially the opening of new land on peat soil by the method of non-burning and traditional methods in Kubu Raya Regency. The selection of plants developed on peat soil is corn (*Zea mays* L.).

2. Material and Method

The study was conducted in a survey by taking samples from the population using a questionnaire, and the survey was used to test hypotheses (Walliman 2015; Bryman 2016). According Bryman (2016), to test the hypothesis whether there are differences in the mean of the two groups of data, using the average difference test with an independent sample T-test with 5% significant level. Quantitative testing uses the SPSS application as a tool to test statistically. The formulation of the research hypothesis is as follows: (H_1) there are significant differences in results between the development of maize on peat soil with the method without burning and traditional methods in Rasau Jaya District, Kubu Raya District, and (H_0) there are no significant differences in results between the development of maize on peat soil with the method without burning and traditional methods in Rasau Jaya District, Kubu Raya District.

For data sources, primary data from interview with peat maize farmers using the no-burn method and traditional methods. The construct validity and the Cronbach alpha were employed to check validitiy and reliability of instrument in this study. Secondary data were obtained from the relevant agencies, in this case the Agriculture Office and the Office of the Statistics District of Kubu Raya.

The population is all corn farmers in Kubu Raya Regency, amounting to 738 farmers. Samples of 60 respondents are consisting of 30 respondents from peat soil corn farmers without the method of burning and as many as 30 respondents were traditional farmers taken purposively especially farmers in Kubu Raya district that have worked more than 5 years. The variables observed in the two methods of developing corn on peat soil were land area, fertilizer use, pesticide use, production costs and yields.

3. Result

Based on the results of interviews which is a method of collecting data, that the characteristics of respondents are 96.6% married, 68.3% are male farmers, 40% are aged between 31-40 years and 25% are aged between 41-50 years, while 48.3% have worked as farmers for more than 10 years and 28.3% have been farming between 5-10 years.

The construct validity test based on the results of the calculation of the research variable indicators has a correlation value (r-count) greater than 0.254 (α= 5%), it can be assumed that the research data meet the validity standard (Field 2013). While the Cronbach alpha value of the corn development variable on peat soil was 0.702, meaning that the reliability value of Cronbach alpha was greater than the standard value of 0.700 (Field 2013; Bryman 2016; Taber 2018). Thus, all items of questions on the research variables are stated to be reliable or reliable.

Table 1. Average area of land cultivated by both groups of farmers between land without burning and traditional methods

	Method	N	Mean	Std. Deviation	Std. Error Mean
Area	1	30	.5583	.1577	.0287
	2	30	.5167	.0913	.0166
fertilizer	1	30	534.7	143.3	26.16
	2	30	325.0	92.84	16.95
Pesticide	1	30	298.6	156.2	28.53
	2	30	234.1	67.75	12.36
Cost	1	30	4136	1187	216.8
	2	30	2311	368.9	67.35
results	1	30	2.418	.4885	.0892
	2	30	1.186	.1901	.0347

Note : Method 1 = Land without burning; Method 2 = Traditional with burning

Based on Table 1, the variable area of land cultivated by both groups of farmers without the land method and traditional methods on peat soil shows a homogeneous average area, while variations in the area of land indicate that the group of farmers without the land method is more diverse than the traditional group. The fertilizer use variable shows that the non-burning farmer group method has a higher average of 60.86% and the use of fertilizer is more diverse. The poison use variable for both groups of farmers tends to be homogeneous, but the variation in the use of pesticide is more diverse in the farmer group without land method. The variable cost shows that the traditional method group of farmers is higher with a ratio of 178.97% and has more diverse variations. Yield variables show that the group of farmers without land method is higher with a ratio of 200% and has a variety of variations.

Based on Table 2, the use of fertilizer obtained t-test. The variance level of 0.107 is greater than the apha value. It means that the variation in the use of fertilizers between groups of farmers without land methods and traditional methods of farmers is homogeneous or the same. While based on the value of sig. t-test of 0,000 is smaller than the apha value, there was a rejection of the hypothesis (H_0 rejected or H_1 accepted) meaning that the use of fertilizers cultivated by the landless farmer group and the traditional farmer group there is a significant difference.

Table 2. Independent sample t-test for the use of fertilizers between groups of farmers between land without burning and traditional methods

Variables		Method	F	Sig.	t	df	Sig. (2-tailed)
Area	EVA	1	9.267	.004	1.253	58	.215
	EVNA	2			1.253	46.488	.216
Fertilizer	EVA	1	2.678	.107	6.709	58	.000
	EVNA	2			6.709	49.698	.000
Pesticide	EVA	1	10.968	.002	2.074	58	.043
	EVNA	2			2.074	39.528	.045
Cost	EVA	1	9.880	.003	8.034	58	.000
	EVNA	2			8.034	34.544	.000
Yield of harvest	EVA	1	8.899	.004	12.868	58	.000
	EVNA	2			12.868	37.588	.000

Note: EVA = Equal variances assumed; EVNA = Equal variances not assumed; Method 1 = Land without burning; Method 2 = Traditional with burning

4. Discussion

Rasau Jaya District which consists of 6 villages has a population of 26,815 inhabitants in 2017 with an area of 111,030 km^2 or 11,103 hectares in villages or sub-districts, so that the population density is 241,51 or 242 people per Km^2. The level of population density which is classified as a meeting, then the Rasau Jaya District includes a narrow / small area when compared to the area of each district in Kubu Raya Regency. The population density of each village in Rasau Jaya Subdistrict, the most populous is Pematang Tujuh village with a population of 1,544 people and a village area of 2.28 km^2 having a density level of 677 inhabitants per km^2. While Rasau Jaya II village has a population of 4,748 people and an area of 36.25 Km^2 has a density level of 131 inhabitants per km^2. Following are data on population density in Rasau Jaya sub-district. The condition of the population in 2017 reached 26,815 people consisting of 13,470 male sex people or 50.23% and female sex of 13,345 people or 49.77%. The difference in the number of men and women is very small that is equal to 0.46%.

Land is a growing medium and is a factor of production in farming. It can be stated simply that farming with a narrow area will be easier to manage compared to the relatively large land area (Purwanto *et al.* 2015). However, the greater the land area, the greater the opportunity for farmers to process their farming business, so that it will have an impact on increasing production and vice versa (Siska *et al.* 2018). According to Sujarweni (2014) to interpratinf the result from Table 2, the land area variable the sig value is obtained. The variant level of 0.004 is smaller than the alpha value in the variation of land area between the groups of landless farmers without land methods and groups of farmers using traditional methods is different. While based on the value of sig. t-test of 0.215 is greater than the apha value, the acceptance of the hypothesis (H_0 accepted or H_1 rejected) means that the area of land cultivated by the non-burn land method farmer group and traditional farmer groups is not significant. While land area has a very significant effect on increasing corn production (Fitriawati 2009), in this case the average farm area is 0.5 ha.

Giving optimal fertilizer to plants will increase better yields (Sujarweni 2014). Traditional farmers' perceptions that burning land surface will reduce soil acidity and increase soil fertility thereby reducing fertilizer use, this is not in accordance with the opinion Limin *et al.* (2003) and Malta (2011) that by burning peat land surface will damage the soil structure. According to the Director General of Plantations (Ditjenbun 2010) preventing land burning can reduce $C0_2$ emissions to 0.284 Gt $C0_2$. Fertilizer application significantly increases the production of corn. Mustopa *et al.* (2018) also found that giving the right dose of fertilizer can increase corn crop production.

According to result in Table 2, there is significant variant level of 0.215 which is smaller than the alpha value that the land area variation between the groups of landless farmers without land methods and groups of farmers using traditional methods is different. While based on the value of sig. t-test was 0.043 smaller than the apha value, there was a rejection of the hypothesis null (H_1 accepted) meaning that the use of pesticide that were cultivated by landless farmers and the traditional methods farmer groups were significant differences. Farmers' knowledge and concern about the importance of plant perticide for the success of

farming has become a necessity. This means that the awareness of farmers about one of the success of farming is preventing or reducing crop disease pests.

Costs are expenses that must be incurred in farming and are calculated to achieve production. Based on Table 2, for the variable use of costs obtained sig. The variant level of 0.003 is smaller than the alpha value that variations in the use of costs between groups of landless farmers without land methods and groups of traditional farmers differ. While based on the value of sig. t-test is 0,000 smaller than the apha value, there was a rejection of the hypothesis (H_1 accepted) meaning that the use of the costs cultivated by the landless farmer group and the traditional farmer group there were significant differences. The use of high costs in the land without burning method is one of the reasons farmers continue to maintain traditional methods / land fires (Subiksa *et al.* 2009; Mustopa *et al.* 2018; Sudirja *et al.* 2018). Efforts to increase farmers' income from a farm, in general are very dependent on the large amount of production costs, especially for the supply of land, seeds, fertilizer and labor, all of which are very influential on the size of the income and income that farmers get from their farming (Purwanto *et al.* 2015). The use of high costs in the Compost method is the wage of labor in the land clearing component.

Harvest is the amount of corn harvest obtained by farmers in a certain area. Based on Table 2, the yield variable obtained sig. The variant level of 0.004 is smaller than the alpha that the variation in yields between groups of farmers without land methods and groups of farmers using traditional methods is different. While based on the value of sig. t-test is 0,000 smaller than the apha value that there was a rejection of the hypothesis (H_1 accepted) meaning that the yields cultivated by the non-burning land group farmers and the traditional methods farmer group were significant differences. Corn yields without burning method of land on peat soil are better, one of which is due to the controlled use of ash from plant litter in the ash house, while the residual ash of combustion provides an amelioration effect with increasing pH and soil base content, so plants grow better. In contrast to traditional methods where land preparation by burning systems causes loss of carbon stocks, subsidies occur, water reserves are reduced and ultimately leads to depletion of peat layers (Subiksa *et al.* 2009).

5. Conclusion

There is a significant difference in the development of corn cultivation in peat soils between no-burning and traditional methods in the use of fertilizers, pesticides, costs, and yields. The difference in variables or factors of production is higher in the use of land without burning methods, whereas traditional methods are more efficient in the use of costs. The land area variable is not significantly different or the farm area of each farmer is homogeneous.

The development of peat soil corn cultivation without burning method is more optimal in application doses of fertilizer and pesticide. Likewise, the use of higher costs in land clearing/processing and processing fees. A difference in yields of up to 200% higher than traditional methods is assumed due to the production factors used in accordance with recommendations/recommendations for the development of corn cultivation.

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