Agricultural Environmental Management Analysis In Taebenu Sub District, Kupang District, Indonesia

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Abstract

Management of the agricultural environment will greatly determine the sustainability of an agricultural sector business. Therefore, to direct an environmental management towards sustainable it is important to analyze the management that is currently taking place at the farmer level. This research has been carried out with the aim of analyzing; 1. Agricultural environmental management by farmers in Taebenu sub-district; 2. What factors are related to the management of the agricultural environment. Spearman's rank correlation analysis was used to find factors related to agricultural environmental management.

The results of the analysis show that, 1). Agricultural environmental management is in the "Moderate" category, with an average score of 16.61 and a range of 13 – 22; 2). Factors related to the agricultural environment are: land size ($p= 0.027 < 0.05$), and farmer group membership ($p = 0.004 < 0.01$); while age, education, number of family members, and farming experience, are not significantly related to the management of the agricultural environment.

Keywords ; Management,Environment, Agriculture.

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1. Introduction

Agricultural management, to support sustainable agricultural enterprises, requires technology and practices that have been proven relevant to increase production, and environmental sustainability in accordance with local needs and conditions. Agricultural environmental management by reducing tillage, use of organic ground cover, crop rotation to improve nutrition and crop pest control and integrated, water management techniques, are important factors related to production and the environment (FAO, 2011b, 2001c citing OECD 2012: 39; UNEP, 2012: 52 in Hendrik, 2020) Although this concept of agricultural environmental management includes sustainable agricultural development as a joint commitment that must be adhered to and implemented, in reality it has not yet achieved satisfactory results. This can be seen from the number of research reports that show that farmers still carry out agriculture in an unsustainable pattern. Hendrik (2015, 2020), Nazarian (2013) for example, in his research obtained results showing that farmers in carrying out their farming still use chemical fertilizers and chemical pesticides with very different doses and frequencies. Likewise, the results of research by Bunce and Maurer 2005, Mackenzie 2008, p. 198; MacLean, 2014, p. 85; in Hendrik, 2015, shows that

on the productivity and income of farmers, the agricultural environment is negatively affected by the excessive and unbalanced use of pesticides and fertilizers, which in turn threatens the sustainability of agricultural development.

Environmental management that can be carried out in farming is illustrated by maintaining good physical, chemical and biological properties of the soil, proper crop rotation, mixed cropping and integration of plants with livestock, increasing the population of soil microorganisms through the use of organic fertilizers, recycling waste into organic fertilizers, manure. livestock, straw and other agricultural wastes which have been considered waste and handling of waste which is unused residual material from agricultural activities.

Agricultural environmental management can be measured from environmentally sound agricultural activities such as minimum tillage, use of environmentally friendly fertilizers and pesticides. Filson, Bucknell, and Hilts, 2012 research results; McCallum, 2003, quoted by MacLean (2014), states, age, gender, and education affect farmers' considerations regarding agriculture and the environment, farmers who are younger, educated and women will be more environmentally oriented. Likewise, Bunce and Maurer (2005) reported that nearly 75% of surveyed farmers follow sustainable land management practices such as low tillage cultivation, leaving crop residues on harvested land, crop rotation and/or using green manure. However, the same source also reported that 84% of farmers surveyed still depend on chemical fertilizers, pesticides, and GM seeds (genetically modified seeds). Less than 25% of farmers are involved in tree planting, and only 13% are active in environmental organizations (Bunce and Maurer 2005, cited Mackenzie 2008. pg 198)..

2. Research Methods

2.1. Sampling and Data Collection Procedures.

This research has been carried out, in the selected Taebenu sub-district, Kupang District. The sample farmers were randomly selected as many as 64 people from a total of 176 heads of farming families who live and farm in the village. Primary data collection was carried out using a questionnaire method which was carried out by visiting farmer households and conducting interviews. Key informant interviews, field observations and interactive discussions. A semi-structured questionnaire was used as a primary data collection tool.

2.2. Agricultural Environmental Management Concept

Agriculture is now widely understood as the business associated with the production of crops, livestock, fisheries and forestry that provide income, food, goods and services. As a contributor to Gross Domestic Product (GDP), in developing countries agriculture is at least twice as effective in reducing poverty as that produced in the non-agricultural sector (FAO, 2012a). Agriculture as the main user of natural resources, although in different ways and to different extents depending on the agricultural environmental management system. Besides land, about 70 percent of the water used is consumed by the agricultural sector (Kabat, 2013). In reality, some agricultural systems are the source of environmental degradation and loss of biodiversity (FAO, 2009; UNEP, 2010). Thus, in the future agriculture needs to be developed not only to provide food, decent work and income but also to address environmental challenges.

Sustainable agriculture is the management and conservation of natural resources, which is carried out in such a way as to ensure the fulfillment of human needs in a sustainable manner for present and future generations. Damaging the environment.

One approach to sustainable agricultural management is minimal input (low input).

The use of minimal inputs in a sustainable approach to agricultural systems is used on the grounds that agriculture itself has a large internal capacity to regenerate using internal resources (Ministry of Agriculture, 2010). Meanwhile, environmentally sustainable agriculture as stated by the National Research Council (NRC) is an agricultural system that can meet human needs for food but also maintain and improve environmental sustainability which includes management of the agricultural environment such as, among others (NRC, 2010): 1. Maintenance and improvement soil quality, 2. Reducing the use of chemical fertilizers, 3. Management of plant pests and diseases. Furthermore, OECD (2001) quoted Sinabell at all (2010), several supporting factors in agri-environmental are:

1. Agriculture in a broader social, economic and environmental view with contextual information (such as adding value to agriculture, agricultural work) and agricultural information sources as a source of farm income, agribusiness environmental expenditure.
2. Agricultural management indicators of all livestock, organic farming, agricultural management plans, pests, soil nutrients, irrigation and water management; 3. Use of agricultural inputs and natural resources related to nutrient use (nitrogen balance and efficiency), pesticide use and risk, and water use (water use intensity, water efficiency, water stress); 4. Environmental impacts of agriculture with respect to soil and water quality, soil conservation, greenhouse gases, biodiversity, wildlife habitat, landscape and ecosystem differences.

Environmental management that can be carried out in farming can be in the form of:

1. Maintaining good physical, chemical and biological soil properties is important in organic farming. For this reason, in organic agriculture, priority is given to soil management methods that minimize erosion, increase soil organic matter content and encourage soil biological diversity and quantity. In organic farming, soil fertility is increased without the use of synthetic chemical fertilizers. Instead, the following techniques are used: 2. Appropriate crop rotation, mixed cropping and integration of crops with livestock. 3. Increase the population of soil microorganisms through the use of organic fertilizers. Minimize processing before use. 4. In addition, the use of chemical fertilizers and synthetic pesticides is also prohibited in soil organic farming systems that interfere with the activities of soil biota, 5. Environmentally friendly agricultural practices reduce the amount of waste through recycling waste into organic fertilizer. Animal manure, straw and other agricultural wastes that have been considered waste, have become materials that have value as a source of nutrients and organic matter for organic agriculture. 6. Handling of waste which is unused residual material from agricultural activities, if not managed properly can cause pollution to the surrounding environment. Garbage that is disposed of in the surrounding environment can cause pollution to the surrounding environment such as soil, water and even rivers or water flows in the surrounding environment and this will disrupt the ecosystem. Therefore, it is very important to handle agricultural waste properly (UNEP, 2002).

2.3. Data analysis

Agricultural Environmental Management Score

Is the number of scores in environmental management which is measured based on farmers' answers to questions about agricultural environmental management. Each question is given a score of 1 to 3. Furthermore, based on the results of the maximum score obtained and the minimum score, the data on agricultural environmental management is categorized into three categories: Good, Fair, Poor. That is, based on the analysis

of the central tendency mean and standard deviation:

X < Mean-Sd = Poor
Mean - Sd < X< Mean + Sd = Moderate
X > Mean + Sd = Good

To determine the factors related to the management of the agricultural environment, Spearman Rank correlation test was carried out.

3. Results and Discussion

3.1. Characteristics of Respondents

Age

The average age of respondent farmers is 49.25 years or is in the productive age category, with a range between 30-70 years, 44 respondents (68.75%) of respondents are in the productive age (15-55 years), although there are respondents who included in the non-productive age category as many as 20 respondents (31.25%), in general these respondents stated that they were still carrying out their farming activities. The results of the study show that there is a significant positive correlation with a 95% confidence level between age and use of information sources and the application of sustainable agricultural practices (Safa, 2011, Ahmadpour, 2016), while Safa (2011) also found young farmers may be more at risk of refusing and more more receptive to new technologies and methods than older farmers.

Education

The education of respondents from the results of this study was at the lowest level from elementary school to undergraduate (S1). Most respondents' education is in the low education category, namely SD as many as 48 respondents (75.00%), the category of moderate-enough education or Junior High-SMU as many as 14 respondents (21.88%) and the Higher education category 3 respondents (4.69%) . The level of education will affect farmers in the application of knowledge and technology related to farming. The higher the level of education and the mindset of farmers, the more open they are to innovation and technology in developing their farming, including the implementation of a conservation farming system, as shown by the results of Nasaria's 2013 research; Reimers and Klasen, 2011, who show that why formal education should have an impact on productivity, various arguments have been put forward and empirically tested in the literature. First, education is expected to make farmers better "managers" by improving farmers' decision-making skills (Asadullah and Rahman 2009 in Reimers and Klasen, 2011). Second, education increases farmers' access to information and therefore enables farmers to potentially pay and receive better prices for inputs used and outputs sold (Jamison and Lau 1982 in Reimers and Klasen, 2011). Third, various empirical studies have shown that better educated farmers adapt promising new technologies faster on average and therefore have a first mover advantage (Feder et al. 1985; Hossain et al. 1990; Lin 1991; Asfaw and Admassie 2004). ; Weir and Knight 2004, in Reimers and Klasen, 2011).

Family Size

The number of respondent's family size is the number of family members consisting of husband, wife, children, and other family members who live together. The average number of respondent's family members is 3.45 or in the medium category with the lowest number of family members is 2 people and the highest number is 6 people. The number of at least family members is related to the use of family labor in running and managing the farm. The large number of family members with mature age is a source of productive labor in managing farming. According to the BKKBN (1998) in Hendrik 2019, the number of family members consisting of husband, wife, children, and other family members who living together. Based on the number of household members, large

households are grouped into three, namely small, medium, and large households. Small household is a household with less than 4 members. Medium household is a household that has members between 4 -6 people. Meanwhile, a large household is a household with more than . 7 people.

Respondents with the number of family members < 4 people or included in the few categories were 39 respondents (60.94%) and respondents with the number of family members in the medium category with the number of family members 4-6 people were as many as 25 respondents (39.06%), and there are no respondents with the number of family members in the category of many with the number of family members 7 people. The results of research by Boru et al., 2015: . shows that households with more people tend to farm more intensively and carry out critical agricultural operations at the right time compared to fewer households. This result is also supported by the results of research by Ahmadpour (2016) which shows that there is a positive and significant relationship between the number of family members and the application of sustainable agriculture.

Farming Experience

Farming experience, which is the period of time taken by the respondent as a farmer, is a benchmark for farming experience, so it is hoped that the longer a farmer carries out his farming activities, the more experienced he will be in running his farm and will also be better at managing his farm. The results of data analysis showed that the average farming experience of the respondents was 28.33 years or included in the experienced category, with a range between 7-45 years. Farming experience is the respondent's experience in running his business as a farmer which is calculated in years from the time the respondent is interviewed. A total of 62 respondents (96.88%) have farming experience which is included in the experienced category (>10 years) and 2 respondents (3.12%) are included in the moderately experienced category (5-10 years).

Farmer Group Membership

The results of data analysis showed that 52 respondents (81.25%) became members of farmer groups, and 12 respondents (18.75%) did not become members of farmer groups. All respondents stated that the farmer groups followed were horticultural farmer groups with the main activities being cultivate horticultural crops. Research conducted by Mwaura, 2014., to determine the effect of farmer group membership on the adoption of agricultural technology and crop productivity, and the results of this study indicate that membership in farmer groups results in increased banana and cassava yields, while negative impacts are observed for sweet potato, peanut-beans and corn. Group members tended to adopt inorganic fertilizers ($P < 0.01$) and superior seeds ($P < 0.05$) than non-group members. Although not significant ($P < 0.05$), the achievement of yields of 3 and 2 tons/ha for banana and cassava group members compared to non-group, sweet potato yields of 1.0 tons per hectare, higher than group members although not significant ($P > 0.05$).

3.2. Farming Characteristics

The pattern of land use owned by respondents consists of yards, rice fields, fields and mamar. These lands are generally owned for generations and managed by family personnel in addition to the mutual assistance of the farmer groups that they participate in. The average area of the yard owned by the respondent is 20.98 acre (64 respondents), rice field 30.71 acre (56 respondents), 30.64 acre field (61 respondents) and mamar 20.52 acre (48 respondents).

The farming pattern carried out by the respondents is a dry land farming pattern with the types of crops cultivated are rice, corn, cassava, vegetables, peanuts, rice beans, papaya, banana, coconut,

cashew, and coconut. Cropping patterns for rice, corn, beans and vegetables are generally planted with the intercropping pattern,
where two or more crops are planted on the same land at the same time without different row arrangements. In addition to food crops, respondents also generally plant Lamtoro (Leucaena leucocephala L) at the edge of the garden as a source of animal feed. Lamtoro plants are also known as conservation plants because they are able to maintain soil fertility, as cover crops in water conservation technology can reduce evaporation, especially in dry land farming systems where rainwater is the main water source in farming. (Liu et al., 2018; Peng et al., 2019, Luo et al. 2020).
Farm land can be categorized based on the area owned by the respondent. land area is grouped into three categories, namely: 1).Small, ie the land area is less than 50 acres, 2). Medium, ie land area between 50 - 200 acres and 3). Large, which is land with an area of more than 200 acres. There is no category of land owned by respondents that is included in the category of small arable area with an area of <50 acres, in the medium land area category with an area of 50-200 are 23 respondents (35.94%) and farmers who have land large > 200 acre 41 respondents (64.06%)

3.3. Agricultural Environmental Management.
The results of data analysis showed that the average score for environmental management in agriculture was 16.61 or was in the moderate category, with a range of 13 – 22.. Respondents included in the category of poor environmental management were 15 respondents (23.44), in moderate category were 33 respondents (51.56) and good category were 16 respondents (25.00%). The distribution of respondents based on the category of agricultural environmental management is as shown in Table 1

Table 1. Distribution of Respondents by Category of Agricultural Environmental Management

Score	Category	Number of Respd	Percentage (%)
< 14,27	Poor	15	23,44
14,27– 18,95	Moderate	33	51,56
>18,95	Good	16	25,00
Total		64	100,00

Respondents who are in the good category are respondents who dispose of inorganic waste such as bottles and cans of used fertilizers and pesticides in public waste disposal sites that have been provided, perform minimum soil management, do not burn crop residues but use it as ground cover, perform crop rotation. On the other hand, respondents with the category of "bad" environmental management do not separate organic waste from inorganic because it is considered unimportant, waste is simply thrown away or burned around the garden/field .

In dealing with waste such as bottles, cans or plastic used for pesticides or fertilizers, 7 respondents (10.94%) stated that they just dumped around the fields or fields, 55 respondents (85.94%) stated that they bury them in the ground, and only 2 respondents (3.12%) stated that they put them in plastic bags to be disposed of in public trash. For the question whether respondents separate waste such as stems, twigs and leaves (organic) from plastic waste, cans and bottles (inorganic), 7 respondents (10.94) stated that they often separate organic waste from inorganic waste, 44 respondents (68.75%) stated that they sometimes separate waste, and 13 respondents (20.31%) stated that they never separated organic and inorganic waste.

Respondents in the good environmental management category also generally have participated in environmental activities in the village and actively seek and share information with fellow farmers, and often participate in

environmental activities in the village such as tree planting. and conversely respondents in the category of poor environmental management are respondents who have never participated in environmental activities, are not actively seeking information about environmental management both in the village and in groups where the respondent is a member. Respondents in this category generally stated that it was important to dispose of agricultural waste such as bottles and cans of used pesticides and fertilizers in landfills in order not to pollute and poison plants. In addition, respondents also stated that it is important to separate organic and inorganic waste.

The annual report of the United Nations Environment Program (UNEP) states that the handling of waste, which is unused residual material from agricultural activities, if not managed properly can cause pollution to the surrounding environment. Garbage that is disposed of in the surrounding environment can cause pollution to the surrounding environment such as soil, water and even rivers or water flows in the surrounding environment and this will disrupt the ecosystem. Therefore, handling agricultural waste is very important to be done properly (UNEP, 2002,) . However, in reality there are many challenges that must be faced in efforts to improve for a better environment for the sake of farming continuity. The results of Hendrik's (2015) research, Nazarian (2013), for example, in his research obtained results showing that several characteristics of respondents were significantly related to environmental behavior and agricultural environmental management.

3.4. Factors associated with Agricultural Environmental Management

The results of the Spearman rank correlation analysis show that the factor that correlates with agricultural environmental management is land size ($p = 0.027 < 0.05$) or significantly correlated. This result also supports the results of Massawe's 2017 study which found that one of the demographic and household characteristics that Affecting household farming choices is land area., Farmer group membership ($p=0.004 < 0.01$) or a very significant correlation, this result is in line with Mwaura's research, 2014, to determine the effect of farmer group membership on the adoption of agricultural technology and crop productivity. , and the results of this study indicate that membership in farmer groups results in increased yields of bananas and cassava, while negative impacts are observed for sweet potatoes, beans and maize. Group members tend to adopt inorganic fertilizers ($P < 0.01$) and superior seeds ($P < 0.05$) than non-group members. this result is as in table 2

Table 2. Factors related to Agricultural environmental management

Factors	Correlation Coefficient	Significance
Age	0,060	0,640
Education	-0,111	0,384
Family Size	-0,018	0,087
Farming experience	-0,057	0,657
Farmer group member	0,352	0,004*)
Land size	0,227	0,027*)

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed)

Factors that are not correlated with agricultural environmental management are: age ($p=0.0640>0.05$), education ($p=0.384> 0.05$), farming experience ($p=0.657>0.05$), and number of family members ($p=0.087>0.05$). Shams and Fard 2017. In their research, they write that the results of the correlation analysis show that age has a negative significant relationship with farmers' attitudes towards organic farming. In addition, the results of Massawe's 2017 study, found that the education level of the head of the household is one of the demographic and household characteristics that influence

household farming choices. Households with a larger number of people tend to farm more intensively and carry out critical agricultural operations at the right time compared to households with fewer household members (Boru et al., 2015; Swai et al., 2012), sources The same also stated that large households are important for providing labor because most household members participate in production activities, an increase in household size is associated with planting on more land.

Respondents are generally small farmers with a small land area, generally farming with the aim of meeting the needs of their own households or subsistence farmers, and the types of crops being cultivated are horticultural crops and food crops of upland rice and corn. carried out once a year, namely in the rainy season. With 4-5 months of rainy months and low and erratic rainfall, the harvest failure factor is also higher. These things are the main supporters so that this study finds the factors that correlate with the management of the agricultural environment, namely the area of farming land and membership of farmer groups, so that in an effort to develop agricultural environmental management it is important to consider these two factors. a serious challenge for the implementation of an environmental management technique is the problem of limited land as farming capital, adaptation to erratic rainfall. This challenge, although difficult in the future, will be overcome by the existence of several policies that support the reduction of fragmentation and conversion of agricultural land. The government's role is very important. important in overcoming the challenges that will provide support for sustainable increases in agricultural productivity.

4. Conclusion

From the results and discussion, the following conclusions can be drawn:

1. Agricultural environmental management is in the “good enough” category, with an average score of 16.61 and a range of 13 – 22; 2.
2. Factors related to the agricultural environment are: land area (p= 0.027 < 0.05), and farmer group membership (p = 0.004 < 0.01); while age, education, number of family members, and farming experience, are not significantly related to the management of the agricultural environment.

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