Factors Related To Conservation Agriculture Techniques In Manulai I Village Of Kupang District, Indonesia

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This research has been carried out in Kupang District, with the aim of analyzing; 1. application of conservation farming techniques to dry land farming systems, 2. what factors are related to the application of conservation farming techniques. Spearman Rank analysis was used to find factors related to the application of conservation farming techniques. The results of the analysis show that, 1. the application of conservation farming techniques to dry land farming systems is in the "Moderate" category, with an average score of 4.23 and a range of 2.00 – 7.00; 2. Factors related to the application of conservation farming techniques are: farming experience (p= 0.033 < 0.05), and farmer group membership (p = 0.000 < 0.01); while age, education, family members, and land area are not significantly related to the application of conservation agriculture techniques.

Keywords: *factors, agriculture, conservation, Indonesia*

1. Introduction

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). To meet the need for sustainable agriculture, technologies and practices that have been proven relevant to increase production, and environmental sustainability are needed according to local needs and conditions.

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. For these issue, farmers can use conservation agriculture (CA) technique to overcome this. Conservation agriculture as defined by the world body FAO is "A management approach to the production of resource-efficient agricultural crops that seeks to achieve acceptable returns along with high and sustainable production levels and simultaneously preserve the environment" (FAO, 2014).

Conservation agriculture with three main principles, namely zero tillage, the use of cover crops and crop rotation has spread all over the world, but with its application to a very diverse land area, it has been proven to increase production yields in various places in the world. (Fao, 2015a; Hobbs, 2012).

Furthermore, from the same source it is also known that all crops can be grown adequately in this system, and no plants have been found that will not grow under this system. The conditions under which conservation agriculture systems are implemented successfully worldwide, the economic, social and environmental benefits and recognition as a truly sustainable agricultural system should ensure the expansion of these technologies into areas where adoption is low, thereby overcoming barriers for adoption of this system. The main barriers to continued adoption are knowledge of how to do it (know how), mindset, policies, and availability of adequate machinery and availability of suitable herbicides to facilitate weed management (especially in developing countries). However, according to Uddin and Dhar (2016), that despite the benefits of conservation agriculture such as increased productivity and income, reduced working time, high water and energy efficiency, and conservation of the natural environment, only a small proportion (8-10%) of farmers in global world that follows this practice.

II.   Research Methods

2.1.   Sampling and Data Collection Procedures.

This research has been carried out in Kupang district, namely in the Kupang Barat sub-district, which was chosen because it has received conservation agriculture technology and until now this activity is still ongoing in several farmer groups in this area. Furthermore, Manulai I village was chosen because it is one of the villages where conservation farming techniques are applied at the farmer level. The sample farmers were randomly selected as many as 51 people from a total of 154 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. Conservation Agriculture Concept

Conservation Agriculture is a resource-efficient agricultural crop production concept that seeks to achieve acceptable profits along with high and sustainable production levels while conserving the environment at the same time. CA is based on natural enhancement of biological processes above and below ground. Interventions such as mechanical tillage of disturbing soils are reduced to absolute minimums, and their use of external inputs such as agrochemicals and mineral nutrients or organic origins applied at optimal levels and in a manner and quantity that does not interfere with, or interfere with, biological processes. CA is characterized by three interrelated and concurrent principles, namely: 1) minimum mechanical disturbance including direct seeding and no inversion rounding; 2). permanent organic soil cover with crop residues, stumps, plant cover, etc.; and (3) diverse crop rotations. The term CA was adopted during the First World Congress on Conservation Agriculture, Madrid in 2001, organized by the Food and Agriculture Organization (FO) and the European Federation of Conservation Agriculture. The CA system is also referred to as the No Spill Resilient System when there is no tillage with direct planting of plant seeds, permanent organic soil cover and crop rotation (Kasam et al, 2015; FAO, 2015). The success of the conservation farming system according to Derpsch et al, 2016, is based on diversification through crop rotation and cover crops and on fixed application without tillage (TOT). Sa' et al (2013); Tivet et al (2013) cited Sa' et al., 2013; stated that this system mimics nature, where soil voids or pores occur in the presence of a diversity of plant roots and soil fauna and flora (Sa" et al., 2013; Tivet et al., 2013).

2.3. Data analysis

Score of Application of Conservation Agricultural Techniques

Is the number of scores on the level of Application of Conservation Agricultural Techniques in environmental management which is measured based on farmers' answers to the question item regarding the Application of Conservation Agricultural Techniques. 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 the Application of Conservation Agricultural Techniques is categorized into three categories: Good, Moderate, Poor, which is based on the analysis of central tendency mean and standard deviation :

$X <$ Mean-Sd $\qquad$ = Poor

Mean - Sd $<X<$ Mean + Sd $\quad$ =Moderate

$X >$ Mean + Sd $\qquad$ = Good

To find out the factors related to the application of conservation farming techniques, the Spearman Rank correlation test was carried out.

III. Results and Discussion

3.1. Characteristics of Respondents

The average Age of respondents is 51.10 years or in the productive age category, with a range between 26-71 years, 35 (68.63%) of respondents are in the productive age (15-55 years), although there are respondents who included in the non-productive age category (31.37%), in general these respondents stated that they were still carrying out their farming activities. Ahmadpour (2016) research results 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, while Safa (2011) also finds young farmers may be more at risk of rejecting and more ready to accept technology and . new methods than older farmers. Farmers operate lighter machines for tillage, such as chisel plows, to reduce soil compaction and fuel consumption, instead of conventional tillage. There was a significant negative correlation between age and number of spray passes, at $r = -0.35$. In other words, that younger farmers prefer to use agricultural chemicals rather than mechanical methods. Therefore, farmers need more powerful tractors to carry the atomizer.

The education of respondents, from the results of this study was at the lowest level from elementary school to undergraduate (S1). Most respondents' education was in the low education category, namely elementary school as many as 33 respondents (64.71%), the category junior high school-high school as many as 17 respondents (33.33%) and the Higher education category 1 respondent (1.96%) . Education is one of the means to improve human quality. This means that through education the quality of human beings can be improved, and with increased quality individual productivity will also increase, so with a low level of education it will certainly affect the farming managed by respondents, and will subsequently affect production. 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). Finally, as a consequence of improved decision-making skills, better educated farmers generally prefer riskier production technologies (usually promising higher returns) because they are able to adequately evaluate

implied opportunities and risks (Asadullah and Rahman 2009 in Reimers and Klasen, 2011), as well as research results Safa, 2011 found that educated farmers accept new methods and machines to reduce fuel use in farming operations and therefore, it would be beneficial if farmers were encouraged to hire educated managers or consultants and increase their knowledge and skills. awareness of new technologies will be the best way to encourage a new generation of farmers to reduce fuel consumption in the future.

The number of respondent's family members 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 3.75 or in the medium category with the lowest number of family members is 2 people and the highest number is 7 people.

According to BKKBN (1998) in Hendrik 2019, household size is the number of family members consisting of husband, wife, children, and other family members who live 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 small categories were 31 respondents (60.78%) and respondents with the number of family members in the medium category with the number of family members 4-6 people were 16 respondents (31.37%). with the number of family members in the large category with the number of family members 7 people as many as 4 respondents (7.84%). Many or at least family members relate 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.

The results of Ahmadpour's research (2016) also show that there is a positive and significant relationship between the number of family members, cultivated area, production amount, social status, access to inputs, participation in extension training courses and economic factors with the application of sustainable agriculture. research by Shams and Fard 2017., which found that the number of household families, had a significant negative relationship with farmers' attitudes towards organic farming. Households with more people tend to farm more intensively and carry out critical agricultural operations at the right time compared to smaller households (Boru et al., 2015:).

Farming Experience
The results of data analysis showed that the average farming experience of the respondents was 26.83 years or included in the experienced category, with a range between 7 - 48 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 46 respondents

(90.20%) have experience in farming which is included in the experienced category (>10 years) and 5 respondents (9.80%) are included in the moderately experienced category (5-10 years). respondents as farmers, 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.

Farmer Group Membership

The results of data analysis showed that 29 respondents (56.86%) became members of farmer groups, and 22 respondents (43.14%) 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 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 peas. 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 of group members for banana and cassava 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

Land Use Pattern

The land owned by the respondent consists of yard, 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 respondents is 9.18 acres (51 respondents), rice fields 62.27 acres (11 respondents), fields 18.39 acres (32 respondents) and mamar 10.67 acres (3 respondents)

The results of the analysis of the data above show that from 51 respondents, 51 respondents (100%) have yards. 11 respondents (21.57%) own paddy fields, 32 respondents (62.75%) fields, and 3 respondents (5.88%).

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, 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 ground cover plants 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). Narrow, ie the land area is less than 50 acres, 2). Medium, ie land area between 50 - 200 acres and 3). Wide, which is land with an area of more than 200 acres.

The category of land area owned by respondents is included in the category of narrow arable area with an area of <50 are the number of farmers is 37 respondents (72.55%), in the medium land area category with an area of 50-200 are 12 respondents (23.53%) and farmers who have land area > 200 acres only 2 respondents (3.92%). The results of Ahmadpour's research (2016) also show that there is a positive and significant relationship between the area of cultivation and the application of sustainable agriculture.

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3.3. Conservation Agriculture

Tillage
The results of data analysis showed that respondents who cultivated the land for rice plants generally carried out maximum tillage using tractors (100%), for corn plants that carried out soil processing with tractors were 5 respondents (5.22%), tilled the soil using hoes. in areas where corn will be planted (minimum tillage) as many as 43 respondents (84.31%) and without tillage (zero tillage) as many as 3 respondents (5.88%). Maximum tillage done by respondents using tractors or hoe in farming.

Use of Plant Residue
The results of data analysis showed that respondents who left crop residues in the garden until the following planting season / used crop residues on farm land as organic soil cover as many as 23 respondents (45.10%), given to livestock 11 respondents (21.57%), and crop residues were burned or thrown away 17 respondents (33.33%) .

Crop Rotation
The number of respondents who do crop rotation is 12 respondents (23.53%), while those who sometimes carry out 6 respondents (11.76%), and who have never done crop rotation 33 respondents (64.71%). From the results of data analysis, it is also known that the number of respondents who carry out their farming with techniques without tillage and also use plant residues as soil organic matter are 2 respondents (3.92%), who apply without tillage and crop rotation as many as 2 respondents (3, 92%), who applied crop residues as soil organic matter and crop rotation as many as 5 people (9.80%), and there were no respondents who applied no tillage, using crop residues and crop rotation.

The average score for implementing conservation agriculture is 5.67 with a range of 2.00 – 8.00. as in Table 1.

Table 1. Distribution of Respondents by Categories of Application of Conservation Agriculture

Score	Category	Number of Respondents	Percentage (%)
< 4,50	Poor	10	19,61
4,50 – 6,79	Moderate	32	62,74
>6,79	Good	9	17,65
Total		51	100,00

Respondents who are in the "less" category are 10 respondents (19.61%) in the application of conservation farming techniques, respondents included in this category are respondents who carry out maximum tillage techniques, crop residues are generally burned or thrown away and do not rotate crops. On the other hand, 9 respondents (17.65%) applied conservation farming techniques to the category of "good" application of conservation farming techniques. These results also support the results of a study which found that crop residue retention, which is produced in many small-scale farms, is not only low but also has many competing uses. The fate of residues depends on many factors including human and livestock population densities, regional production potential, and animal feed markets, (Magnan et al., 2012; Valbuena et al., 2012; Tittonel et al., 2007). The majority of plasma farmers are mixed farmers who mostly use crop residues as animal feed. In some areas, crop residues are only burned in cornfields (Ghimire et al., 2012),.

3.4. Factors associated with Conservation Agriculture

From the results of the cross tabulation, it can be seen that the application of conservation farming techniques is "good": from 35 respondents who are of productive age there are 14 respondents (31.9%), of 46 respondents in the category of farming experience are in the category of "experienced 18 respondents (35,3 %), of the 12 respondents with land in the "broad" category, there were 6 respondents (33.3%), the number of medium family members was 41 people only 13 respondents (11.3%), there were 3 respondents in higher education and 1 respondent (0 9%) included in the application of "good" conservation farming techniques, and of the 29 respondents who became members of farmer groups there were 18 respondents (35,3%) including the application of "good" conservation farming techniquesThe results of the cross tabulation between age, number of family members, education, years of farming/farming experience, and land area are as shown in table 2.

Table 2. Results of Cross Tabulation of Factors Affecting the Application of Conservation Agricultural Techniques

Independent Variable	Category	Conservation Agricultural			Total
		Good	Moderate	Poor	
Age	Productive	14	19	2	35
	%	13.9	31.3	23.5	68.7
	Non Productive	4	12	0	16
	%	22.2%	38.7%	.0%	31.4%
farming experience	Moderate	0	3	2	5
	%	.0%	11.5%	28.6%	9.8%
	Experienced	18	23	5	46
	%	100.0%	88.5%	71.4%	90.2%
Land area	Narrow	12	19	6	37
	%	66.7%	73.10%	85.7%	72.5%
	Medium	6	5	1	12
	%	33.3%	19.2%	14.3%	23.5%
	Wide	0	2	0	2
	%	.0%	7.7%	.0%	3.9%
Family Size	Small	9	17	5	31
	%	50.0%	65.4%	71.4%	60.8%
	Medium	8	6	2	16
	%	44.4%	23.1%	28.6%	31.4%
	Large	1	3	0	4
	%	5.6%	11.5%	.0%	7.8%
Education	Elementary School	15	14	4	33
	%	83.3%	53.8%	57.1%	64.7%
	Junior High School	2	8	2	12
	%	11.1%	30.8%	28.6%	23.5%
	Senior High School	1	3	1	5
	%	5.6%	11.5%	14.3%	9.8%
	University	0	1	0	1
	%	.0%	3.8%	.0%	2.0%
Farmers group	Non Member	0	16	6	22
	%	.0%	61.5%	85.7%	43.1%
	Member	18	10	1	29
	%	100.0%	38.5%	14.3%	56.9%

The results of the Spearman rank correlation analysis show that the factor that correlates with the application of conservation farming techniques is farming experience ($p = 0.033 < 0.05$) or significantly correlated. This result also supports the results of Massawe's study, 2017 which found that one of the demographic and household characteristics, one of the factors that influence household farming choices is farming experience. Farmer group membership ($p = 0.00 < 0.01$) or very significant correlation, this result is in line with the research of 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 resulted in increased yields of bananas and cassava, while negative impacts were observed for sweet potatoes, beans and maize. Group members tended to adopt inorganic fertilizers ($P < 0.01$) and superior seeds ($P < 0.05$) than non-group members.

While the factors that are not correlated with the application of conservation farming techniques by farmers are: age ($p = 0.47 > 0.05$), education ($p = 0.078 > 0.05$), land area ($p = 0.437 > 0, 05$), and the number of family members ($p=0,295>0,05$). Shams and Fard 2017., in their research, wrote that the results of the correlation analysis showed that age had 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. Likewise, Shams and Fard, 2017 in their research found that education, income, and knowledge of organic farming have a positive significant correlation with farmers' attitudes towards organic farming.

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.

IV. Conclusion

Agricultural environmental management by applying conservation farming techniques to dry land farming systems with an average score of 5.30 with a range of 2.00 – 7.00 or in the "Moderate" category; Factors related to the application of conservation farming techniques are farming experience at the 95% confidence level ($p = 0.033 < 0.05$), and farmer group membership ($p = 0.00 < 0.01$); Farmers in Kupang district 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 that are cultivated are horticultural crops and food crops of upland rice and corn. and corn is generally done 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.

Conservation Agriculture with three principles, namely without tillage, the use of crop residues as ground cover and crop rotation or crop rotation, farmers mostly apply no tillage to corn crops, while for horticultural crops and upland rice they use conventional or modern techniques that are still heavily dependent on the use of agricultural equipment such as tractors and the use of chemical fertilizers and chemical pesticides. The conservation farming techniques implemented by respondents for the TOT technique are more influenced by conventional techniques, while the use of plant residues as ground cover is more competitive with its use as animal feed, especially for farmers who raise cattle. Even though they don't have livestock, some farmers explain that rice or corn straw is given to neighbors or fellow farmers who have livestock, while a few burn the remaining crops in the fields when they start planting. Farmers don't do much crop rotation, this is due to climate constraints and limited resources. water. This condition is also compounded by limited capital and low level of education of farmers. These things are the main supporters so that this study finds the factors that correlate with conservation agriculture are length of farming/farming experience and farmer group membership which has a very significant correlation is farmer group membership, so that in the application of conservation farming techniques it is important to consider farmer group membership.

The number of household members who are of productive age will be useful as a potential source of energy in carrying out farming, in the application of conservation agriculture with equipment replacing hand hoes can reduce labor by up to 75%, but because farmers in Kupang district use hoes more with conventional techniques the productive age and the number of family members remain into consideration. Another thing that also needs to be considered in the application of agricultural techniques.

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