Characteristics of organic rice cultivation of farmer groups at Gajah sub- district, Demak district, Central Java Province, Indonesia

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Abstract. Research was aimed to study the organic rice cultivation technology practiced by farmers at Gajah sub-district, one of organic rice centers in Demak district, Central Java Province, Indonesia. Survey method was used throughout the experiment. Sample of respondents were taken from 3 different organic rice farmer groups such as *Sri Rahayu, Mawar* and *Kumpulsari* at Mlatiharjo and Gedondong villages. Primary data was collected quantitatively by distributing questionnaires to the respondent. Data was analyzed to evaluate the performance of inter-group observation and relationship of behavioral levels of organic rice cultivation. The results showed that the dominant level of organic rice cultivation technology were moderate category (78.33%), high category (16.66%), and less category (5.00%), respectively. There was significant difference in regression relationship $Y = 18.400 + 0.298\ X_1 + 0.188\ X_2$ ($R = 0.544$) between knowledge and attitude toward organic farming cultivation level. The *Mawar* farmer group showed the highest behavior of organic rice cultivation (36.5 score), but it was not significantly different from *Sri Rahayu* (34.71 score) and *Kumpulsari* (32.57 score). The level of appplication of organic rice cultivation technology among farmer group was uniform in the medium catagory so it still need to be developed, score).

1. Introduction

Agricultural sector is one of the main contributors of high economic growth of Indonesia. At present the population of Indonesia reaches 226 millions and about 56.35% live in the Java island. It has an area of only 32,548 km^2 of Indonesia area of 5,455,675 km^2 with a land area of 1,910,931 km^2 so agricultural land of Java island is dominated by "narrow land" [1]. Under theses condition, strategy that should be conducted in narrow land farming is to increase crop productivity through improvement of genetic and production environment. Central Java province has population of 34,551,900 so that the population density is 1,061.56/km^2.

Rice is the staple food of Indonesia. Its production in Indonesia currently reaches 80 million tons with the contribution of lowland rice production reached 75 million tons [2]. The level of national rice production is about 53.35 kuintal/ha, while it in Central Java province reaches 56.59 kuintal/ha. Organic rice cultivation is becoming a trend recently and it will be developed in the future as the awareness of healthy food needs and environmental sustainability. Organic farming aims to produce agricultural products especially as food that is safe for consumers besides organic farming activities do not affect environmental degradation.

Organic farming becomes a farming system that may comprehensively support and accelerate biodiversity, biological cycles and soil biological activities [3]. Organic farming is agriculture based on the biological nutrient recycling process. This nutrient cycle comes from byproducts of plants and livestock or other waste that plays a role in improvement physical, chemical and biological soil

fertility [4]. The products obtained are high quality and quantity of food, natural crop cultivation as well as being a driver and enhancement of the biological life cycle of agricultural ecosystems. Organic farming also maintains and enhances long-term soil fertility, avoid all forms of pollution as a result of the application of agricultural techniques, maintains and increases genetic diversity and suppresses social and ecological impacts [5]. The purpose of organic farming systems is to maintain natural harmony with the maximum utilization and development of natural processes in managing farming systems [6]. Organic matter play an important role in the soil. Soil organic matter is also an indicator for soil health. Healthy soil shows high levels of organic matter wich is around 5% vice versa. Soil health is important to ensure agricultural productivity. Organic matter in the soil is the source of all nutrients in the biological cycle that plants need, giving them the ability to store water and create soil structures that create agroecosystem health [7]. Organic fertilizer has the advantage because it contains all the nutrients needed by plants compared to inorganic fertilizers, eventough the content of nutrients is relatively low [8].

The important of soil orgnic matter becomes a common awarenees, because its contains all the complete nutrients, stimulates soil microbial activity, forms a good soil structure so that it produces good aeration, high water retention, enhances cation exchange capacity, suppress the rate of nutrient leaching, adsorb Al and Fe in acid soils so that the availability of essensial nutrients is increased as well as neutralize saline soils [9]. Organic farming is becoming a new orientation in the future both by producers and consumers related to awareness of the dangers of using agricultural chemicals. Organic farming technology is sufficiently available through compost technology, biological fertilizers, organic pesticides, minimum tillage or zero tillage and others [10].

Organic farming is part of an integrated farming system because this system combines agriculture, animal husbandry, fisheries, forestry and other science related to agriculture in one land productivity, land development and conservation programs and integrated village development. The agricultural system may integrate the activities of agricultural sector and its supporting sectors both vertically and horizontally according to the potential of each region by optimizing the utilization of existing local resources [11].

Lowland rice is the main commodity as the main source of food for the Indonesian people. Its cultivation which is known today conventionally is actually modern agriculture that relies on superior seeds with the application of inorganic artificial fertilizers. Lowland rice is one type of food crops that needs to be planted organically to produce healthy food. Organic rice must be approved by an independent body, planted and processed according to established organic standards. The characteristics of organic rice are: (a) Does not contain synthetic or artificial chemical pesticides and fertilizers that have been used, (b) Soil fertility is managed through a "natural" process that is planting cover crops, use of organic fertilizer from manure and composted plant waste, (c) crop rotation to avoid planting the same crop continuously from year to year in the same paddy field, (d) Use of non-chemical materials, to control pests and weeds through predator insects to prey on pests and use straw to suppress weeds, also organisms another to suppress the disease [12]. Accordingly, organic rice is superior compared to non-organic rice, relative for consumption because it does not contain chemical residues, texture is fluffier, with a stronger shelf life. The superiority of organic rice is to encourage farmers to do organic cultivation, besides that consumers feel safe eating organic rice [13]. Indonesian organic rice has penetrated markets in several countries, such as Italy, America, Singapore, Malaysia, and the United Arab Emirates (UAE). The tendency of interest in organic products is in line with the increasing market for these products. America is the largest organic product market with a value of 27.04 billion US dollars, and followed by Germany, France, and China with a value of 8.45, 4.8 and 2.67 billion US dollars, respectively [14].

Based on the organic rice export market opportunity that has economic prospects, the Central Java Government also has a policy of developing organic rice farming in the form of socialization and technical guidance. The results of the policy on developing organic rice farming in Central Java may be seen as an example in Demak district. Communities in Gajah sub-district, Demak district are familiar with environmentally friendly agriculture, namely organic rice farming. This is evident from the combination of farmer groups that have implemented organic rice cultivation, both those that are still in the conversion stage and those that have been certified, in addition to the marketing links that

have been formed. The aim of the research was to study of characteristies of rice cultivation of farmer group at Gajah sub-district, Demak district, Central Java propince, Indonesia.

2. Materials and Methods.

The observational research was conducted by survey methods of farmer groups at Gajah sub-district, Demak district, Central Java Propince, Indonesia. The survey was conducted on farmer population with sample of responden were taken from all three defferent organic rice farmer group such *Sri Rahayu, Mawar and Kumpulsari* at Mlatiharjo and Gedondong village. The survey was conducted to determine of the descriptive and the causal relationships of the research variables as different observation groups at three different groups. Primary data were collected quantitatively by distributing questionnaires to the respondent. Respondents were all the members of organic farmers in Gajah sub-district, Demak district. The groups of 60 respondents were *Sri Rahayu (*29 respondents), *Mawar* (20 respondents) and *Kumpulsari* (11 respondents) farmer groups, respectively. Secondary data was collected based on documents related to the research.

The observed parameters of characteristics of rice cultivation of farmer were behavioral level of technology application including knowledge, attitude and application of organic farming. Data were analyzed to evaluate the performance of inter-group observation and relationship of behavioral levels of organic rice cultivation. Total score of the knowledge was 15-60, meanwhile attitude score was 8-32 and total score of application was 10-40. The data was processed descriptively to obtain the frequency distribution of Organic Agriculture. Behavior Level of farmers was divided into high, moderate and not good. Multiple regression analysis was to determine the relationship between knowledge and attitudes toward skills. Kruskal Wallis analysis was to determine the comparison of knowledge, attitudes and skills among farmer groups.

3. Results and Discussion

3.1. Identity of Respondents

Identity of respondents (Table 1) were grouped into five categories, namely nature of work, farming experienced, wetland ownership, yard ownership, and livestock ownership, respectively. Based on the nature of work about 75.00%, 8.33% and 16,66% of the farmers work as farmers, farmer-ranchers and others, respectively. Based on farming experience, the respondents were divided into farming experiences of less than 10 years, 10-15 years and over 15 years. On the basis of the criteria of farming experienced, 31.66%, 11.66% and 56.66% of the farmers respectively were more than 15, less than 10 and 10-15 years experienced. Meanwhile, respondents of organic rice farming at Mlatiharjo and Gedondong villages of Gajah sub-district have not been fully supported by the integration of livestock farming. Based on the ownership of paddy fields, 21.66%, 65% and 13,33% of the farmers were classified as farmers with paddy field less than 1000 m^2, between 1000-5000 m^2 and more than 5000 m^2, respectively. Meanwhile, based on the yard area ownership of 28.33%, 23.33% and 8.33% of the respondents respectively has a yard area with an area of less than 500 m^2, between 500-1000 m^2 and more than 1000 m^2. Based on livestock ownership about 73.33% of respondents own poultry between 10-100 heads, 40.00% own goats/sheep between 2-10 heads, and 21.66% own cattle between 2-5 heads, respectively. Even though there were 28.33%, 23.33% and 8.33% respondents, respectively raised 10-100 poultry, 2-10 sheep, and 2-5 cows. Respondents' farmers in general have narrow land tenure, which is 65.00%, 21.66% and 18.33%, consecutively own 1,000 - 5,000 m^2, less than 1,000 m^2, more than 5,000 m^2 of land tenure.

Tabel 1. Identity of Respondent Farmer Group at Mlatiharjo dan Gedondong, Gajah Demak

No	Respondent's identity	Number of respondents	Proportions (%)
1.	Nature of job	45	75.00
	• Farmers	5	8.33
	• Farmers-ranchers	10	16.66
	• Others		
2.	Farming experienced		
	• <10 years	7	11.66
	• 10 – 15 years	34	56.66
	• >15 years	19	31.66
3.	Wetland area ownership		
	• < 1.000 m^2	13	21.66
	• 1.000 – 5.000 m^2	39	65.00
	• >5.000 m^2	8	13.33
4.	Yard area ownership		
	• <500 m^2	15	25.01
	• 500-1.000 m^2	25	41.66
	• >1.000 m^2	20	33.33
5.	Livestock ownership		
	• Cow (2-5 head)	5	8.33
	• Goat/Sheep (2-10 head)	14	23.33
	• Poultry (10 – 100 head)	17	28.33

Agricultural cultivation should still be oriented to high productivity by applying low-input technology from outside the farm by utilizing as much as possible local resources to increase farmers' income [15]. The rapid increase of the Java island population resulted in increasingly narrow agricultural land. On the other hand, the quantity of land conversion on the island of Java has a culture of parents will bequeath the division of land to children from generation to generation, resulting in a narrowing of the area of agricultural land that turned into non-agricultural land of housing and industry. Decreased agricultural land due to land fragmentation or inheritance patterns, in turn makes business interest in agriculture decreases. Narrow land tenure results in lower profitability and farm efficiency. The problem of narrow land tenure for agricultural cultivation needs to be overcome by increasing productivity and business efficiency. Integrated organic farming cultivation is the hope of agricultural farming on narrow land.

3.2. The Behavior Level of Application of Organic Rice Cultivation

The long rice cultivation experience of the respondent farmers brought the behavior level of the application of dominant organic rice cultivation technology 78.33% in the moderate category while the rest 16.66% and 5.00% in the good and the low categories, respectively (Table 2). This gives a clue that respondent farmers are quite successful in developing themselves to behave as a group of farmers cultivating organic rice farming. The behavior of the application of organic rice cultivation technology of farmer respondents in the moderate level category was supported by 75.00% of the attitude of the application of the technology of organic rice cultivation in the moderate category, good category and less 16.66% and 10.00% respectively. This condition was supported by the knowledge and skills in implementing the application of organic rice cultivation which is also dominant in the moderate category, 51.66% and 60.00%, while the remaining good categories were 40.00% and 30.00%, consecutively.

The level of decision of farmers in implementing technology was influenced by the level of knowledge and attitudes towards a technological innovation. The higher the level of farmers' decision

to apply organic fertilizer, the higher the level of application of organic fertilizer [16]. The attitude of the respondents of moderate category towards organic farming resulted in the decision of respondent farmers to apply organic rice cultivation technology in their village. Even though the level of knowledge and skills was dominated by the moderate category, the development of organic rice farming in the villages of Mlatiharjo and Gedondong has been successful. Based on a qualitative interview with the respondent of the head of the farmers group, it was proven that the process and organic rice products were in a transition period, but the productivity was classified as good, between 4-5 tons/ha milled dry rice with the mainstay of very diverse local varieties including *mentik wangi, mentik susu* and *cinta mur*. Although it was known that research results in Demak *IR-64* and *Chiherang* rice crop productivity, it was shown that bio-slurry dosage of 8.5 ton/ha replaced the role of inorganic fertilizers achieved higher production [17]. Various rice products were marketed in the form of premium bulk rice ready for consumption at a price of only IDR 10,000/kg at the mill level. Although the category of production was moderate, it was economically quite good because of minimal external input, both fertilizers and pesticides. Irrigation needs to be improved so that it is truly guaranteed because it comes from primary water sources or the need for filters to be cleaner.

Tabel 2. Organic Agriculture Behavior Level of farmers at at Mlatiharjo dan Gedondong, Gajah Demak

No.	Cultivation behavior	Number of respondents	Proportions (%)
1.	Knowledge of organic farming		
	Good	24	40.00
	Moderate	31	51.66
	Not good	5	8.33
2.	Attitude to organic farming		
	Good	18	30.00
	Moderate	36	60.00
	Not good	6	10.00
3.	Application of organic farming		
	Good	10	16.66
	Moderate	45	75.00
	Not good	5	8.33
4	Cultivation behavior level of organic farming		
	Good	10	16.66
	Moderate	47	78.33
	Not good	3	5.00

This success shows that the application of the "Standard Operating Procedure - Good Agriculture Practice" has been carried out largely by joint members of farmer groups. The level of application of organic rice cultivation was related to the availability of production facilities and product selling prices [18]. The application of organic fertilizer may simultaneously apply the technology of low external input sustainable agriculture (LEISA) because it uses input from local resources both organic fertilizer and organic pesticides [19]. The application of organic rice cultivation technology shown by the organic rice cultivation skills score was influenced by the knowledge possessed and the attitude in approving the application of organic fertilizer. There was significantly different of regression relationship $Y = 18.400 + 0.298\ X_1 + 0.188\ X_2$ ($R = 0.544$) between knowledge and attitudes towards the skill level of applying organic rice cultivation technology. However, the regression relationship showed that the positive regression coefficient was not significant ($P<0.05$) both knowledge (X_1) and attitude (X_2). This shows that the application of organic rice cultivation technology still needs to be developed especially by increasing the level of

knowledge and understanding of attitudes to improve skills in the application of organic rice cultivation technology.

Agricultural technology development is a complex process because it was influenced by internal and external factors [20]. Internal factors are derived from the farmers themselves in receiving knowledge, attitudes and willingness to apply the application, while external factors are the availability of resources, information and technology (Table 3). Farmer respondents joined in three farmer groups, *Sri Rahayu*, *Mawar* and *Kumpulsari*, respectively had a score of behavioral application of organic rice cultivation technology was 24.37; 26.45 and 25.27. These were reached by the *Mawar* farmer group at an average higher value, but not significantly higher than the *Sri Rahayu* and *Kumpulsari* farmer groups. The total behavioral score of the application of organic fertilizer was in line with the attitude and skill scores, the *Mawar* farmer group was significantly different ($P<0.05$) compared to the *Sri Rejeki* and *Kumpulsari* farmer groups, but the *Mawar* farmer group's knowledge was not significantly higher than the *Sri Rejeki* farmer group but was significantly different ($P<0.05$) compared to *Kumpulsari*. This also shows that there was still a need for equitable level of knowledge, attitudes and skills in the application of organic rice cultivation technology hence that all farmer groups may further develop creative application of organic rice cultivation technology, so that productivity increases.

Tabel 3. Differences in Behavior of Organic Farming between Farmers Groups

Farmer groups	Knowledge	Attitude	Application	Cultivation behavior of organic farming
Sri Rahayu	45.55a	32.20b	24.37a	34.71b
Mawar	47.25a	35.80a	26.45a	36.50a
Kumpulsari	41.18b	31.27b	25.27a	32.57c

Different letters follow the values in the same column with significant difference ($P<0.05$).

4. Conclusions

The results concluded that the level of behavior in the application of organic rice cultivation technology in Gajah sub-district was generally dominant at the moderate category (78.33%) and followed by the good and not good category, respectiely were 16.66% and 5.00%, respectively. The category being the application of organic rice cultivation technology was closely related to knowledge and attitudes in the application of organic rice organic fertilizer. The level of application of organic rice cultivation technology among farmer groups was uniform in the medium category so it still needs to be developed.

The category of attitude and application towards the application of organic rice cultivation technology which was currently categorized shows that there was still a need to increase knowledge and skills for the further development of the application of organic rice cultivation technology to achieve certification.

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