ADOPTION OF TECHNOLOGY OF ORGANICS VEGETABLES CULTIVATION BY FARMERS IN THE AREA OF MOUNT MERAPI ERUPTION YOGYAKARTA INDONESIA

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ABASTRACT

Vegetables are one of the types of commodities while the much-cultivated by farmers in the area of the slopes of Mount merapi. Mount merapi's eruptions resulted in the large number of damaged land so is impacting productivity decreased organic vegetables. The Government is encouraging farmers to cultivate organic vegetables with cultivation technology in the form of adopting Standard Operational Procedure (SOP) The farmers who conducted organic farming have to adopt various organic cultivating aspects in order to reach organic harvest. The purpose of this research are to identify characteristics of farmers, to analyze farmer's application rate of the technology of organic vegetables cultivation, and to analyze about correlation between characteristics and adoption rate. The methods used in this research is descriptive analysis method and analysis of rank spearman

The results show that the average of farmers's age is 45 years old.. Average field area is in 3.666 m². Farming experience has an average in 11 years. Partner duration has a younger in 2-3 years and the older has 8 years partnership. 90% farmers make this onfarm as a priority, and then the field status 11 farmers are the owner his field and 4 farmers have a rent status, the nearest farmers are in 3 Km meanwhile the fartest is in 62 Km. Farmer's adoption rate is very high, 88.1 percent of farmer adopted the technology as recommended by Standart Operational Procedure (SOP). The relationship between the characteristics and the adoption rate is interpreted through the correlation coefficient, it was found that the relationship with the characteristics of the low adoption rate

Keywords: adoption, cultivation, farmer's characteristics, organic vegetable

INTRODUCTION

Vegetables are one of the types of commodities while the much-cultivated by farmers in the area of the slopes of Mount merapi. Mount merapi's eruptions resulted in the large

number of damaged land so is impacting productivity decreased organic vegetables. The Government is encouraging farmers to cultivate organic vegetables with cultivation technology in the form of adopting Standard Operational Procedure (SOP) The farmers who conducted organic farming have to adopt various organic cultivating aspects in order to reach organic harvest.

Cultivation of organic vegetables in a practical understanding or regulation of a technological innovation to meet the needs of the community will be the vegetables that do not provide long-term negative effects in the form of chemical residues for the body and the environment. Innovation will be essential to be adopted by farmers because there are various treatments that must be done.

The program to improve horticultural production carried out so far have not been in a holistic manner or on the basis of the resource, but it is still partially or on the basis of the commodity which is generally more favorable productivity of land resources, with feedback inputs (fertilizers and pesticides) inorganic into an agro-ecosystem agriculture is quite high. Farming system is only oriented to maximize productivity significantly, but less recognized is followed by a deterioration of environmental quality and the reduction of production stability by the emergence of biotypes and strains of pests and diseases, the formation of toxic compounds for plants, and declining soil fertility, as well as damage to the environment by the use of pesticides excessive (horticultural crops Protection Directorate, 2014).

People's desire to consume organic vegetable products is affected by the awareness of communities seeking to implement a healthy lifestyle. Vegetables are an important source of food for public consumption every day for protein, vitamins, minerals and fiber which is owned vegetable useful for the human body. Long-term impact of conventional farming is the health problems caused by the presence of residual chemicals contained in vegetable products (Saragih, 2010). In the understanding of practical, organic farming is a

method of farming that does not use synthetic chemicals. The main goal of organic agriculture is to optimize the health and productivity of the community who are related to one another in the soil, plants, animals, and humans (Saragih, 2010).

Cultivation of organic vegetables in a practical understanding or regulation of a technological innovation to meet the needs of the community will be the vegetables that do not provide long-term negative effects in the form of chemical residues for the body and the environment. Innovation will be important to be adopted by farmers as actors cultivation because there are different treatments to be done. Farmers benefit by adopting the cultivation of organic vegetables, because as a producer farmers can sell organic products are produced with high prices, even 10-50 per cent higher than the price of conventional agricultural products (FAO, 2002).

Adoption of farmers to agricultural technologies is largely determined by the need for technology and technology conformity with the biophysical and socio-cultural conditions. Therefore, the introduction of an innovative new technology must be adapted to specific conditions. Adoption is the decision to use a completely new idea as a way of acting the most good. (Suprapto and Fahrianoor, 2004).

Information on the extent of adoption of the farmers at every stage, which aspects that have and have not been adopted, as well as the possibility of a relationship between the characteristics of farmers with increased adoption need to know, then the problem in this research are: (a) How do the characteristics of organic vegetable farmer in the area of Mount Merapi eruption? , (c) How to organic vegetable farming technologies adopted by farmer, (d) How relationships factors of Farmers characteristic with application of organic vegetable cultivation technology. The purpose of this research are : (a)Identify the characteristics of organic vegetable farmers in the area of Mount Merapi eruption, (b) Analyzing the level of aplication of farmers on all aspects of organic vegetable cultivation technology, (c) Analyzing

the correlation between the characteristics of farmers with a level of organic vegetable cultivation technology

MATERIAL AND METHODS

The method used in this research is descriptive analysis method. Determination of research area is done deliberately or purposive sampling based on the characteristics or nature areas with special consideration. The research area is taken Ngablak, Magelang and Balangan, Wukirsari, Cangkringan, Sleman, Yogyakarta, which is an area of volcanic eruption. The number of farmers is taken a sample of 15 people.

The adoption rate is measured by looking at the suggested use of technology is starting from land preparation, seeding, maintenance, harvesting and post-harvest. From all variable rate of adoption of the obtained amount of maximum score is 50 and a minimum score of 10, the adoption rate category is divided into five categories:

1. Very Low with a range of scores 10-17,9
2. Low with a range of scores 18-25,9
3. Medium with a range of scores 26-33.9
4. High with a range scores 34-41.9
5. Very High with a range score 42-50

Factors of characteristics that affect farmers adopting organic vegetable cultivation technology were analyzed quantitatively by using Spearman rank correlation test

γs = Spearman rank correlation coefficient

N = number of samples

di = the difference between variable ranking

RESULTS AND DISCUSSION

A. Characteristics Farmers

Characteristics of the farmers in this study included age, formal education, farming area, farming experience and status of the land

Table 1. Distribution of characteristic of farmer

Variable		n	%
Age (Years)	18-40	5	33,3
	41-60	8	53,4
	> 60	2	13,3
Formal Education	Junior High School	4	26,6
	Senior High School	10	66,7
	Bachelor	1	6,7
farming area (m^2)	< 2.000	6	40,0
	2.000-5000	8	53,3
	>5.000	1	6,7
farming experience (years)	5-10	10	66,7
	11-15	2	13,3
	16-20	2	13,3
	>20	1	6,7
status of the land	Owner	11	73,3
	Rent	4	26,7

Age farmers pertaining to the implementation of a farming operation, it is also related to the management of aquaculture farmers in doing so the thinking abilities to make decisions organic vegetable cultivation becomes more mature. According to Hurlock (1994) by age groups of respondents can be grouped into three initial or early adulthood (ages 18-40 years), middle-aged adults (aged 40-60 years) and older adults age (age above 60 years). The high number of farmers in the productive age is expected to optimize its role in the adoption of organic vegetable cultivation technology and optimizing production inputs that impact both for the sustainability of farming, from table 4 is also known that the distribution of the age of majority at the

age of 18-40 years means that in the cultivation of organic vegetables requires the ability in the effort to apply to be categorized into organic vegetables.

Formal education shows the length of the farmers mengeyam school education. Education is very important for everyone, both in everyday life as well as farmers do with the ability of farmers receptive to new technologies and other agricultural information as well apply. The level of formal education will affect the mindset of someone in the face of something so as to make way decisions are different from one another. At the farmer's level of formal education will also affect the rate of adoption of organic vegetable cultivation technology. Based on table 1 is the level of formal education, respondents were more concentrated at the level of high school (SMA) that as many as ten farmers (66.7 percent), farmers who graduated from S1 by one farmer (6.7 percent), and the rest just being in junior high school graduation as many as four farmers (26.6 percent). This means that the formal education levels of farmers are in a level adequate to absorb the use of innovation and technology cultivation of organic vegetables is characterized by minimal formal education reached junior high schools, in addition to the farmer respondents who have education level of high school ie bachelor's degree are expected to have a mindset more open and many try new things to improve productivity in the field of organic vegetables

The land area is a picture of the area of land cultivated by farmers CV partners. Organic Farmer Merapi (CV.TOM) is, Based on research results acreage farmers who tilled by peasant majority is in the category of land was that the area between 2000-5000 m² by 8 farmers, or 53.3 percent, then farmers who have land category small farmers as much as 6 or 40 percent of the remaining 1 or 6.7 per cent of farmers have a large area of more than 5,000 m². Some farmers who have small

land caused by agricultural land leased or also from parents passed on to the farmers, so that the farmer requires dividing the acreage with their next of kin.

Farming experience indicates how long the respondent cultivate the field of agriculture, before an organic vegetable farming, most respondents've been in the field of agriculture both in theory and in practice. The more experienced farmers it is hoped will be adopted the organic vegetable cultivation technology because it is more related to the control of the farm had gone through. From Table 1 known to respondents who have farming experience more than 20 years as one farmer or about 6.7 percent, between 16-20 and 11-15 years respectively of two farmers, or 13.3 percent, and between 5-10 years as many as 10 farmers, or 66.7 percent.

Status of arable land is land ownership status of each farmer respondents. The status is private property, or lease. As many as 66.6 percent of respondents, or 10 farmer is the owner of his farm land, and the remaining 26.6 percent of respondents, or 4 farmers use the land leased, note also that respondents who use the rent is also no use sharing system. The percentage of organic vegetable tenure in Table 4 shows the status of land ownership is important, because tenure is expected to encourage farmers to devote every effort and power in his land, by selecting the sustainable cultivation. Status in their own land, encouraging a sense of freedom in applying new technologies for the sustainability of farming better.

B. Adoption of Organic Vegetable Cultivation Technology

Organic vegetables are also environmentally friendly and more to the concept of nature (back to nature). Agricultural cultivation is done without the use of chemical fertilizers and pesticides. This makes organic vegetables free of chemical residue so it fit for consumption and healthy. According Prestilia (2012) in his thesis mentions

that organic vegetables grown naturally then these vegetables contain a variety of advantages compared with non-organic vegetables. One of the advantages of organic vegetables are safe from chemical residues, so as to support health. This makes consumers to switch from conventional to organic vegetables vegetable.

In Isdiayanti study (2007) also mentioned that vegetables organic vegetables is a commodity much in demand to be developed at this time resulting from agricultural cultivation is done without the use of chemical fertilizers and pesticides. The specialty of organic vegetables contain antioxidants is 10-50 percent above the organic vegetables. Antioxidants, commonly known as a substance that helps and needed by the body and can heal diseases which are immune substances. Organic fruits and vegetables are known to contain vitamin C and essential minerals such as potassium, phosphorus, magnesium, iron and chromium, higher than anorganic..

Cultivation of organic systems are already regulated by Government Regulation contained in SNI-01-6729-2002 covering all the good organic farming organic vegetables and organic food.

1. **Land Preparation**

Ttillage. Any length of the conversion period, organic food production only starts when the production has got control system, if the entire land cannot be converted at the same time, it should be done gradually. Converting from conventional farming to organic farming techniques should effectively use permitted. If all agricultural land cannot be converted simultaneously, the overlay must be divided into several units. The area is in the process of conversion, and the areas that have been converted to organic food production should not be changed (back to normal or otherwise) between food production methods of organic and conventional. Fertility and biological activity of the soil must be maintained or enhanced by planting

legumes (*Leguminoceae)* and mix the organic matter into the soil in the form of compost or not, from the production unit. Byproducts farms, such as animal manure, may be used if it comes from farms that do comply with the requirements.

At the stage of preparing land farmers must apply three indicators: land preparation, land management, irigation management. From Figure 1 it is known that in Adoption in the preparation stage there are three indicators that must be applied by the farmer respondents, each indicator there are also aspects of adoption. In preparation indicator in total has reached a very high level of adoption which reached 0.92 but in the third aspect, the first and second aspects of achieving very high levels but in the third aspect only achieve high adoption rate category only it is known from the majority of respondents did not have dolomite lime and assume that their land has been good so it does not need the addition of dolomite lime, actually on aaspek first and second there are some farmers who apply adoption incorrectly because their land is less and vegetables that they grow a lot of the width and length of the raised bed sometimes not carried out in accordance with the recommendation of adoption. On the second indicator, the total levels of adoption reached into the high category, known also in the second aspect has the arithmetic mean of the most low because many farmers indifferent to the remains of plants and grasses, as well as the thought that they could dry yourself so do not do, but there are also People think that sometimes there is a pest that comes from the remnants of grass dry them. In the third indicator, the first aspect and the second in the category of low because farmers to implement its place in well construction is inadequate and most irrigation is done by using a pump, directly from the river. But overall adoption rate in land preparation is in conformity with the recommendations set.

2). **Seeding**

The next stage is the nursery, there are two indicators that the procurement of seeds and seedlings. Seeds and seedlings must come from plants grown using natural means without genetic engineering is not appropriate, in this standard for at least a generation or two seasons for crops. If the operator can demonstrate to the authority / agency official certification that seeds and seedlings required is not available then the authority / agency sertifiasi can allow that there are early stages can be used seeds or seedlings without treatment, or if not available, it can be used seeds and seedlings are already got a particular treat. The competent authority may establish criteria to limit the exception of the exclusion.

From Figure 2 it can be seen that in Adoption in the nursery stage there are two indicators to be applied by the respondent farmers, seed procurement In indicator in total has reached very high levels of adoption, reaching 0.88 is supported on all aspects therein very well done , In a first aspect known to have the lowest score because there are farmers who use seed from own production and there are also seeds that are not available in the CV. TOM since the stock is not there, then the farmer take from the outside. On the second indicator also have achieved levels are very high but in the second aspect only reached the level of adoption of high category alone it is known from respondents who cut the time span of fertilization that they thought that it was not until a week had their land ready for planting da tones are not apply for fertilization has been done at the beginning of the preparation. But overall adoption at the Nursery has reached very high category and

farmer respondents is considered appropriate to apply the recommended SOP of CV. Organic Farmer Merapi (TOM).

3) Maintenance and control of Plant Pest Organisms

Fertilization was prioritized using biological fertilizer (biofertilizer) is a soil conditioner materials that contain microorganisms or living cells in a dormant state which serves to increase the availability of nutrients to support plant growth. Some types of microbes commonly used among other microbes nirogen fastening elements, phosphate solvent microorganism, and growth hormone-producing microorganisms. In addition, there are types of microbes from the group called mycorrhizal fungi are found as the source of a potential biofertilizer to improve crop productivity. Biofertilizer or biological fertilizers of this kind are environmentally friendly and can maintain soil quality on an ongoing basis. Pests, diseases and weeds should be controlled by one or a combination of species and varieties appropriate rotation program that is appropriate, tillage mechanically, protection of natural enemies of pests through provision of suitable habitats such as creating a living fence and a nest buffer zones ecology which maintain the original vegetation of the local pest predators, giving natural enemies including release of predators and parasites or mulching.

From Figure 3 it was known that the adoption in the maintenance phase includes two indicators watering and fertilizing as well as control of Plant Pest Organisms (OPT), both these aspects have reached very high levels of adoption. In the first indicator was the lowest value in the second aspect that is only reached moderate levels of adoption as it is known in the field that many farmers do not apply these aspects, that when plants were damaged or wilted farmers do not replace them with new ones. On the second indicator, the third aspect is considered to be

applied in accordance with the recommendations there, out of the total maintenance stage is all suggestion is considered to be applied very well supported by the outcomes achieved adoption category into the category very high.

4). Harvest

Harvest results conducted after the planting period corresponding mature or fulfill criteria for each type of plant. Collection of production, growing naturally in natural areas, forests and agriculture, can be considered organic production methods where: (a) the products come from an area which is undefined so do the actions of certification / inspection in this standard; (B) the area is not getting treatment with the other ingredients; (C) harvesting does not disrupt the stability of the natural habitat or the maintenance of the species in the collection area; (D) the products come from oparator who manages the harvesting or collection of products, which are clearly identified and properly recognize the collection area.

5). Post-harvest

Handling, transportation, storage, processing and packaging of organic food product integrity must be maintained during the processing phase. This can be done by using appropriate means and careful to minimize the purification and the use of additives and processing aids. Such as ion Radiation (Ionizing Radiation) for pest control, food preservation, elimination of pathogens or sanitation, are not allowed to do on organic food products. Food processing methods should be mechanical, physical or biological (such as fermentation and smoking) as well as ingredients and additives minimizes the use of non-agricultural. Packaging packaging materials should be selected from materials that can be decomposed by microorganisms (bio-degradable

materials), recyclable materials (recycled materials), or materials which can be recycled (recyclable materials);

Storage and transport of organic product integrity must be maintained during storage and transport, as well as dealt with using preventive measures as follows: (a) Organic products must be protected at all times so as not mixed with non-organic food products; and (b) Organic products must be protected at all times in order not touched ingredients that are not permitted for use in organic agricultural production systems If only part of certified products, the other products should be stored and handled separately and both types of products should be able to be identified clearly. Storage of organic products must be separated from conventional products and must be clearly labeled. For storage areas and containers for the transport of organic food product should be cleaned using methods and materials permitted to be used for organic agricultural production systems. If the storage area or container that will be used not only for food products oganik, then it should do the security measures that organic food products are not contaminated with pesticides or other materials.

Based on Figure 4, it can be seen that the application made on harvest and post-harvest has reached very high levels. However, as the data presented in Figur 4, the first indicator of the harvest, there is only one aspect of being applied is not optimal because in that aspect there are farmers who let their crops are exposed to sunlight for too long. On the second indicator of post-harvest, farmers have to apply all aspects of the maximum recommended.

Level Organic Vegetable Cultivation Technology Adoption

In the calculation of the rate of adoption, calculated based on each variable stages of adoption itself is the stage of land preparation, seeding, planting, maintenance, harvesting and post-harvest. Then the results will be known percentage of achievement of each variable stages of adoption. The adoption rate overall is presented in the following table:

Table 2. The Adoption rate Overall

No	Stage	The Mean Score obtained	Achievement (%)
1	Land Preparation	11,9	74,2
2	Seeding	9,3	91,2
3	Planting	4,7	92,5
4	Maintenance	8,9	86,2
5	Harvest and Post-Harvest	9,7	96,2
	Adoption In Overall	**44,5**	**88,1**

From table 2, can be informed that the overall adoption reaching a percentage of 88.1% meaning that it has entered into the category of very high based on the interval of five categories. At the stage of land preparation, there are three indicator with a maximum value of each indicator by 5 and a minimum score on each indicator is 1, at this stage the average scores obtained in the amount of 11.9 out of a total score of 15, the accomplishments are calculated from the scores obtained reduced by score total of at least three indicators divided by the maximum total score minus the total score of at least the importance of the achievement of 74.2% at the stage of land preparation, it can be said at this stage of adoption classified into categories based on the interval high percentage of very low categories 0-20, 21-40 categories of low, medium category 41-60, 61-80 and 81-100

high category is very high category. Then on stage nurseries tedapat 2 indicator with a maximum value of each indicator that is equal to 5 and a minimum score on each indicator is 1, at this stage the average score obtained is equal to 9.3 of the total score up to 10 then to calculate achievement scores obtained reduced by a minimum total score divided by the maximum total score minus the total score of at least then obtained a percentage of achievement in the nursery stage by 91.2% and categorized as very high.

At the planting stage there is only one indicator only, the maximum value is 5, while the minimum value of 1, the average score obtained for 4.7 and later known accomplishments of 92.5% in the category is very high, while the next phase of the maintenance stage there 2 indicators, the average score obtained at this stage is by 8.9 of a total maximum of 10, then the achievements can be seen at 86.2% and into the category of very high as well. The rest, harvest and post-harvest stages with 2 indicators, obtained an average score of 9.7 this stage of a total maximum of 10, the percentage achieving the adoption is found to be 96.2% and classified at very high category. So overall it can be concluded that the adoption carried into the very high category.

Analysis of Characteristics Relationship with Technology Adoption Rate

Rogers and Shoemaker (2007) says that a person's characteristics will influence the perception which will influence the actions or behavior. Characteristic according to Rogers (1995) is covering socio-economic status, personality traits and behavioral communication. In more detail these characteristics are translated back into the age, formal education, non formal education, family size, experience farming, family business, family income, kekosmopolitan, the participation of

community institutions, participation in groups, and media contacts as well as the characteristics of the adopter allegedly had a relationship with the perception of a person in connection with the adoption of the innovation process, involving the search for new ideas. While Soekartawi (1988) mentions that the main characteristics of adoption and diffusion of innovations consist of:

1). Age; Older farmers are less inclined to do the diffusion of agricultural innovations than those who are relatively young.

2). Formal education; The level of education both formal and nonformal farmers will affect the way of thinking that is applied to the business that is in the rationality of business and the ability to utilize any existing economic opportunities. The higher the level of education, the adoption of innovation will tend to be high. Education is also a reciprocal process of every human person in coping with nature, friends and the universe.. formal education is the education level of the lowest to the highest is usually given as an organized delivery of education outside the school system, the content of educational programs.

3). Non-formal education; in the form of training or counseling that is a system that is non-formal education or an education system outside the regular school system, which indicated the means of achieving something with that person while still satisfying to do it themselves so learn to do yourself.

4). Farm size; The area of land for farming, farm size is often positively associated with the adoption of innovation.

5). Land ownership; the owners can make a decision to adopt the innovation in accordance with keinginanannya, but the tenant must obtain the consent of the owner first. Consequently, the adoption rate is usually higher in farming than the farmers owners who rent. To determine the relationship with the characteristics of

farmer adoption level partners against each phase of cultivation on organic vegetable cultivation SOP then analyzed with SPSS.

Table 3. Adoption correlation analysis with characteristics

Characteristic	Adoption Level	
	Corellation coeficient	Category
Age	-0,01	Very low
Formal Education	0,41	Moderate
Area Farming	-0,29	Low
Farming Experience	-0,20	Low
Status of Land	-0,11	Very Low

The older the respondent, usually the more slow in adopting something new or new innovations, because of their abilities and tend to only engage in activities that have been implemented by local communities or of a general nature.

Education is very important for everyone; both in everyday life as well as farmers do with the ability of farmers receptive to new technologies and other agricultural information as well apply. Formal education is the structure of a teaching system that chronological and tiered educational institutions ranging from pre-school up to college. They are educated is relatively faster in implementing the innovation adoption. Likewise those who are less educated, they will be more difficult to implement the adoption of innovations quickly than those with high education (Soekartawi, 2005).

The land area is a picture of the area of land cultivated by farmers. According Lionberger in Mardikanto (2003) in terms of farm size, the broader usually slowed adopt, because it has more production needs. The results showed, in an area less than 2000 m2 has a higher adoption of more than 2000m2 area due to the narrow area will be easier to control everything related to organic systems so that applications do tend to be higher.

In the correlation calculation result, farming experience with adoption rate has a value of r (correlation coefficient) is -0.20, the correlation coefficient was interpreted in a lower category and the correlation between these two variables is negative, meaning that the longer farming, the adoption rate is likely to be lower due to these farmers follow the activities that have become habit History.

On the count of correlation values obtained correlation coefficient (r) of -0.11 correlation coefficient is interpreted in a very low category and correlation in this study between these two variables is the opposite, respondents who are land owners adoption of organic vegetables that do tend to be lower.

CONCLUSIONS AND RECOMMENDATIONS

Characteristics of the respondent farmer's organic vegetable growers in the area of volcanic eruption: Respondents aged 26 years, while the lowest was the highest of 63 years the average age of 45 years. At the level of formal education, respondents were more concentrated in junior high, high school and Bachelor. Vast majority of farmers are farming on a medium that is 2000-5000 m² area and the level of a relatively large land area owned only by one farmer alone and an average area of 3,666 m². Experience farming majority are at least 5-10 years and over more than 20 years with an average of 11 years

The adoption rate of organic vegetable production farmers in the volcano eruption area as a whole is at very high category. The relationship between the characteristics and the adoption rate is interpreted through the correlation coefficient, it was found that the relationship with the characteristics of the low adoption rate.

Advice for farmers in the eruption of the volcano can implement the entire SOP cultivation technology of organic vegetables as recommended in order to produce optimally and efficiently.

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