The Benefits of Organic Fertilizer Application: Case Indonesia: Garut and Sragen Regencies[1]

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Abstract

This paper examine the benefits of applying the organic fertilizer on the rice paddy. We use 200 farmerôs households as a case. We compare whether applying organic fertilizer is more beneficial to farmers. To account for the influence of other factors we include education, years of farming, location, and whether farmers operate under the farmer groups or individual. The results show that organic fertilizer could increase the farmerôs income. In addition the productivity is higher with organic fertilizer compare to the chemicals. Farmers mentioned that productivity will decrease during the first two to three years of organic fertilizer application. Therefore, government subsidy is needed to increase the application of the organic fertilizer. Moreover, agriculture extension and farmer group speed up the organic fertilizer adoption. Farmer understanding the importance of the organic fertilizer is a key to increase their willingness to apply it. It is up to the government to facilitate the farmers.

1. Introduction

The Indonesian government set policy to induce farmers to grow organic paddy in 2001. After 10 years, the government intensify the

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effort to promote the use of organic fertilizer through the òGo Organic Campaign.ò The farmers response vary. The application of new technology depend upon: 1) whether the use of organic fertilizer increase production, 2) increase the efficiency, 3) increase the farmerôs income, 4) other possible strategy, and 5) government policy. In this paper we limit the analysis a) farmers readyness to face *technology change*, b) how farmer respond to *risk and uncertainty*, c) the *speed of adoption*, and d) production efficiency. The analysis based on the farmers behavior in Garut in West Java and Sragen (Central Java).

2. The Use of Organic Fertilizer in Indonesia

The Ministry of Agriculture (2010) stated that decrease in the agricultural productivity due to the over application of the chemical fertilizer and pesticide for a longer period that damage the quality of land and the environment. The decrease in the paddy productivity was caused by the degrading quality of the top soil. Not only the low quality of top soil reduces the productivity but decrease the quality of paddy. The land quality degradation observed in Banten, West Java, Central Java, East Java, Yogyakarta, South Sulawesi, South Sumatera, and West Sumatera. The degraded area covers 96 percent (38 percent of worst, 50 percent medium, and 8 percent minimum damage).

In addition, analysis at the farmers level in 6 provinces (West Java, Centtral Java, Lampung, West Sumatera, West Kalimantan and South Sulawesi) recorded over application of the chemical fertilizer above the recommended level. In fact, in the long term quality arable land will deteriorate due to depletion of nutrients that plants need to be called Earth fatigue symptoms (Pingali and Gerpacio, 1997). Therefore, the decrease in productivity resulting from land degradation should be anticipated.Berdasarkan perkembangan di atas, Program "Go Organic 2010" by the Ministry of Agriculture is used as an extension of the momentum of the movement back to the popularization of organic farming technology products that have been initiated since 2001.

Organic farming system that had previously been done by our ancestors are updated and turned on again. Many farmers, among others in Sleman, Garut, Sragen, and Magelang has performed extensively since the early 2000s, while others have not been interested because they do not know the benefits, especially for the improvement of soil properties (Utami and Handayani, 2003; Saepurrohman, 2003; Sugiyanto et al 2006 and 2010). The positive impact of organic farming has been widely recognized, among other things: First, producing quality products that people need, the Second, was able to get around the cost of production so that more light, Third, environmentally safe and legal use of balance, and Fourth, build an agricultural civilization friendly environment.

However, changes in the use of chemical fertilizers to organic fertilizers will not increase production and income directly. Farmers in Sragen for example, have to wait 2-3 years after the switch to using organic fertilizers, new rice production increased (Sugiyanto et al, 2006). In addition, organic rice market is also growing, so the sale of rice / rice may not be smooth organic white rice. These things cause why the adoption of organic fertilizer for rice is rather slow.[2]

Learning from the success of Guidance (Bimas) in the past, one key to successful development of the High Yield Variety, HYV in 1970 provided an example. By seeing itself the result of the use of superior seeds, farmers have become convinced that they felt the information was incomplete (incomplete information) and uncertainty (uncertainty) about the new technology can be reduced. For the case of developing countries, such as risk reduction should be considered in making decisions amid uncertainty, (Just, 2008). The implication is a necessary precursor (pioneers) who are willing to be an example in applying organic fertilizer. During this pioneering role was made chairman of the farmer groups. But, acknowledges that not all groups of farmers went well. Limitations and barriers to farmer groups

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[2] Government to facilitate the implementation of the program Go Organic 2010 starting from the policy-making system, the socialization of organic food, organic food preparation system of infrastructure, institutional preparation, preparation of the facilitator / trainer of organic farming systems, preparation of organic inspectors, including facilitating access to markets for organic products quality.

inactivity accelerating adoption of organic fertilizer.

Sources of information reflects the reliability of information retrieved. Farmers, although they can get information from newspapers, radio, or TV, was more confident for the people closest to the Field Extension Officers (PPL) and chairman of the farmer groups. Since decentralization in 2001, the "conflict" if the PPL to be an employee or an employee area of the central government, functional or structural, drafting SOTK (Organizational Structure and Work) areas that are not in favor of the interests of extension to the role of PPL in the eyes of the farmers are becoming less and less. This led to the adoption of new technologies to be obstructed.

Furthermore, organic rice takes cow manure and urine that can not be met from internal resources of the household. Increasing the scale of agricultural production will ensure the availability of organic fertilizer. Cattle in groups that have been conducted in Lombok NTB and various other areas could be the answer to this problem. Uniformity is needed from the cropping pattern in blocks / fields to ensure the purity of organic rice, not contaminated with rice from other type of neighboring fields. Therefore, application of organic rice farming is usually done in groups (blocks). Cooperation of farmers, following the direction of group leader or PPL are the key to successful organic farming. The diversity of types of fertilizers (rejection of the deal the group) to threaten the purity of organic rice produced. [3]

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[3] So far, empirical studies that highlight the partnership focused on corporate behavior relationships (principal) by the farmer (agent) in terms of how the diversion contract. Associated with principal-agent theory, although the agricultural company (principal) and farmers (agents) have been bound by a formal contract, but the possibility of substantial deviation of behavior contract. This happens because when signing the contract, have not seen the actual behavior of individuals who undergo the contract. The emergence of behavioral deviations in a partnership contract between the actors as described above often the case that ended with the termination of cooperation that can endanger and threaten the sustainability of the partnership. Whether the deviation will also

From various studies show the group or partnered could increase the farmers' income (Grosh, 1994; Key and Runsten, 1999, Warning and Key, 2002; and Winter, et al 2005). With a group, farmers can reduce the uncertainty factor and inaccurate information that has become a barrier to immediately implement their new technology. Inaccuracy of information, uncertainty, and high transaction costs that have been neglected in the analysis using the model of neoclassical economics (North, 1995) should be an important consideration in adoption research and policy introduction of new technologies such as the case of organic fertilizers.

In addition, most of our farmers are landless farmers (having land less than 0.5 ha) so that their lives depend on a parcel of land and have an aversion to risk, avoid risk, high. When farmers have switched to using organic fertilizer, they invest in the uncertainty (of investment under uncertainty), (Dixit and Pindyck, 1994). Farmers need to diversify risk or a reduction in adoption fees as an incentive. Farmers lose the option to diversify their land given the limited technical and ineffective when the planting of two rice varieties (which uses organic fertilizer co-exist with chemical fertilizers) on the same stretch. Farmers need incentives so that they take the choice to adopt organic fertilizer for rice production. In the past it has been perceived threats and intimidation of farmers to participate in the program Bimas. Currently, the government uses the policy of subsidies, free fertilizer aid, and tools to produce organic fertilizer.

The next problem is whether the use of organic fertilizers led to higher land productivity and production processes are more efficient than using chemical fertilizers. Experience shows that in the early stages of a change in the use of chemical fertilizers to organic fertilizers led to declining land productivity, (Sugiyanto et al. 2006 and 2010). After 2-3 years, rice production back to its original level and even more. Nevertheless, analysis compares the productivity needs to be done with caution. There are many factors that affect the productivity of the land so that comparing the production per hectare

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occur when the relationship between the farmers are relatively similar (with fellow farmers in approving the use of organic fertilizers)? Is contract rejection becomes less often?

of organic and non organic rice will direct bias, (Lichtenberg and Zilberman, 1986).

Comparison of fertilizer efficiency in production is also influenced by how long the farmers to use organic fertilizer technology. Farmers who are in the same field does not always make the adoption of organic fertilizer at the same time. Data cross-sectionis often used to estimate the production function as the basic measurement efficiency is not able to capture differences in the rate of adoption of technology because it is not uniform among farmers in a expanse. Estimation using a long panel data allows the use of dummy variables (time and place, fixed effects) to detect differences in technology. However, panel data-based farm households may not be easily obtained.

Furthermore, in determining the use of inputs, farmers will always consider the combination of inputs and other conditions. Unfavorable weather, the rain too much or too little, affects the amount of fertilizer to be used. Similarly apply to pesticides and manpower. Interactions between inputs with weather variations, which are usually treated as a disturbance variable (error variable) reduces eksogenity and causes inaccurate ordinary least squares estimates. The alternative is to use the GMM (Generalized Method of Moment), (as done by Druska and Horrace, 2004 and Zengfei et al. 2006).

In addition, the farmer looked differently between organic rice technology with the use of chemical fertilizers. Estimated production function to compare the effectiveness, attention should be paid to the farmers ' preferences for risk (the risk preferences), including a farmer who does not like risk (risk averse), neutral (risk neutral), or willing to accept the risk (risk lovers). Analysis of the determinants of the decision to use or no use organic fertilizers may require logistic model/polynomial functions (polynomial functions of logistic). In addition to the socio-economic situation of farmers ' characteristics, whether the decision to use organic fertilizers in individually or in groups, to consider.

In general, input in paddy production process consists of: the growth of inputs (input growth) such as seeds, fertilizers and facilitator input (input facilitate) such as labor. Fertilizer and labor are the two primary inputs in the production of rice is often treated the

same (symmetric) in the estimation of production functions despite the fertilizer directly affects the biological growth of rice, while labor is not. While increasing the production of chemical fertilizers also reduces soil quality, and ultimately reduce product-tivitasnya. As a result, estimates in the lead (treating two types of the same input) symmetric bias and negative impact of chemical fertilizers should be taken into account in the estimation of production functions, (such as those conducted by Lichtenberg and Zilberman, 1986; Chambers and Lichtenberg, 1994; Carpentier and Weaver, 1997 ; Saha et al, 1997). The alternative is the estimation of rice production function for detecting the effectiveness of fertilizer needed to treat both inputs are not symmetric (asymmetric).

3. The Indonesian Organic Fertilizer Program

In what follows I will focus on government policy and the organic fertilizer market. To increase the use of organic fertilizer, in addition to using the system of price subsidies, governments also provide direct assistance fertilizer (BLP), the provision of the Organic Fertilizer Equipment Manufacturers (APPO), and Pilot Production House Organic Fertilizer (RP3O), since 2008. So, there are at least three types of organic fertilizers in the community: first, the production of organic fertilizer is subsidized by the state-owned enterprises designated partners; second, organic fertilizer farmers are given free assistance to farmers, and third, production of organic fertilizers farmers, farmer groups, or a combination of farmer groups.

Three types of organic fertilizers have different market characteristics. Organic fertilizers are subsidized state-owned company's production partner (Pusri Holding) and produced in accordance with the Indonesian National Standard. The distribution of subsidized fertilizers is made with a closed pattern. Subsidized fertilizer is sold at the highest price (Retail Price Highest, HET), which regulated the government. The second type of organic fertilizer is organic fertilizer Farmers Assistance, which can be received by farmers for free. However, because the number and a limited budget, not all farmers' needs can be met by this fertilizer subsidy directly.

In addition, because not all farmers know and use organic fertilizer, fertilizer directly aid the spread is not done in all areas. Because organic fertilizers directly submitted to the group and not tested standards of quality, then in some areas of organic fertilizers do not directly aid in accordance with established standards. As a result, farmers are reluctant to be fooled and then use organic technology as "organic fertilizer" is false. In addition, fertilizer aid is also distributed directly to groups of farmers who receive subsidized fertilizer, so that they receive assistance from some and produce poor absorption of subsidized fertilizer.

The third type of organic fertilizer fertilizer production farmers / farmer groups / farmer groups who received the combined assistance programs and RP3O APPO. In addition there are self-supporting farmers who produce their own organic fertilizer, whether conducted under the coordination of groups of farmers or independent. There is no proof whether the production of organic fertilizer in any form in terms of quality by most farmers is lower than the granular organic fertilizer manufacturers. Technically, farmers prefer to use fertilizers in granular formed because of time and labor more efficiently.

Government intervention in affecting the price of fertilizer for rice production in the above so far have a positive impact. The study of the role of chemical fertilizers on agricultural productivity show the value-added fertilizer use in rice production will increase significantly. Fertilizer subsidy of Rp 912, / ha or 10 percent of the actual sale price can increase the income of rice growers' Rp 1915, / ha. Timmer (1986) estimates that 1.5 percent of growth in rice production in the period 1968-1984, is associated with increased incentives to farmers in the form of fertilizer subsidies and price stabilization. Subsidies on fertilizers to boost rice production is relatively large, larger even than rice imports in 1989.

Reflecting on the experience of the above, the government intervened to organic fertilizers, whether through subsidies, free help, and help the production of fertilizer. The use of organic fertilizers in Sragen, Bantul, and Garut has a positive impact on farmers' income, (Sugiyanto et al, 2006 and 2010). However, governments also need to plan when to remove the provision of subsidized fertilizer should be

from certain areas farmers in the area are already able to[4].

4. Summation

In general, the policy encourages re-use of organic fertilizer since 2001 has been a positive response by farmers. Organic rice farmers have increased their incomes and feel an improvement of soil fertility. Some things to consider in disseminating the program back into organic fertilizer are

The first speed to adopt the technology of organic fertilizer will be supported by a decrease in adoption costs and uncertainty. Fertilizer subsidies should be continued, but with a rigorous evaluation and assistance in order to known when the subsidy should be removed.

Second, the price of rice to guarantee farmers to adopt organic fertilizer instentif. Price stability reduces uncertainty farmers' income. Village warehouse and price support institutions (such as BULOG) awaited by the farmers to take part again.

Third, the Field Extension Officer (PPL) and the farmerôs group activity increased confidence of farmers that brings farmers to immediately switch to using organic fertilizers. Reorganizing PPL within the district/city government structure needs to consider the function as an extension PPL.

Fourth, researchers, the dynamics of rice farming is still wide open to be observed both in terms of technology adoption, efficiency estimation, risk preferences, as well as cooperation among farmers. The study of this topic can increase our knowledge of the peasant economy so that opportunities accuracy improvement of agricultural policies that increase farmers' income and welfare.

Lastly, hopefully accelerate the widespread use of organic fertilizers through the "Go Organic 2010" continue to be encouraged and maintained so that the sustainability of rice production in Indonesia will be guaranteed.

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[4] Some farmers already have a level of willingness to pay for fertilizer (willingness to pay) that reflects the high level of welfare so that the provision of subsidized fertilizer can be stopped.

Case Study: Garut and Sragen

1. Sampling

	Organic	Conventional
Members farmers group	50	50
Non member	50	50

Table 1. Distribution of Farmers by Gender

	Garut		**Sragen**	
	Men	**Women**	**Men**	**Women**
Organic				
Member farmer group	**25**	**0**	**18**	**7**
Non Member	**23**	**2**	**21**	**4**
Non Organic				
Member Farmer group	**25**	**0**	**24**	**1**

Non Member	**23**	**2**	**23**	**2**
Total	**96**	**4**	**86**	**14**

Source: Survey (2010)

Table 2. Age Distribution

	Garut	**Sragen**
Organic		
Member farmer group	**53 Th**	**52 Th**
Non member	**55 Th**	**47 Th**
Non Organic		
Member farmer group	**57 Th**	**51 Th**
Non Member	**54 Th**	**44 Th**

Source: Survey (2010)

Table 3. Education distrbution

	Garut	**Sragen**

Organic		
Under Elementary	**2**	**2**
Elementary	**26**	**29**
Secondary	**10**	**14**
Hugh School	**9**	**5**
University	**3**	**0**
Non Organic		
Under Elementary	**0**	**6**
Elementary	**41**	**29**
Secondary	**9**	**10**
Hugh School	**5**	**5**
University	**0**	**0**

Source: Survey (2010)

Table 4. Distribution of Land Size

	Garut	Sragen
Organic		
Member farmer group	**3348 m^2**	**4920 m^2**
Non member	**4192 m^2**	**3656 m^2**
Non Organic		
Member farmer group	**3736 m^2**	**7008 m^2**
Non Member	**1612 m^2**	**3720 m^2**

Source: Survey (2010)

Table 5. Family Member

	Garut	Sragen
Organic		
Member farmer group	**4**	**3**
Non member	**4**	**4**
Non Organic		
Member farmer group	**4**	**4**

Non Member	**3**	**4**

Source: Survey (2010)

2. **Results**

A. Organic (Linear)

Table 6. Organic Model-Linear

Name Variable	Coeffisient
Constant se(C)	157.6959 (255.991)
Lahan se(lahan)	0.183681*** (0.03934)
Benih se(benih)	30.62834** (12.4589)
Pupuk se(pupuk)	0.048984 (0.0604)
Obat se(obat)	0.013861 (0.01308)
HOK (Hari Orang kerja) se(hok)	11.5349** (5.2964)
D_kelompok se(d_kelompok)	-399.222*** (145.01)
D_kota	-232.652

se(d_kota)	(154.281)

Keterangan :

* = signifikan pada α = 10 %, ** = signifikan pada α = 5 %

*** = signifikan pada α = 1 %

B. Non Organic (Linear)

Tabel 7. Non Organic Linear

Nama Variabel	Koefisien
Konstanta se(C)	-587.8893** (273.1578)
Lahan se(lahan)	0.091542*** (0.026044)
Benih se(benih)	30.40262*** (10.17489)
Pupuk se(pupuk)	0.695489 (0.531081)
Obat se(obat)	0.089311*** (0.026493)
HOK (Hari Orang kerja) se(hok)	12.48920* (6.586354)

D_kelompok se(d_kelompok)	186.6661 (176.2466)
D_kota se(d_kota)	547.1587*** (203.3805)

Keterangan :

* = signifikan pada α = 10 %

** = signifikan pada α = 5 %

*** = signifikan pada α = 1 %

C. Organic (Non Linear)

Table 8. Organic Non Linier

Nama Variabel	Koefisien
Konstanta se(C)	0.531110 (0.539284)
Log Lahan se(log lahan)	0.710516*** (0.116049)
Log Benih se(log benih)	0.037326 (0.129915)
Log Pupuk se(log pupuk)	0.063312 (0.061667)
Log Obat se(log obat)	0.010564 (0.008425)

Log HOK (Hari Orang kerja) se(log hok)	0.188502 (0.165394)
D_kelompok se(d_kelompok)	-0.24329*** (0.069492)
D_kota se(d_kota)	-0.26080*** (0.076918)

Keterangan :

* = signifikan pada α = 10 %

** = signifikan pada α = 5 %

*** = signifikan pada α = 1 %

D. Non Organic (Non Linear)

Table 9. Non Linear Non Organic

Nama Variabel	Koefisien
Konstanta se(C)	1.181196** (0.564501)
Log Lahan se(log lahan)	0.323941*** (0.118642)
Log Benih se(log benih)	0.396401*** (0.107916)
Log Pupuk se(log pupuk)	-0.026871 (0.070877)

Log Obat se(log obat)	0.037464 (0.031195)
Log HOK (Hari Orang kerja) se(log hok)	0.489807** (0.233806)
D_kelompok se(d_kelompok)	0.065443 (0.080991)
D_kota se(d_kota)	0.380466*** (0.111932)

Keterangan :

* = signifikan pada α = 10 %

** = signifikan pada α = 5 %

*** = signifikan pada α = 1 %

a. Intensity of Fertilizer Use

Table 10. Composition of Input Use

	Garut	Sragen
Organic		
Productivity	**0.6255**	**0.4597**
Benih	**0.0070**	**0.0051**
Pupuk	**0.5071**	**0.4956**
Obat	**0.9921**	**0.7352**
HOK	**0.0215**	**0.0162**
Non Organic		
Productivity	**0.4734**	**0.5830**
Benih	**0.0063**	**0.0063**
Pupuk	**0.0442**	**0.0813**
Obat	**1.0236**	**0.5697**
HOK	**0.0302**	**0.0178**

Sumber: analisis data primer (2010)

b. Adoption Model

Table 11. Linear Model

Nama Variabel	Koefisien
Konstanta	10.6043

se(C) t-statistik	(8.6282) 1.229
Umur se(umur) t-statistik	-0.0633 (0.1156) -0.548
Pendidikan se(pendidikan) t-statistik	0.1033 (0.4536) 0.228
Jumlah Tanggungan se(jumlah tanggungan) t-statistik	-0.6646 (0.7741) -0.859
Dummy Kepala keluarga se(*dummy* kepala keluarga) t-statistik	2.2263 (3.8427) 0.579
Lahan se(lahan) t-statistik	0.0003 (0.0004) -0.904

c. Income Analysis

Table 12. Income Profile

	Garut		Sragen	
Organic				
	Farmer Group	**Non Farmer Group**	**Farmer Group**	**Non Farmer Group**
Cost	**1,659,180**	**2,224,900**	**1,373,640**	**1,777,780**
Revenue	**6,184,000**	**7,968640**	**3,514,000**	**5,570,000**
Profit	**4,524,820**	**5,743,740**	**2,140,360**	**3,792,220**
Non Organic				
	Farmer Group	**Non Farmer Group**	**Farmer Group**	**Non Farmer Group**
Cost	**1,584,800**	**1,110,640**	**3,268,080**	**2,112,300**
Revenue	**7,288,800**	**3,990,200**	**10,304,000**	**4,754,800**
Profit	**5,704,000**	**2,879,560**	**7,035,920**	**2,642,500**

Source: Survey (2010)

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