

Research and Promotion of Organic Rice Production in Hanoi, Vietnam

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Abstract – This paper aims to evaluate the economic and environment as well as society effectiveness of organic rice production that is recently introduced in My Duc District, Hanoi, Vietnam. The paper pointed out that (1) Organic rice production not only generated high economic effectiveness but also strongly contributed to improving soil environment better and more stable day by day. (2) Suitable organic techniques could help farmers produce organic rice with adequate yield with high return therefore encouraged them to adopt this new cultivation methods. (3) It not only transferred production techniques and marketing techniques but also built trust between consumers and producers in order to achieve success in promoting stable organic rice production now in Hanoi.

Keywords – Economic Effectiveness, Environment Effectiveness, Organic Rice Production, Organic Techniques, Social Effectiveness.

I. INTRODUCTION

Recently organic farming in general and organic rice production in particular in Vietnam have attracted a lot of consumers and producers' attention as the food safety is becoming a more serious issue. In 2011, the total area of agriculture was 10126.4 thousand hectare, but of which rice grown land accounted for 4120.2 thousand hectare only [1]. Moreover, under the effect of climate change, the area of rice land will gradually decrease in Vietnam [2]. Organic rice production can be one of the solutions that will not only provide high quality and safe rice product but also increase of economic effectiveness per area to cope with rice area reduction caused by climate change. Organic rice production does not use any agricultural chemical but applies organic fertilizers such as compost fertilizer from animal excrement, food waste and crop residues. Accordingly, it will strongly contribute to improving the environment (soil, water and climate) and even human being [3].

The question is how organic cultivation can be adopted and replaced the conventional method in Vietnam. What should be done to increase organic rice area constantly? In Cambodia, the neighbor of Vietnam, about 1,000 tons of milled organic rice was sold in domestic market in 2010 [4], what about in Hanoi? This research aims to find out a good organic rice model and evaluate the effectiveness of organic rice in order to promote organic rice production in Hanoi, Vietnam that could be one of the solutions for production and environment of rice cultivation in Vietnam.

II. METHODOLOGY

A. Study Area

The study area was in My Duc District in the southern west of Hanoi, Vietnam, where the cultivation soil is alluvial soil without compensation annually and medium properties with nitrogen, phosphorus and potassium contents, organic matter content in both regions were low, from 2 to 4% OM, and light acid with pH from 4.76 to 6.4. Fig. 2.1 illustrates the geographical location of the studied area in Hanoi, Vietnam.

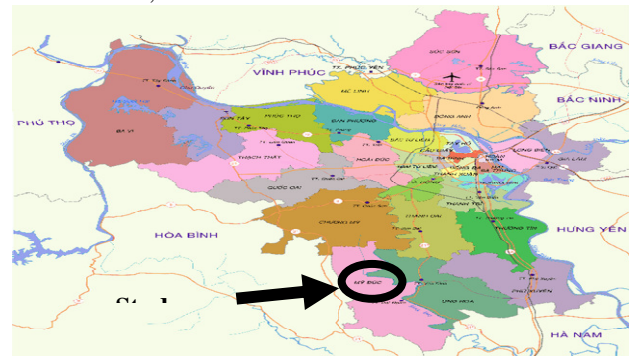


Fig. 2.1. Geographical location of studied area in Hanoi, Vietnam

B. Field Investigations and Analysis of Economic Effectiveness

Data were collected by the authors in the applied project on organic rice production carried out by Hanoi University of Agriculture (HUA) and University of Tokyo with project title: "Capacity building Project for improvement of environmentally-friendly rice production and process management in the rural area of Hanoi, Vietnam" (PAMCI-SAFERICE).

Field investigations were collected in 2007, 2008, 2009 (before establishment of projects) and in 2013, 2014, 2015 (after projects finished) and details of farming practices and chemical or organic fertilizer application were obtained from interviews with conventional and organic rice farmers. For organic rice production, farmers applied organic rice model introduced in our study. Both organic and conventional farmers used rice variety Bacthorm 7 which is *indica* variety with rice quality of aroma, delicious, sticky, and medium yield. Based on the interview data, the cost for farming and amount of labor required for farming were calculated. The prices of materials were also obtained through interviews with merchants.

The economical effectiveness measurements of organic and conventional rice production are as follow:

Total variable cost = \sum Cost of all variable inputs = Cost of land preparation + Cost of fertilizer + Cost of human labor + Cost of other inputs.

Gross return = Returns from grain + Return from straw

Net income = Gross return – Total variable cost.

C. Soil and Crop Analysis

Organic fields applied SRI method with some modification and incorporated with some effective techniques identified in our study. Conventional fields continued to be fertilized with chemical input and no organic fertilizer. Both fields of organic and conventional rice production were located in the same area.

* Soil Sampling

Topsoil samples (from a depth of 0–10 cm) were taken from conventional field and from organic fields after 2 and 4 season applied organic method. pH was determined by pH met machine; organic carbon (OC%), total phosphorus and total potassium, was determined by Walkley-Black method, Ascorbic Acid method spectro photometer method and the K concentration by flame photometric method, respectively. Total aerobic and anaerobic microorganism was analyzed by diluting in a specialized semi-solid culture medium, after which the number of colony were counted at 3 concentrations in succession (KOCH method).

* Rice Yield and Rice Quality

Grain yields were estimated by air dried samples after manually harvesting. (Spectrophotometer method). The

following methods were used to analysis the bio-chemical properties of rice: Protein (Kjeldahl method); Starch (Hydrolysis method by HCl 5% acid); Cellulose (Kürschner-Hanack); Vitamin B1 (fluorescence method); NO_3^- (Spectrophotometer method).

III. RESULTS AND DISCUSSIONS

A. Situation of Using Fertilizers and Pesticides of Farmer in the Study Area

The data of utilization of fertilizers showed that the farmers in study area used a larger amount of nitrogen and lower amount of potassium as compared to recommendation for rice production in Red River Delta that led to unbalance nutrition for rice growth and may have negative effects on rice quality and environment (Table 3.1). The reason are the price of urea, the nitrogen fertilizer was commonly used by farmer for their rapid effectiveness, was rather cheap while price of potassium fertilizer was high. Moreover, it is alarmed about the way to use pesticides of farmers. They spray pesticides whenever the appearance of pest and disease on the field and do not follow the instruction of extortionist and continue until no pest left on the field. Therefore, the frequency of pesticides application is too much in one season, about 20% of farmers used pesticides 3-5 times per season (Table 3.2). These data showed that new techniques should introduced to ensure rice productivity and environment protection.

Table 3.1. Situation of using fertilizers for rice in My Duc District, Hanoi

		<i>Unit: kg ha⁻¹</i>			
Type of fertilizers		Spring season		Summer season	
		Pure rice	Hybrid rice	Pure rice	Hybrid rice
Nitrogen (N)	Utility*	95	127	83	112
	Recommendation**	90 – 110	120 - 140	80 - 90	110-130
Phosphorus (P ₂ O ₅)	Utility*	72	85	60	76
	Recommendation**	60 – 80	80 -100	40 - 60	60 -80
Potassium (K ₂ O)	Utility*	30	87	48	84
	Recommendation**	40 – 60	70 - 90	30 – 50	70 – 90

Source: *Extension Department of My Duc Province, Hanoi; ** The favorable dose of fertilizers for rice in Red River Delta (Nguyen, 2000)[5].

Table 3.2. Situation of using pesticides for rice in My Duc District, Hanoi

Times of using pesticide	<i>Unit: (% homestead)</i>		
	2007	2008	2009
-Spraying 0 - 2 times/season	65.3	74.8	82.3
-Spraying 3 - 5 times/season	32.8	25.2	17.7
- Spraying > 5 times/season	1.9	0	0
- Investment more than 2 mil. VND for pesticides/season	7.3	4.8	0

Source: Extension Department of My Duc Province, Hanoi

B. Introduction of Some Techniques for Organic Rice Production

Until the year 2010, there was almost no research paper on organic rice cultivation techniques in Hanoi. In order to promote farmers to produce organic rice for the purpose of increasing income per area of cultivated land and coping with climate change, the authors in the Center for Organic Agriculture Promotion and Studies (COAPS) had studied some cultivation techniques for organic rice production, including treating rice straw on the field and applying organic fertilizer (both manure and foliar fertilizer) to organic rice production. Thereafter, we will summary the effects of these techniques on rice yield and economic effectiveness.

The experiment result about incorporation of rice straw to soil showed that plowing and burying rice straw with

the help of micro-organism products (Bioplant) increased rice yields 11-17% and resulted in increasing economical

Table 3.3. Effectiveness of some incorporated technic in organic rice production

Descriptions of technics	Increase in yield compared to control*	Increase in net income compared to control	Source
- Burring rice straw with Bio-plant	11-17%	5-7 million VND ha ⁻¹ (116-135%)	<i>Dzung and Xanh, 2012</i>
- Application of 15 ton, ha ⁻¹ of manure fertilizer and 2.5 ton, ha ⁻¹ of Songgiahn microorganism fertilizer	-	10-12 million VND ha ⁻¹ (~180-200%)	<i>Dzung et al., 2012</i>
- Spraying foliar fertilizers (CHELAX Lay O)	34%	14 million VND ha ⁻¹ (~ 182%)	<i>Dzung, 2012</i>

*: Control means without treatment

Effectiveness of organic rice production from about 5 million VND to 7 million VND (equivalent to increased 116-135%) in the summer and spring season, respectively, as compared to the one without support of micro-organism (Table 3.3) (*Dzung and Xanh, 2012*) [6]. It was reported that 100 kg of dry rice straw contained 0.6% N; 0.1% P₂O₅ and 1.5% K₂O [7] and recycling of rice straw appeared to have great potential for reducing fertilizer-N requirements in irrigated rice systems [8].

The experiment result about application chicken manure and Songgiahn micro-organism fertilizer in organic rice showed that the yield of rice was the highest when applying of 2500 kg chicken manure and 15 ton, ha⁻¹ Songgiahn micro-organism fertilizer and increased economical effectiveness of organic rice production about 10 to 12 million VNDha⁻¹ (equivalent to increased 116-135%) in the summer and spring season, respectively, as compared to combination of lowest doses (Table 3.3) (*Dzung et al., 2012*) [9].

The experiment result about foliar fertilizer had determined that the CHELAX Lay O treatment reached the highest yield with yield increase of 34% and profit increase of 14 million VND ha⁻¹, equivalent to 182% increase as compared to control (Table 3.3) (*Dzung, 2012*) [10].

C. The Economic and Environment Effectiveness of Organic Rice Production Model

The organic rice production model was established based on SRI techniques with some modification and application of techniques we have presented in Table 3.3 and its economic effectiveness is presented in Table 3.4. The data showed that organic rice production was not higher than conventional in yield but with higher total cost, however consumers accepted to buy organic products with higher price so it led to higher gross return, it was 69 million VND per ha as compared to 45 million VND in organic and conventional, respectively. Therefore, the net incomes of organic rice therefore was about more than 2 times higher than conventional one.

We compared some soil characteristics of conventional field and organic field after 2 and 4 seasons participating organic rice cultivation method in Table 3.5. Organic soil

changed markedly in organic carbon, total nitrogen and total microorganisms population which may play an important role in improve soil fertility and in turn increasing rice yield. The total aerobic and anaerobic microorganism were about 4 and 2 times higher in organic field than in conventional field. Organic carbon in organic field also higher than in conventional field. This data was agreed with results of *Komatsuzaki and Syuabi (2010)* [11] that organic rice farming has a lot of potential to improve soil carbon sequestration and it may also mitigate global warming. The results of the interview with residents living in the study area also agreed that environment for living and production was more safe and soil fertility was improved (Table 3.6).

The data also revealed that the application of organic method increased grain bio-chemical properties of rice such as protein, starch, cellulose, vitamin B1 and reduce nitrate residuals as compared to conventional method (Table 3.7), results in increasing rice cooking quality (data not shown).

Table 3.6. Evaluation of environment characteristics of organic rice production area Dai Nghia commune, My Duc District, Hanoi

No.	Criteria	Number of interviewee	Percentage of evaluation (%)	
			Good	Not good
1	Decreasing pollution of soil and water environment	30	100	0
2	Not harmful for producer	30	100	0
3	Reduce production cost	25	20	80
4	Improvement soil fertility	30	100	0
5	Awareness of consumers	15	35	65

D. Society Effectiveness of Organic Rice Production

Evaluation of society effectiveness of organic rice production in study area showed that numbers of farmers believed that organic rice used more labor but earned more

money than conventional one; organic rice method made farmers did not relied on chemical inputs then they reduce habit to use agriculture chemical so that they will exposed to chemical substances during practicing (Table 3.8).

Table 3.4. Economic effectiveness* of organic versus conventional rice production in My Duc District, Hanoi

No.	Criteria	Unit	Organic	Conventional
Production Cost				
1	Seed	1000 VND ha ⁻¹	389	833
2	Manure	1000 VND ha ⁻¹	18,000	0
3	Microorganism fertilizer	1000 VND ha ⁻¹	5,000	0
4	Nitrogen fertilizer	1000 VND ha ⁻¹	0	2,132.9
5	Phosphorus fertilizer	1000 VND ha ⁻¹	0	2,216
6	Potassium fertilizer	1000 VND ha ⁻¹	0	2,493
7	Foliar fertilizer	1000 VND ha ⁻¹	554	0
8	Land preparation	1000 VND ha ⁻¹	2,770	2,770
9	Pesticides	1000 VND ha ⁻¹	0	1,108
10	Irrigation	1000 VND ha ⁻¹	350	200
11	Labor	1000 VND ha ⁻¹	24,580	24,376
Total variable cost		1000 VND ha ⁻¹	51,643	36,479
Rice yield		ton ha ⁻¹	5,360	4,528
Price		1000 VND kg ⁻¹	13**	10
Gross return		1000 VND ha ⁻¹	69,680	45,280
Net income		1000 VND ha ⁻¹	18,037	8,801

* Economical effectiveness calculated at the price in 2010

** The price for rice with husk

Table 3.5. Soil measurement before and after practicing organic rice

Sample time	pH _{KCl}	OC (%)	N (%)	P ₂ O ₅ (%)	K ₂ O (%)	Total aerobic microorganism (10 ⁶ CFU/gr)	Total in aerobic microorganism (10 ⁶ CFU/gr)
Conventional	4.76	1.20	0.22	0.45	2.72	1.48	0.79
After 2 seasons practicing organic	5.16	1.60	0.24	0.73	2.55	5.42	1.43
After 4 seasons practicing organic	5.12	1.80	0.27	0.62	2.57	5.88	1.28

Table 3.7. Quality of organic rice versus conventional rice of Bac Thom 7

Criteria	Unit	Organic	Conventional
Protein	gam/100 gam	6.9	6.4
Starch	gam/100 gam	78	71
Cellulose	gam/100 gam	1.1	1.2
Water content	gam/100 gam	12.26	13.52
Vitamin B1	mg/100 gam	0.063	0.060
NO ₃ ⁻	mg/100 gam	1.6	4.2
Iron (Fe)	mg/100 gam	0.65	0.60

The success of organic rice production had encourage the farmers adopt the new cultivation method, i.e. organic rice, which is presented in increasing organic rice area in Fig. 3.1. We do not have data of organic area expansion in My Duc District because there farmers could not organize into organic rice production group themselves but it is interesting that our working have been spread to neighbor

District (Chuong My) and the organic area increased gradually in Chuong My District averagely 240% per season and up to now the rice area in this District reach to 15.93 ha, comprising approximately 1.7% of rice production area. The data in Fig. 3.1 also showed that organic rice give stable and acceptable yield by time only

in summer season the yield was low due to raining when rice plant were flowering.

The success of organic rice production was partly due to successful building marketing and PGS (Participatory Guarantee System) certification system that made “trust”

between producer and retailers as well as consumers. The data showed that the number of consumers increased gradually season by season (Table 3.9).

Table 3.8. Evaluation of society effectiveness of organic rice production area in Dai Nghia commune, My Duc District, Hanoi

		<i>Unit: (no. of interviewee)</i>	
No.	Criteria	Organic	Conventional
1	Using more labor	22/30 (73.3)	8/30 (26.7)
2	Making habit not use agricultural chemical	20/30 (66.6)	10/30 (34.4)
3	Producers were not exposed to chemical substances	25/30 (83.3)	5/30 (17.7)
4	Higher income (with market acceptance)	18/30 (60.0)	12/30 (40.0)

Table 3.9. Number of consumers and retailers on organic rice after each season

After	Consumer		Retailer	
	Number	%	Number	%
Summer Season 2012(7 months)	10	0	10	0
Spring Season 2013 (10 months)	32	220	17	70
Summer Season 2013(3.5 months)	51	410	19	90

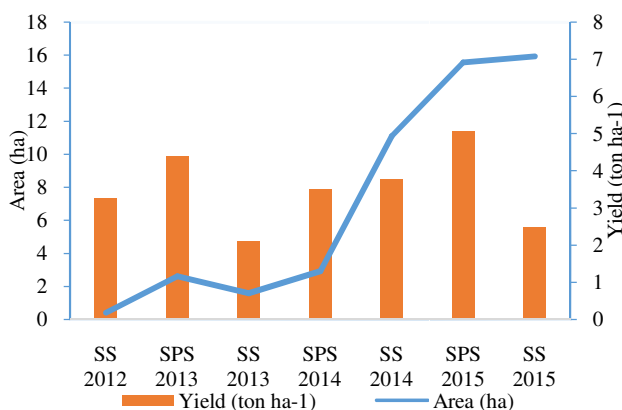


Fig. 3.1. Organic rice yield and area at Chuong My District, Hanoi

SPS: Spring season; SS: Summer season

IV. CONCLUSION

It is clear that suitable production techniques and good marketing activities made farmers in the study area have more beliefs in the success of organic rice production so the organic rice production area increased season by season. The farmers in study area have changed their habit to use chemical inputs in agriculture practice. In fact, by both suitable organic rice production techniques transfer and trusty marketing strategies, we have successfully developed stable and effective organic rice production in Hanoi.

IV. ACKNOWLEDGMENTS

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