

ADOPTION OF ORGANIC RICE FOR SUSTAINABLE DEVELOPMENT IN BANGLADESH

Shaikh Tanveer Hossain¹, Hideki Sugimoto², Hideto Ueno³ and Sheikh Mohammed Rafiul Huque⁴.

Ehime University, Matsuyama, Japan.

Abstract

Bangladesh now needs to thank its soil health, environment and human health for the country being almost self-sufficient in rice production. The present study has been undertaken to gain knowledge of the level of awareness by farmers and consumers regarding the status of organic rice, and knowledge of demand and marketing opportunities and limitations for organic rice in the country. The present study has highlighted the overall organic rice situation in Bangladesh, which is not yet well documented. The results also demonstrate that farmers and consumers are aware of the hazards of chemical compounds but have little knowledge about organic rice. The present study may open a new window for organic rice research and marketing (both local and export) for all stakeholders (including planners) and could succeed in the adoption of organic rice in Bangladesh.

Key words: Awareness, Bangladesh, Consumer, Farmer, Export, Organic rice, Sustainable agriculture, Technology adoption.

Introduction

Bangladesh's economy is heavily dependent on agriculture. It is beyond question that the rice industry has an overwhelming influence on the national economy. Bangladesh is now essentially self-sufficient in rice, its basic cereal, and is emerging as a significant exporter of high-value agricultural products (USAID Bangladesh, 2006). There has also been a sharp increase in the use of inorganic nutrients, i.e., chemical fertilizers, to get a higher yield from modern varieties of rice. During the green revolution, for example, 1 kg of added nitrogen fertilizer would produce 20 kg of grain, but now it only produces 8 to 10 kg (FAO, 2004). Declining productivity due to soil degradation is now a major constraint. It is said that a good soil should have an organic matter content of more than 3.5%, but in Bangladesh most soils have less than 1.7%, and some soils have even less than 1% organic matter (BARC, 1997). Moreover, the continuous and unbalanced use of inorganic nutrients in an intensive cropping system has been considered to be the main cause for stagnating or declining crop productivity. Unless the use of balanced fertilizers and organic matter in soils is seriously considered, sustenance or an increase in productivity can hardly be achieved.

In terms of total rice production, Bangladesh occupies the 4th position in the world at present (USDA, 2001). In the year 1996, a total of \$16 million (U.S.) in pesticides and \$6 million in herbicides were sold in Bangladesh, and in 1999, a total of 13 million tons of chemical fertilizers were also used (IRRI, 2007). The use of chemicals is increasing every year in Bangladesh. Bangladesh has just initiated some studies on organic rice, but very little or no research work has been done (BRRI, 2007). Some studies have been done on the evaluation of cow dung, poultry manure, rice straw, and farmyard manure as supplemental nutrient sources for growing rice that would improve or maintain soil health. These studies, however, did not fulfill the desired concept of "Organic Rice Cultivation" because in these cases weed and pest controls were not considered. Some technologies, like integrated rice-duck farming, are available or known to farmers as means of growing organic rice. Rice-duck practices is a very new organic rice technology in Bangladesh which have become very popular with resource-poor farmers (Hossain et al., 2005).

¹ The United Graduate School of Agricultural Sciences, Ehime University, 3-5-7, Tarumi, Matsuyama 790-8566, Japan

² Faculty of Agriculture, Ehime University, 3-5-7, Tarumi, Matsuyama 790-8566, Japan

³ University Farm, Faculty of Agriculture, Ehime University, 498 Ko, Hattanji, Matsuyama, Ehime 799-2424, Japan

⁴ Department of Business Administration, Jahangirnagar University, Savar, Dhaka-1342, Bangladesh

E-mail: tanveer@agr.ehime-u.ac.jp; < tanveer107@yahoo.com >

Saleque *et.al.*, (2004) has stated that Integrated Pest Management (IPM) and the use of cow dung and ash is effective on rice yield and soil fertility. Bhuiyan (1987) suggested that a maximum return can be achieved by the addition of crop and animal residues to soil, the balanced use of chemical fertilizer, the use of biofertilizer, practicing green manuring in crop rotation, and the proper utilization of farm manure, night soil, composts and nitrogenous organic materials, all ways of improving soil fertility in Bangladesh. A number of nongovernmental organizations, namely, UBINIG (Policy Research for Development Alternatives), Proshika, and CARE Bangladesh, have launched initiatives in different parts of the country to promote sustainable agriculture and organic rice production.

Among the organic materials tested, cowpea (*Vigna unguileata*) was superior with respect to mineral composition, followed by dhaincha (*Sesbania aculeata*) and azolla. The grain yield response clearly demonstrated that cowpea was the best source of organic material for wetland rice, followed by dhaincha (Bhuiyan, 2001). To increase soil organic matter, some farmers are using compost, quick compost, cow dung, and azolla and growing grass pea (*Lathyrus sativus*) at maturity of Aman rice as a relay crop (Hossain 2001). Recycled rice straw has appeared to be a good supplementary source of K fertilizer in rice cultivation and some nutrient-enriched organic fertilizer (namely, Moni Mukta, Agro-sar, Jaibo-sar, Super Greenfield, Chook-Chook 111) has been evaluated for wetland rice cultivation and has been found effective and could therefore reduce the use of chemical fertilizer (BRRI, 2007). Integrated weed management is also widely practiced in Bangladesh (Ahmed *et.al.*, 2006).

The time has come to think about organic rice farming from considerations of rural development and socio-economic and environmental factors. Organic agriculture is developing rapidly and is now practiced in more than 120 countries of the world (Willer and Yussefi, 2007). Very recently, the government of Bangladesh formulated a new agricultural extension policy in which one objective is to take the necessary steps to ensure environmental protection as well as “environment-friendly sustainable agriculture” through an increasing use of organic manure and strengthening of the IPM programs (MOA, 2007). There are two streams of organic agriculture in Asia, one as part of sustainable farming and other as export-oriented organic products. Now it is important to verify the opportunity for exporting organic rice that results from the country’s low cost of production (labor and agricultural inputs).

Hence, our study has been implemented with the following objectives:

1. We proposed to set benchmarks regarding existing organic rice production techniques and the identification of opportunities to increase the sustainability of Bangladesh’s organic rice production systems.
2. We evaluated the current situation regarding the awareness level of farmers and consumers in Bangladesh about organic rice.
3. We studied the limitations and possibilities of exporting organic rice from Bangladesh.

Material and Methods

The responding farmers were from mostly small land units of 0.41-1.0 ha and marginal farmers from 0.40 ha or less (BBS, 2004). Households were selected through a systematic random sampling technique, and male heads of household were interviewed. A questionnaire was set in the Bengali (native) language in accordance with the question-setting criteria suggested by Kerlinger (1973). The following data were collected independent variables for the individual (age, sex, education) and family (size and landholding) with dependent variables (awareness, available technology, opportunities and constraints). In contrast, a consumer questionnaire was created based on independent variables for individuals (age, sex, education, social status) with dependent variables (awareness and intention to buy organic rice). Marketing (local and export) opportunities and limitations were also assessed from discussion with farmers and rice businessmen.

Farmer Questionnaire

The questionnaire methodologies are described in the following steps:

Step 1: Selection of research location

The studies were carried out in the Sylhet (24.92 N latitude and 91.77 E longitude) and Sunamganj district (24.87 N latitude and 91.42 E longitude), north-eastern districts of Bangladesh, during 2006-2007 with 100 farmers. Initially, rice producers in four villages (in every district, two *upazilla* (a new administrative unit, called upazilla, or subdivision, was created to facilitate decentralization of power), and in each *upazilla*, two villages) were selected. In the Sylhet district, Badedewli and Judhistipur villages in the Fencuganj *upazilla*, Noagao and Khanua villages in the South Surma *upazilla*, and in the Sunamganj district, Manikpur and Chanpur villages in the Chatak *upazilla* and Chonogao and Agunrayer gao in the Doarabazar *upazilla* were selected. The study focused on soil, crop and water management, weed control, crop nutrition, and socio-economic aspects.

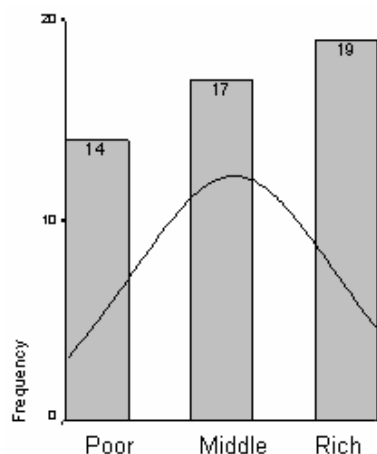
Step 2: Selection of participating farmers

Through a purposive random sampling technique, 100 farm households were selected. In addition, farm size and existing resources, number and area of interventions, awareness of the farmers, resource base and management capability of the farmers, easy accessibility to the households in all seasons, and other aspects were considered in selecting the participating farm households. The results of this questionnaire produced a view of each farmer's awareness and understanding regarding organic rice production. A descriptive cum exploratory research instrument was created, the data were analyzed, and relationships between the variables were examined.

Consumer questionnaire

Our objectives were to discover the awareness-level of rice consumers about organic rice. We collected data from 50 rice consumers in the capital, Dhaka City. Consumers were randomly selected (interviewed the consumers in the open places as random basis) for this study. We classified those who responded into three groups based on monthly income: poor (income less than 5000 Taka), middle class (5000 taka to 15000 Taka) and rich (15000 Taka to more). Of the 50 consumers, 20 were males and 30 were females.

Fig. 1. Distribution of the samples among the social status of the consumers`.



Statistical Analysis

Data were analyzed with statistical techniques like frequency distribution, cross-tabulations and chi square testing using the SPSS package, v. 10.0.

Results and discussion

Farmer data analysis

The frequency distribution in Figure 2 shows that farmers have a significant interest in cultivating organic rice. 97% of the farmers expressed such an interest. This interest in organic rice may link with a rising awareness of the harmful effects of pesticides on the soil and environment. 67% of the farmers, agreed with the proposition that 'Chemical fertilizers and pesticides have harmful effect on soil, human and environment'. The cross tabulation analysis in Table 1 supports this conclusion. It can be observed that 66% of the farmers were

aware of chemical fertilizers and pesticides harmful effect on soil, human and environment and showed their interest to know and cultivate such a technology where agro-chemicals are need not to apply (Table 1).

Fig. 2. Interests of farmers in cultivating organic rice.

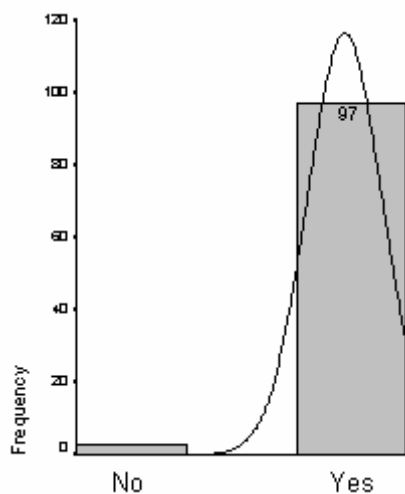


Fig. 3. Level of awareness of farmers about the harmful effects of pesticides.

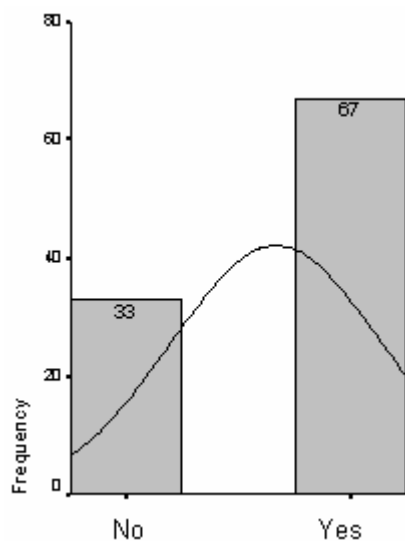


Table 1. Cross tabulation of farmer-awareness of harmful effects of pesticides and interested in cultivating organic rice.

Count of respondents					
		Interested to know and cultivate organic rice		Total	Chi square value
		<i>Negative</i>	<i>Positive</i>		
Awareness of harmful effect of pesticides	<i>Unaware</i>	2	31	33	11.56**
	<i>Aware</i>	1	66	67	
Total		3	97	100	
Chi square value		88.36**			

** (P<0.01)

The analysis in Figure 4a and Table 2 strengthens the above conclusion. It is observed that 70% of the farmers are uses organic material to improve soil fertility. Again, 28 farmers (who are not currently applying any organic materials to the field) also showed interest to know and cultivate rice cultivation technology (where agro-chemicals are needed not to apply) if the technology were to be made available to them (Table 2).

Fig. 4 a. Application of organic matter by the farmer to improve soil fertility.

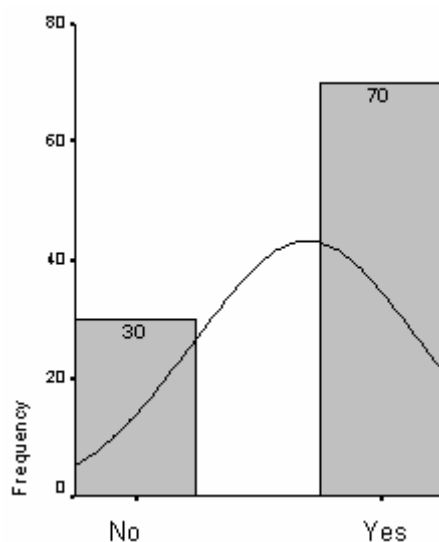


Table 2. Cross tabulation of farmers' application of organic matter to increase soil fertility and interested of cultivating organic rice.

Count of respondents					
		Interested to know and cultivate organic rice		Total	Chi square value
		<i>Negative</i>	<i>Positive</i>		
Apply organic matter to increase soil fertility	<i>Do not apply</i>	2	28	30	16.00**
	<i>Apply</i>	1	69	70	
Total		3	97	100	
Chi square value		88.36**			

** (P<0.01)

Fig. 4 b. Application of kinds of organic materials applied by the farmer.

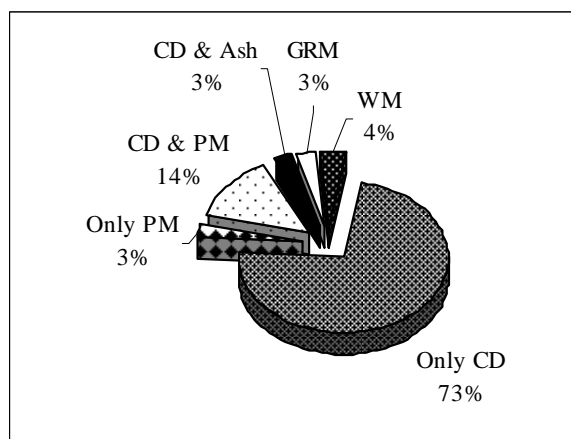
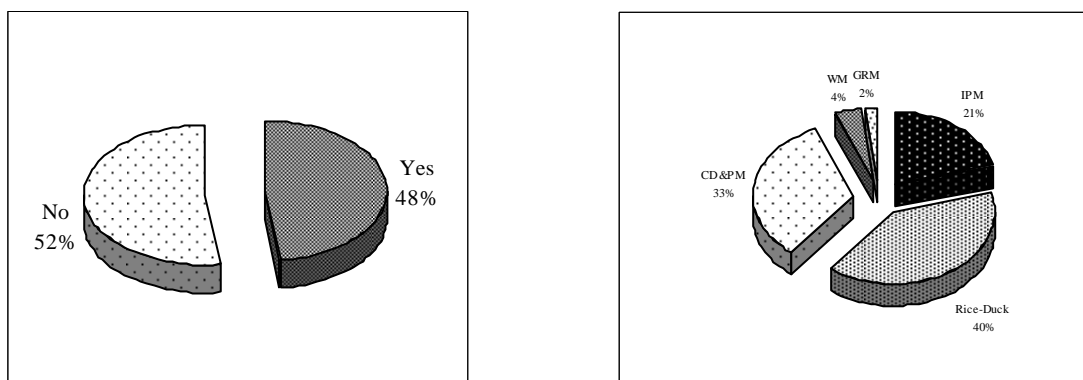


Figure 4 b shows that of the farmers who (70% of total farmers, Fig 4a) are applying organic material, out of these farmers 73% apply only cow dung (CD) and 14% cow dung and poultry manure (PM) together. A few apply green manure (GRM), waste material (WM) and sole poultry manure in the rice fields.

Fig. 5 a & b. Level of awareness of farmers about the organic or semi-organic rice farming.



Currently, very few complete organic rice technologies are available to the farmers. Some are cultivating rice on partial or semi-organic basis (some part of cultivation followed organic way). For example, some farmers controlled their insects by biological method, but for plant nutrients they applied chemical fertilizer. Figure 5 shows that 48 farmers know about organic or semi-organic practices. Of these, 40% know about integrated rice-duck farming, 21% know about cow dung and poultry manure, 21% know about IPM, and very few know about waste material and green manure.

Consumer data analysis

It is observed that 82% of the consumers were aware of the 'harmful effects of pesticides or chemical fertilizer on human body human body and environment' (Figure 6). Due to the lack of knowledge about organic rice, they have no option to normal rice. Only 28% of the consumers have heard of organic rice (Figure 7). 58% of the consumers, the mean of the distribution, would be interested in buying organic rice were it widely available to them (Table 3).

Fig. 6. Level of awareness of consumer about the harmful effects of pesticides.

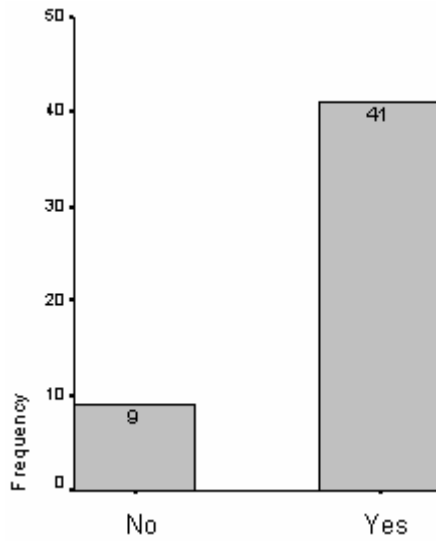
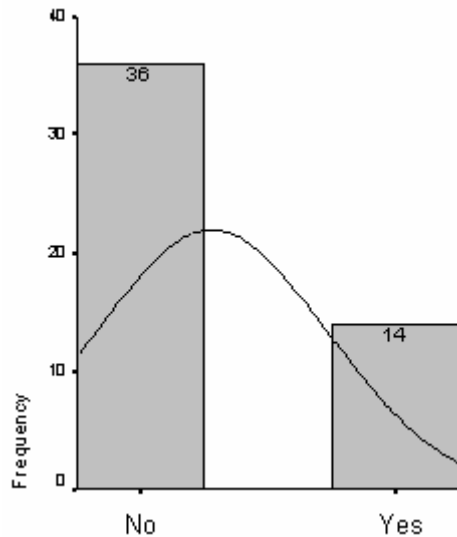


Fig. 7. Level of awareness of consumer on organic rice.



Certified organic products are generally more expensive than their conventional counterparts (for which prices have been declining) for a number of reasons. Organic food supply is limited compared with demand. In addition, production costs for organic foods are typically higher because of greater labor input per unit of output and because the greater diversity in enterprises means economies of scale cannot be achieved (IFOAM, 2005). Post-harvest handling of relatively small quantities of organic foods results in higher costs because of the mandatory segregation of organic and conventional produce, especially in processing and transportation. Finally, the marketing and distribution chain for organic products is relatively inefficient, and costs are higher because of relatively small volumes (IFOAM, 2005). Regarding this issue, the response by the consumers was highly encouraging.

Cross tabulation analyses of the consumers show some interesting results. It is observed that social status has a significant bearing on the purchase of organic rice. Consumers from the high income group have a significant interest in buying organic rice even though the price is higher than for normal rice. Around 34% of the consumers belonging to the high income group were interested in buying organic rice, but due to unavailability they cannot do so. In addition, consumers from the middle income group are moderately interested in buying organic rice. Consumers from the low income group, on the other hand, are not interested at all in buying organic rice due to its high price. The results of the analyses are given in Tables

3 and 4. The interest of the consumers in buying organic rice may be linked with their awareness of the harmful effect of pesticides in the soil, human body and environment. It can be observed that 50% of the consumers, who were interested in buying organic rice, were also aware of these harmful effects of pesticides (Table 5).

Table 3. Cross tabulation of social status of consumer and interested to buy organic rice.

Count of respondents		Social status of the consumers			Total
		<i>Low</i>	<i>Medium</i>	<i>High</i>	
Interested to buy organic rice though price is high	<i>Not interested</i>	14	5	2	21
	<i>Interested</i>	0	12	17	29
Total		14	17	19	50

Table 4. Cross tabulation of consumer social status and idea about organic rice.

Count of respondents		Social status of the consumers			Total
		<i>Low</i>	<i>Medium</i>	<i>High</i>	
Idea about organic rice	<i>Negative</i>	14	11	11	36
	<i>Positive</i>	0	6	8	14
Total		14	17	19	50

Table 5. Cross tabulation of consumer awareness about harmful effect of pesticides and interested to buy organic rice.

Count of respondents		Interested to buy		Total
		<i>Not interested</i>	<i>Interested</i>	
Aware about harmful effect of pesticides	<i>Unaware</i>	5	4	9
	<i>Aware</i>	16	25	41
Total		21	29	50

Production and Marketing of Organic rice by the Non-Governmental Organizations (NGOs)

Organic rice cultivation is usually carried out by some NGOs in Bangladesh like UBINIG, MeenaBazar (Zemcon group), Proshika, PRAN, and others. Meenabazar cultivates local varieties of organic rice like Ninia, Dhekichata, Nazirshail and aromatic rice like Kataribhog and Basmati in the Ponchagor district. They generally use cow dung as nutrient sources. Sometimes, green manuring crops are also used for this purpose. UBINIG acts as a form of organic farming `Nayakrishi Andolon` (new agricultural movement). Around one and half million farmers in different districts are engaged in this movement. Sanatani village, Atia union in the Tangail district, has been declared as "Fertilizer-Pesticide Free Union". They use organic fertilizers, neem (*Azadirachta indica*), or vertipata in the rice fields. UBINIG has a selling center in Dhaka named "SassaProbortona" and are selling many organic rice varieties

including Biroi, Katarivog, Boilota, Sassori, Pakri, Chamara, Digha, Binni (Bandarban) and Birishiri (Netrokona). Usually, organic rice at market sells at a price 10-15% higher per kilogram than conventional rice (personal communication in selling center). On the other hand, some aromatic organic rice varieties such as Kiligira, Begunbichi, and Shahib chikon (Cox's bazaar) have a market price almost the same as that of non-organic rice. A salesman of the center remarked (personal communication) that the upper middle class-to-rich people are the main customers for organic rice.

Feasibility study to export organic rice from Bangladesh

Rice is a food staple worldwide, and China is the world's leading rice-producing country, producing just over one-third (33.9%) of the world's rice supply. Thailand is the world's leading rice exporter, however, and it exports 28.3% of the world's rice exports. India is the world's second largest producer and exporter (IRRI, 2007). Again, Thailand is now world's leading organic rice producer country, followed by Philippines (Willer and Yussefi, 2007). The Asian governments have become interested in organic farming for the last 5 years, as the organic market further expands and exhibits its potential and significant market opportunities (Panyakul, 2003). In addition, some private companies in India, Pakistan and Thailand are exporting organic basmati, jasmine, long-grain white and Thai rice to different parts in the world (Tradekey, 2007). Some private companies in Bangladesh are exporting some aromatic and non-aromatic rice like Kaligira, Chini Atob, Katharibhog, Naigarsail, Pajam and Minikit.

It is observed that fine rice is a profitable farming venture for farmers and a good source of livelihood (Giovannucci, 2005). The income potential is higher for fine rice cultivation since it does not require extra input. In contrast, the indiscriminate use of fertilizers increases the thickness of the rice and reduces aroma (Sarker, 2007). The use of organic fertilizers in traditional practices is believed to enhance the aroma and preserve the fineness, as mentioned by the farmers. In this regard, fine aromatic rice could be a potential choice for organic rice cultivation.

The following table 6 projected the rice export scenario of Bangladesh.

Table 6. Rice Export scenario of Bangladesh, 2005-2006.

Variety	Quantity exported	Percent exported	Export price (US\$/ton)	Cost of production#
Aromatic	255.1	50	700	156
Nazersail/paja	102.04	20	500	120
Minikit	153.06	30	550	95
Total	510.2	100		

Note: Aromatic includes Chinigura and Kaligira. Data source: APEX NGO.

Cost of production at the farm level. Source of table: (BRRRI, 2007)

Discussion with the exporters

Until now, there have been no organic rice exports from Bangladesh. Mostly, there have been aromatic and fine rice exports to the USA, UK, the Middle East, and some EU countries like France, Germany, Spain, and Italy. From 1992, rice began to be exported and has gradually increased every year. There is a great possibility and opportunity to export organic rice from Bangladesh due to its comparatively low cost of production and suitable environment and as well as the quality of rice. (Personal communication with Mr. Faridul Hasan Chaudhury, President, Bangladesh Rice Exports Association (BREA) and Proprietor, M.N.R. Limited.). Mr Chaudhury also remarks on the reasons for not exporting organic rice from Bangladesh:

1. Currently there is no organic rice certification authority in Bangladesh that can certify organic rice as an international standard, though, currently 395 organizations worldwide offer organic certification services (Willer and Yussefi, 2007).
2. In general, to grow organic rice according to an international standard, the field is usually kept fallow for three years or a transition or crop rotation by organic inputs (Paull, 2007), all of which are difficult for growers unless the price can be ensured.

3. He suggested forming contract growers as a joint venture project whereby foreign buyers could ensure the marketing of the product marketing and farmers' security.

Conclusion

The current study, although the level of awareness about organic rice was low, did reveal that both farmers and consumers are aware of the toxic effect of chemical fertilizers and pesticides. With the introduction of organic rice cultivation technology and the assurance of some relevant factors (like price and quality), we expect an increase in the marketing of organic rice in both domestic and overseas market. Like some private companies in Asian countries that are exporting organic rice, Bangladeshi private companies also have the scope of expanding this export in the international area.

Finally, we would like to make some recommendations for enhancing the adoption of organic rice in Bangladesh.

1. Usually by wind and irrigation, chemical compounds are brought to organic plots from neighboring fields. Hence, the formation of groups by organic rice farmers or community farmers' group is very important.
2. Ensure the market price and organic rice farmers production cost.
3. From a discussion and consideration of other social factors, we recommend that rich and big farms rather than small households initiate organic rice farming because of the latter's present food insecurity. After the system is strengthened, small farmers may become involved in it. Of course, in China, mostly poor and from small farms has contributed the foundation of organic agriculture (Paull, 2007) and government and investors chose remote and underdeveloped areas in the mountainous region (Chen, 2006). But, the situation of China is quite different of Bangladesh in context of land reform, agriculture policy, marketing and political, which is one of the important factor to farmers for conversion to organics (Rahmann & Nieberg, 2005).
4. On-farm trials, field days, and farmers' participatory research and extensions could play a vital role in enhancing a build-up in farmers' capacities.
5. Primarily, organic rice cultivation and exports can emphasize traditional fine and aromatic rice.
6. A research institute should pay attention to finding new technology such as an alternate organic fertilizer source (as cow dung needs a large volume), post-harvest and storage methods of an organic way and green manure seed production.
7. An organic certification authority needs to be established on the basis of international standards. Of course, for local marketing certification is not mandatory.
8. Media (both electronic-television and radio and print-newspapers) can play important roles in increasing awareness of farmers and consumers.

The presented data are both interesting and informative for a future plan of work regarding organic rice in Bangladesh. They offer not only academic value but also raise serious concern for environmentalist and planners.

Acknowledgement

The authors would like to thank the farmers and consumers who participated in the research and businessman for their valuable comments. The study was supported by the United Graduate School of Agricultural Sciences (UGAS), Ehime University, Japan student research support program. The support obtained from Mr. Malik Anwar Khan, Coordinator, Friends in Village Development of Bangladesh (FIVDB), Sylhet and other Livelihood Enrichment Program (LEP) staff of FIVDB are gratefully acknowledged. The authors are also thankful to Ms. Shamim Ara Saima for cooperation at the time of consumer data collection.

References Cited

- Ahmed, GJU, Bhuiyan MKA, Riches, C. & Mortimer, M 2006, Weed identification and management in rice. *Bangladesh Rice Research Institute (BRRI)*, Gazipur, Bangladesh.
- Bangladesh Rice Research Institute (BRRI) 2007, Annual Report (*in press*). BRRI, Gazipur, Bangladesh.
- Bangladesh Bureau of Statistics (BBS) 2004. Yearbook of Agricultural Statistics of Bangladesh.
- Bangladesh Agricultural Research Council (BARC) 1997, Fertilizer recommendation guide-1997. Soils publication no. 41, BARC, Dhaka. Bangladesh.
- Bhuiyan, NI 2001, Country paper presented in *ESCAP Organized Regional Workshop on 'Integrated Plant Nutrition System (IPNS) Development and Rural Poverty Alleviation'* held on 18-20 September, Bangkok, Thailand.
- Buiyan, ZH 1987, 'Organic matter status and organic recycling in Bangladesh soils', *Resources and Conservation*. 13 (2-4): 117-124.
- Chen, U. 2006, 'South China organic food market brief', USDA Foreign Agricultural Service, Guangzhou.
- Food and Agricultural Organization (FAO) 2004, 'Bangladesh: land-related constraints', retrieved February 28, 2007 from http://www.fao.org/ag/aql/swlwpnr/reports/y_sa/z_bd/bd.htm#s511
- Giovannucci, D 2005. 'Organic agriculture and poverty reduction in Asia: China and India focus', International Fund for Agricultural Development (IFAD), Rome.
- International Federation of Organic Agriculture Movements (IFOAM) 2005, 'Frequently asked questions (FAQ)' retrieved September 23, 2006 from <http://www.ifoam.org/sub/faw.html>
- International Rice Research Institute (IRRI) 2007, 'Atlas of Rice & World Rice Statistics' retrieved February 7, 2007 from <http://www.itti.org/science/ricestat/index.asp>
- Kerlinger, FN 1973, *Foundations of Behavioural Research*. 2nd edn. Holt, Reinhart and Wiston Inc., New York.
- Ministry of Agriculture (MOA). Government of the People's Republic of Bangladesh. 2007, retrieved March 12, 2007 from <http://bangladeshgov.org/moa/moa.html#Agricultural%20Development>
- Panyakul, V. 2003, 'Overview of Organic Agriculture in Asia', Proceedings of the seminar on the production and exports of organic fruit and vegetables in Asia. FAO, IFOAM and the EarthNet Foundation. Bangkok, Thailand, 3-5 November. P.23.
- Paull, J. 2007. 'China's organic revolution', *Journal of Organic Systems*. 2 (1): 1-11.
- Rahmann, G. & Nieberg, H. 2005, 'New insights into organic farming in Germany - empirical results of a survey in 218 farms', *Landbauforschung Volkenrode*, 3 (55): 193-202.
- Hossain, ST, Sugimoto, H, Ahmed, GJU, and Islam, MR. 2005, 'Effect of integrated rice-duck farming on rice yield, farm productivity, and rice-provisioning ability of farmers', *Asian Journal of Agriculture and Development (AJAD)*. Regional Center for Graduate study and Research in Agriculture, Philippines. 2 (1 & 2): 79-86.
- Hossain, MZ. 2001, 'Farmer's view on soil organic matter depletion and its management in Bangladesh', *Nutrient cycling in Agroecosystems*. 61: 197-204.
- Salaque, MA, Abedin, MJ, Bhuiyan, NI, Zaman, SK, and Panaullah, GM. 2004, 'Long-term effects of inorganic and organic fertilizer sources on yield and nutrient accumulation of lowland rice', *Field crops research*. 86 (1): 53-65.
- Sarker, MAH. 2002, 'Indigenous Fine Aromatic Rice Production: Bangladesh Perspective'. 1st RDA/ARONA International Conference on 'Development of basic standard for organic rice production', 12-15 November, RDA & Dankook Uni. Korea, retrieved August 7, 2007 from [http://www2.rda.go.kr/jpsm/Korean/03_undp/morque/rice/file/OA-16\(Sarker\).doc](http://www2.rda.go.kr/jpsm/Korean/03_undp/morque/rice/file/OA-16(Sarker).doc)
- Available from:
- Tradekey company 2007, 'Sell offers- Organic rice', retrieved January 18, 2007 from www.tradekey.com/ks-organic-rice/
- United States Agency for International Development / Bangladesh (USAID Bangladesh). 2006, 'Food and Agriculture in Bangladesh: A success Story', retrieved January 31, 2007 from http://www.usaid.gov/bd/files/food_sucess.pdf
- United States Department of Agriculture (USDA) 2001, retrieved January 26, 2007 from www.ers.usda.gov/briefing/rice/background.htm
- Willer, H. & Yussefi, M 2007, 'The World of Organic Agriculture: Statistics and Emerging Trends', International Federation of Organic Agriculture Movements (IFOAM), Bonn, and retrieved August 6, 2007 from <http://orprints.org/10506/01/willer-yussefi-2007-p1-44.pdf>