Knowledge, Attitude and Perceptions of Bangladesh Civil Society on rice Biotechnology Research

A.M. Muazzam Husain
Department of Economics and Social science
BRAC University, Dhaka, Bangladesh
Manik L. Bose
Mahabub Hossain
Social Science Division, IRRI, Philippines

Proloy Barua
Shantana R Halder
Research and Evaluation Division, BRAC

Paper presented at the Biofortification Challenge Program Rice Crop Meeting, 6-8 October 2003, IRRI, Los Banos, Philippines

Knowledge, Attitude and Perceptions of Bangladesh Civil Society on Rice Biotechnology Research

A.M. Muazzam Husain, M.L. Bose and Mahabub Hossain

Introduction

Background of the study: A survey was conducted on the knowledge, perception and attitude of civil society groups in Bangladesh on rice biotechnology research in the country. This study was a part of the IRRI-PETRRA funded broader study on "Dynamics of Livelihood System in Rural Bangladesh: Generation of Information for Facilitating Dialogues on Strategies and Policies Pertaining to Elimination of Poverty".

As a low-income developing country, with agriculture as the primary sector of the economy, Bangladesh suffers from problems like relatively low productivity in agriculture, growing population resulting in increased demand for food and reducing land area under crops. Rice is the staple food in Bangladesh. Its production area covers three-fourth of its cropland. The country has been able to increase its rice production about 2.5 times during the last three decades by introducing HYV rice. However, it is often said that the maximum potential yield limits have been reached under the present technology. Yield limits can probably be extended to some extent by improving production management practices and their wide scale acceptance by rice farmers. But the fact remains that to attain food self-sufficiency and more importantly to provide food security, a breakthrough is required in rice production increase in Bangladesh. One choice is to use biotechnology in evolving new rice with higher yield by effectively overcoming the complex problems of disease and pest incidence, tolerance to and biotic and abiotic stresses such as drought, submergence, heat and cold, etc., and also for improving the quality of rice to help solve problems of nutrition and health.

The development of research in agricultural biotechnology has become a debatable issue where environmentalists and others express apprehension about possible human health and environmental hazards. We have thus to strike a balance between food security and the possible risks associated with biotechnology.

Public policy regarding biotechnology has to be enunciated very carefully against this context. The present study was, therefore, undertaken to expose the Bangladesh civil society groups to ascertain their knowledge, perceptions and attitude on undertaking rice biotechnology research in the country. It is believed that the study would be important since civil society groups mould public opinion on various national issues, and in this case, their opinion may be given due consideration in formulating policies on this issue.

Study methods: BRAC a non-government development organization in Bangladesh and IRRI jointly undertook this survey. In late 2002, IRRI conducted focus group discussions for a pilot testing of the questionnaire for the survey and during the first half of 2003 BRAC conducted the survey using the revised questionnaire. A mailed questionnaire survey method was used and 232 respondents filled in the questionnaire and returned the same. The findings of the study are based on these 232 samples.

Questionnaires were sent by mail to different civil society groups including policy makers and government officials, agriculturalists (research and extension personnel), academicians/university teachers, NGO officials, environmentalists and other civil society members. Number of responses varied among different groups. So these groups were classified into six groups to find out if there is any perceptible difference among these broad groups in their understanding and attitude to biotechnology research in the context of Bangladesh.

Limitations of the study: One limitation of the study was a relatively low level of response received from the mailed questionnaire used for data collection. Secondly, the sample selection was purposive. Mostly highly educated and seniors from different civil society groups were selected. Finally, the sample size was relatively small considering the different sub-groups of civil society.

Findings and discussions

The respondents and some of their characteristics

Distribution of sample from different civil society groups: The respondents were divided into six groups as shown in Table 1, which also present their age distribution. The agriculturists, both research and extension officials, constituted the largest group with 80 respondents (35%), followed by NGO Senior staff (26%), university teachers (21%), policy makers and govt. officials (7%), and environmentalists (3%). Other civil society members constituted 8% of the respondents.

Table 1: Distribution of the respondents among different broad civil society groups.

Respondent group	No. of respondents	Age*		
		<40	41-55	>55
1. Agriculturists (Res. and extension)	80 (34.5)	9	64	6
2. NGO senior staff	61 (26.3)	38	15	4
3. Academicians/University teachers	49 (21.1)	5	30	13
4. Policy makers & high govt. officials	16 (6.9)	5	7	4
5. Environmentalists	8 (3.4)	1	7	-
6 Other civil society groups	18 (7.8)	-	5	6
All groups	232 (100)	58 (27)	128 (58)	33 (15)

* Thirteen respondents (6%) did not indicate their age.
Note: Figures in parentheses indicate percentages

Age distribution: The age distribution of the respondents shows that 73% of the respondents were over forty while a little over one-fourth were below 40 years (Table 1). The distribution excludes six percent of respondents who did not indicate their age.

Educational qualification: About the educational qualification of the respondents, data presented in Table 2 show that 45% had PhD degree, about the same number had Masters' degree while 10% were graduates. Since the questionnaires were administered by mail to senior level people of different sections of the civil society groups which included university teachers, research and extension personnel, policy makers and senior officials of different organizations the level of education was found to be very high. All respondents among teachers and environmentalists had Masters' or PhD degrees. Among the agriculturists 55% had PhD degrees, most of being researchers.

Table 2: Level of education of the respondents

Respondent group	Education*		
	BA	MA/MS	PhD
1. Agriculturists (Res. and extension)	9	27	44
2. NGO staff	-	13	36
3. Academicians/University teachers	8	39	10
4. Policy makers & govt. officials	3	7	5
5. Environmentalists	-	5	3
6 Other civil society groups	3	7	1
All groups	23 (10)	98 (45)	99 (45)

* Twelve respondents did not respond.
Note: Figures in parentheses indicate percentages

Rural and urban background: The place of birth of the respondents who indicated their place of birth shows that 76% of them were born in rural areas while only 24% were born in urban areas (Table 3). Seven percent respondents did not indicate their place of birth. All the environmentalists were from rural background while the least percentage (54%) of rural background was for teachers. The overall rural background of the respondents should make them knowledgeable about agriculture.

Table 3: Urban and rural origin of respondents

Respondent group	Place of birth*		
	Urban	Rural	Total
1. Agriculturists (Res. and extension)	12	67	79
2. NGO staff	21	25	49
3. Academicians/University teachers	12	45	61
4. Policy makers & govt. officials	2	13	16
5. Environmentalists	-	8	8
6 Other civil society groups	4	6	18
All groups	51 (24%)	164 (76%)	215 (100)

* Seventeen respondents did not respond.
Note: Figures in parentheses indicate percentages

Respondents' knowledge of green revolution

A few questions were asked on green Revolution to test the knowledge of respondents on improved agricultural technology. All respondents stated to have heard about green revolution although 95% could define the term correctly. Sixty three percent defined the term as 'dramatic increase in food grain production' and another 31% defined it as 'increase in food production while conserving natural resources (Table 4). All respondents among the university teachers and environmentalist groups could correctly define the term. The least knowledgeable group was the policy makers and govt. officials 81% of them giving correct answer. Only five percent gave incorrect answers.

Table 4: Knowledge about green revolution

Respondent group	Meaning of green revolution			Total
	Dramatic increases in food prod.	Increase in food prods. While consuming national resource	Incorrect answer	
Agriculturists	56	19	5	80
NGOs	34	24	3	61
University teachers	33	16	-	49
Policy makers	10	3	3	16
Environmentalists	6	2	0	8
Other civil society groups	8	9	1	18
All groups	147 (63)	73 (31)	12 (5)	232 (100)

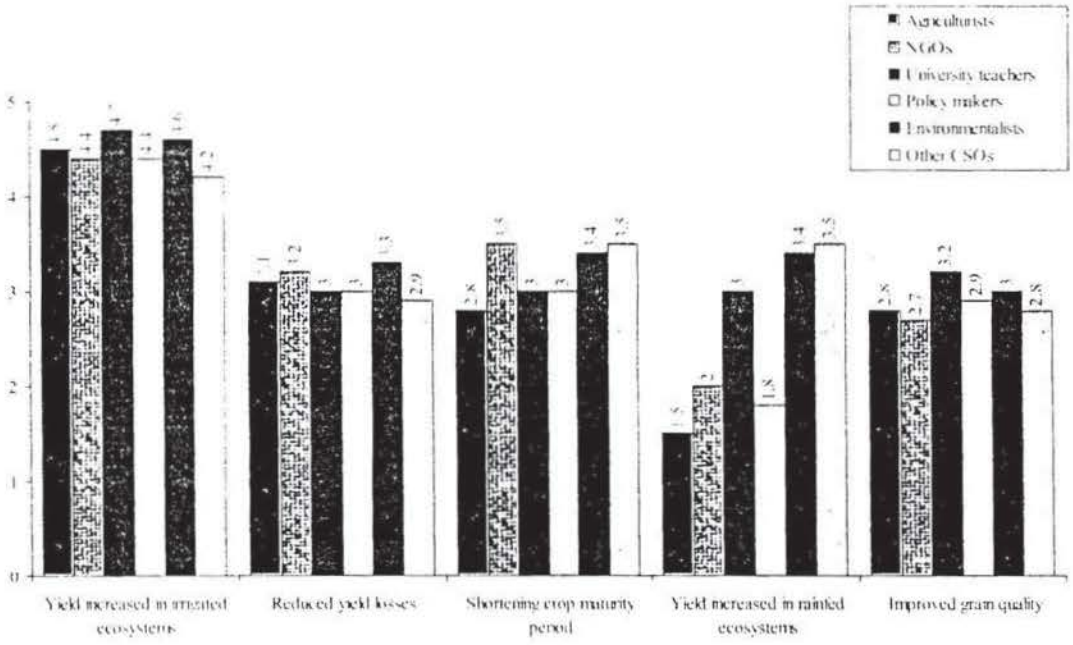
Note: Figures in parentheses indicate percentages

Positive effects of green revolution: Among the positive effects of green revolution 97% respondents ranked the answer 'increase in rice yields for irrigated areas' as highest by giving top score of 4.49 out of five. Other positive effects included 'reducing yield loss through insect and disease resistance', 'shortening the growing period of rice', increase in rice yield for rain fed areas' and 'improving taste of rice' (grain quality) in ranking order (Figure 1).

Negative effects of green revolution: Major negative effects of green revolution were, in order of ranking:

- Use of chemical fertilizer destroys soil
- Some HYV erodes biodiversity
- Intensive rice cropping reduce fertility
- Tube-well irrigation increases arsenic contamination
- Makes poor farmer indebted
- Increase regional income disparity
- Accentuates income inequality.

Figure 1: Knowledge on positive effects of green revolution in Bangladesh
[Five point scale, 5=high and 1=low]



The responses on the positive and negative effects of green revolution suggest that the respondents have the right perceptions about the term. The ranking of the answers did not vary widely, though environmentalists showed relatively more concern than other groups about erosion of biodiversity, farmers' indebtedness and income inequality. The NGOs were not overly critical about green revolution compared to other groups. One reason might be that a few NGOs in Bangladesh, which are known to be highly critical about modern agricultural technology, did not provide answers to the questionnaires sent to them.

Knowledge and perception on biotechnology

Ninety five percent of the respondents reported that they have heard about biotechnology while 59% reported that they have heard about GMO. Among those reporting to have heard about biotechnology, 73% were found to be knowledgeable about biotechnology. Among those who heard about GMO, 98% gave correct answer on what the term GMO stood for i.e. genetically modified organism. Forty six percent of the respondents stated that they heard about Frankenstein food, the slang version of GMO used by critics.

Source of information: The major source of information on green revolution was newspapers (60%). Among other sources are teachers, TV, other institutions, literature and NGOs. NGOs appeared to be only a minor source of information (9%).

Source of information on biotechnology were more or less similar. The major source was newspapers (53%), followed by other institutions (34%), teachers (26%), literature (21%), TV (19%), other civil society groups (14%) and NGOs (13%).

Among those who heard about Frankenstein food, the sources of information were newspapers, literature, TV, other civil society groups, other institutions, NGOs and teachers.

Negative aspects of GMO/Frankenstein food: Fifty two percent of respondents mentioned about negative aspects of GMO or Frankenstein food. The most important negative aspect mentioned was the negative effect of GMO on food and human health. The second negative aspect mentioned was 'hazardous changes in natural environment' followed by 'threat to bio-diversity and creation of natural disaster'. Among others mentioned were 'farmers will face seed related problem', 'may change human genes and behavior' and 'unethical in socio-religious context'. A comparison among different civil society groups shows that the largest percentage of the agriculturists (66%) mentioned negative aspects followed by environmentalists (63%) while the least percentage was that of the NGO group (34%). Thus food safety, human health and ecological considerations were taken into account by the respondents in expressing their perceptions on the negative aspects of GMO.

Perceptions on biotechnology research

Support for biotechnology research: On the question of whether the respondents support research on rice biotechnology, only about 14% of them expressed unconditional support. The largest supporting group was University teachers (18%), followed by agriculturists (15%), policy makers (13%), and NGOs (12%), while none among the environmentalists supported biotechnology research unconditionally (Table 5). It was expected that a larger number of NGO officials would oppose biotech research but it did not happen so. One reason may be, as mentioned before, that some NGOs believed to be against biotech research did not provide answers to the questionnaires sent to them. On the other hand, it may be mentioned here that BRAC, the largest NGO in Bangladesh has undertaken a programme for developing tissue culture and the production and distribution of hybrid maize and rice seeds. The major source of hybrid maize seed in Bangladesh is BRAC. However, 83% respondents gave conditional support to biotech-research.

Conditions for supporting biotech-research: The conditions under which they support biotech-research include the following, in order of importance:

- ⇒ If health and environmental impact of biotech-research are assessed before undertaking such research
- ⇒ If the technology provides substantial health benefits
- ⇒ If the technology reduces use of pesticide
- ⇒ If the biotech-research is done by the public sector and products are provided free of charge to farmers.

Table 5: Support for biotechnology research

Respondent Group	Whether support biotech research			Total
	Yes	Yes, undo certain conditions	No	
Agriculturists	12 (15)	67 (84)	1 (1)	80
NGOs	7 (12)	50 (85)	2 (3)	59
University teachers	9 (18)	40 (82)	-	49
Policy makers	2 (13)	13 (81)	1 (6)	16
Environmentalists	-	6 (75)	2 (25)	8
Other civil society groups	2 (11)	15 (83)	1 (6)	18
All groups	32 (14)	191 (83)	7 (3)	230 (100)

Note: Figures in parentheses indicate percentages

Though there was no perceptible variation among different respondent groups on this question, the percentage of response was highest for agriculturists (84%) while it was lowest for environmentalists (75%). The cautious support expressed by different civil society groups appears to be quite rational and reasonable.

Reasons for not supporting research on biotechnology: Only seven respondents (3%) respondents were against biotech-research in Bangladesh. They mentioned a few reasons for not supporting research on rice biotechnology that included the following:

(a) Farmers will become dependent on private companies and multinationals who will charge high price for seed,
(b) Gene transformation is unethical,
(c) GM rice will be allergic to human health,
(d) BT will create pests that would destroy food sources. The negligible opposition to biotech-research came more from environmentalists and NGO groups than other civil society groups. These factors might be taken as the negative aspects of biotech-research.

Perception on import of transgenic Bt rice varieties into Bangladesh

Since the respondents may not be aware of the recent developments in rice biotech products, and potential benefits of the products, which have already been developed in the laboratory, these were explained in the questionnaire and response was solicited on the advisability of their field-testing in Bangladesh. One such product was Bt rice, which is resistant to stem borers, a major pest in Bangladesh. The response was quite positive.

Fifty two percent of the respondents said that they would support import of transgenic pest resistant (Bt) rice into Bangladesh for testing their suitability under Bangladesh conditions, 38% supported it under certain conditions, and 8% opposed it (Table 6).

Conditions for support: The pre-conditions for supporting import of transgenic rice for testing in Bangladesh stated by the respondents included the following:

- Effect on health and environment is assessed
- Product improvement and other economic benefits are accrued
- Bio-safety regulations are followed
- Skilled scientists/technicians are available

Table 6: Support for import of transgenic Bt rice in Bangladesh

Respondent group	Whether favor import of transgenic				Total
	Yes	Yes, undo conditions	Sub-total	No	
Agriculturists	42 (53)	34 (43)	76 (95)	4 (5)	80
NGOs	34 (60)	19 (33)	53 (93)	4 (7)	57
University teachers	27 (56)	19 (40)	46 (96)	2 (4)	48
Policy makers	5 (31)	8 (50)	13 (81)	3 (19)	16
Environmentalists	1 (14)	3 (43)	4 (57)	3 (43)	7
Other civil society groups	8 (50)	5 (31)	13 (81)	3 (19)	16
All groups	117 (52)	88 (39)	205 (91)	19 (9)	224 (100)

Note: Figures in parentheses indicate percentages

Thus the respondents expressed concern for food safety and bio-safety regulations. They also considered economic benefits. The positive response, including conditional support, came from 91% of the respondents. The largest percentage of respondents (96%) providing support, unconditional or conditional, was from the academic community (university teachers) followed by agriculturists and NGOs. The least support was received from the environmentalists (57%). Those opposing import of Bt rice mentioned health, environment and bio-diversity problems, among other reasons.

Perception on health and environmental aspects of rice biotech-research

Problems of iron and vitamin A: Regarding the problem of iron deficiency in Bangladesh 87% respondents said that it causes health problem. However, only 30% considered this as a very serious problem while 53% regarded this as a serious problem.

Ninety two percent respondents mentioned vitamin A deficiency to be a health problem in Bangladesh. Thirty three percent considered this as a very serious problem while 58% considered it as a serious problem, thus a overwhelming majority considered both iron and vitamin A deficiency to be a major health issue.

Supporting biotech research for incorporating iron and vitamin A in rice: Eighty three percent of the respondents supported biotech research in Bangladesh for incorporating iron and vitamin A in rice in Bangladesh. Eighty two percent supported field testing of vitamin A enriched rice developed at IRRI in Bangladesh while 80% supported field testing of iron enriched rice developed at IRRI in Bangladesh. Only nine percent respondents opposed biotech research on iron and vitamin A enriched rice. They mentioned that 'deficiency in iron and vitamin A can be met by production of non-rice crop' or supplemented by tablets or by fortification of rice and wheat; 'health risks will outweigh the benefits'; 'it is unethical and might disrupt natural balance'; and 'scarce resources should not be allocated for such rice'.

The agriculturists (90%) and university teachers (88%) expressed highest support for biotech research to incorporate iron and vitamin A in rice while least support was received from environmentalists (63%). Seventy five percent of NGO personnel and policy makers expressed support on this issue.

The problem of pesticide use: On the question whether pesticide use in rice poses a serious problem in Bangladesh, 40 considered it as a very serious problem, 45% considered it as a serious problem and 13% as a marginal problem.

Summary and Conclusion

The survey on different civil society groups conducted through a mailed questionnaire survey elicited a favourable response on the issue of undertaking rice biotech research in Bangladesh. The respondents, numbering 232 represented six groups. Nearly three-fourth of the respondents was over forty years of age and about 90% had Masters' degree or PhDs. None was found below graduates. Three-fourth of them was also born in rural areas.

All respondents had heard about green revolution and 95% could define the term correctly. Their perception about positive effects was also highly satisfactory. There was not much variation in the responses among different groups though environmentalists showed greater concern about erosion of biodiversity, farmers' indebtedness and income inequality. The NGOs were also not found to be overly critical about green revolution.

Respondent's knowledge and perception about biotechnology was also found to be at a very high level, 95% having heard about the term, three-fourth of those found to be knowledgeable. Fifty nine percent heard about GMO and almost all could define the term correctly.

On the source of information about green revolution, biotechnology and GMO, the major source was found to be newspapers, electronic media, literature, teachers and NGOs. NGOs were found to be a minor source of information.

On the question of introducing rice biotech research in Bangladesh, the respondents expressed cautious support. In general they showed their concern on health and environmental impact of biotech research before providing their support. They also favoured biotech research to be undertaken by the public sector and expected the benefits to be freely available to farmers.

The majority (52%) of respondents also supported import of transgenic pest resistant Bt rice for testing under Bangladesh condition but support was conditional. Prior assessment of health and environmental effects including bio-diversity problems, economic benefits, observing bio-safety regulations and availability of skilled scientists were mentioned for consideration before importing transgenic rice. Those opposing it mentioned health, environment and bio-diversity problems.

The respondents considered the problems of iron and vitamin 'A' deficiency as serious health problems. Eighty three percent supported biotech research in Bangladesh for incorporating iron and vitamin 'A' in rice in the country. Most of the agriculturists and university teachers supported this research while relatively less support was received from environmentalists and NGOs.

Thus, the findings of the study show a high level of knowledge and perception of different civil society groups about rice biotechnology. In general they also expressed a positive attitude to undertaking research on rice biotech in Bangladesh, though they expressed their due concern over food safety, health, biodiversity and environmental effects which need to be considered before undertaking such research.

Some policy issues raised by the study findings include, among others, maintaining favourable health and environmental effects, undertaking such research by the public sector to protect the interest of the rice producers, and enacting and enforcing bio-safety regulations before undertaking rice biotech research.