

## ABSTRACT

Genetically modified (GM) rice has been developed to confer agronomic benefits such as tolerance to herbicides, drought, flood, and salinity, and resistance to insects, as well as health benefits such as improved vitamin content. Yet regulatory, policy and market barriers including perceptions of consumer and producer unwillingness to purchase and grow GM rice have prevented commercialization.

This study is designed to help understand the barriers and controversies of GM rice acceptance in Bangladesh and identify the factors that affect the willingness of consumers to purchase and producers to grow GM rice.

Double bounded dichotomous choice (DBDC) contingent valuation (CV) and multinomial logistic maximum likelihood models are estimated to measure consumer willingness to pay (WTP) for resource stress and enhanced nutritional GM rice events. Stochastic payment card (SPC) approach is used to estimate rice producers' willingness to adopt (WTA) GM rice.

The results point to a positive view of GM rice by consumers represented by WTP higher than the reference price for regular rice.

Producers in Bangladesh have a low yield gain, cost saving, and nutritional benefit threshold to switch to GM rice.

## INTRODUCTION

GM technology has been adopted worldwide except for food grain crops, rice and wheat. It has generated sizable economic benefits to the adopters, many in the developing world<sup>1</sup>.

Despite the benefits associated with this technology, to date no GM food crop, including rice, have been commercialized at a large scale<sup>2</sup>.

Despite the barriers to commercialization, research and development of GM rice continues, focusing on agronomic and nutritional improvements to stabilize production and improve the well being of consumers.

Bangladesh is one of the few countries that has approved field trial of Golden rice, but no approval for production has been made by the regulatory authorities. The approval of Bt eggplant for commercial production certainly offers hope for the approval of other GM food crops for commercial production in the near future.

The objective of this study is to analyze the willingness of consumers to purchase and producers to grow GM rice in Bangladesh. Also to identify the factors that affect the willingness of consumers to purchase and producers to grow GM rice.



## METHODOLOGY

**Consumer surveys** in Bangladesh included random selection of 219 consumers. Selected locations were in Dhaka, Gazipur, Mymensingh and Dinajpur. WTP of consumers were estimated using the DBDC CV method.

Four science-based information treatments were applied, including:

1. Neutral, no information provided
2. Environmental GM, information about Bt rice
3. Nutritional GM, information about Golden rice
4. Stacked environmental plus nutritional GM

Ordering effects (benefits first vs. risks first) were tested. The DBDC questionnaire had 5 different GM rice starting prices. Socio-demographic questions were also included.

Consumer data were analyzed following the procedure by Lopez-Feldman<sup>3</sup>.

**Producer surveys** included 200 rice producers from Sherpur, Mymensingh, Bogra and Dinajpur districts. WTA was estimated using SPC CV methods following Whittington and Wang<sup>4</sup>. Three GM potential trait gains were framed as SPC questions—likelihood by rice farmers to produce GM rice compared to inbred rice given 0% - 20% improvements in yield, cost of production reduction and nutritional benefit.

## RESULTS

**Consumer results.** The vast majority of respondents had no knowledge about GM rice prior to the survey. Most are male, with a normally distribution of income. Over half of the respondents hold a college degree or higher, and the vast majority spent a large share of income (> 25%) in food.

The WTP for GM rice across the full sample was estimated at Tk. 44.7/Kg (US\$ 0.58/Kg). Based on the WTP estimates and the reference price of non-GM rice (Tk. 40/Kg), the findings suggest consumers in Bangladesh are willing to pay a premium of 11.8% for GM rice.

We found no significant differences in WTP among information treatments or ordering effect. Furthermore, we found no socio-demographic variable with significant explanatory power to explain variation in WTP. These results are preliminary, and further analysis of the data is ongoing.

Table 1. Frequency of selected socio-demographic variables of consumers and estimated WTP

No Prior Knowledge	Male	Income Class			Education				Share Food Expenditure			Average WTP USD/Kg	GM Rice Premium
		Low	Medium	High	<= Primary	High School	College	Graduate	<= 15%	15% - 25%	>= 25%		
95%	95%	37%	51%	12%	19%	23%	35%	23%	4%	11%	85%	0.58	11.8%

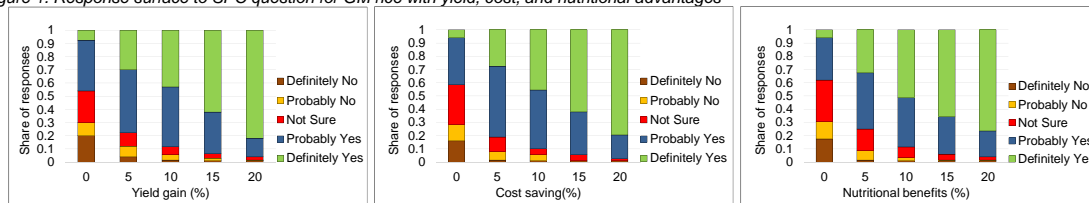
**Producer results.** Similar to consumers, most rice producers (99%) had no previous knowledge about GM rice. Roughly 95% of the respondents were men with an average age of 41 years. The average farm size is 1.1 ha.

Table 2. Frequency of selected socio-demographic variables of rice producers

Own Land	Try new varieties	Self Consumption >50%	Income Class			Education				Receive Agronomic Advice	Participate Extension Activities
			Low	Medium	High	<= Primary	High School	College	Graduate		
84%	65%	94%	56%	33%	11%	44%	47%	7%	2%	68%	82%

The results suggest that producers have a low yield gain, cost saving, and nutritional benefit threshold to switch to GM rice. Everything else constant, producers require a 2.3% yield gain (of GM vs. inbred), 2.0% reduction in production cost, and 1.9% increase in nutritional benefits to switch to GM rice.

Figure 1. Response surface to SPC question for GM rice with yield, cost, and nutritional advantages



## DISCUSSION

The results of this study point to an aggregate favorable view of GM rice by consumers, represented by willingness to pay estimates higher than the reference price for regular rice. No significant effect was found for information treatments, ordering effects, prior knowledge, and socio-demographic variables.

Everything else equal, producers require economic and nutritional benefits to switch from inbred to GM rice varieties. The results suggest Bangladeshi farmers have a low yield, cost, and nutritional benefit threshold to switch to GM rice.

Further analysis will focus on estimation of factors to explain rice producers WTA. The findings of this study can certainly help GM private and public stakeholders design appropriate GM rice policy strategies.

Data analysis of both consumer and producer surveys is ongoing, therefore the results presented here are to be considered preliminary.

## REFERENCES

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