



Consumer awareness and preferences towards genetically modified crops

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Abstract

Genetically modified organisms (GMO's) refer to plants and animals containing genes transferred from other species to produce certain characters such as resistance to pest, disease and drought etc. There are controversies in GM crops production and consumption, apart from that it's useful to know the consumer awareness and preferences is essential for policy development towards the production and consumption of GM crops. This paper analyzes the consumer awareness and preferences of genetically modified crops in Coimbatore district of Tamil Nadu, India. Apart from consumer survey, the probit model was used to analyze the willingness and non-willingness of the consumption of GM crops. The results showed that the consumer preferences towards GM crops is positive and about more than 50 % of the sample respondents are willing to consume GM crops if the government approved. Yet, there are many challenges ahead for the scientists and governments, especially in the areas of safety testing, regulation and food labeling.

Keywords: awareness and preferences, GM crops, probit model

1. Introduction

Population, Poverty and hunger, Shrinking area of agricultural land, Climate change in agriculture, Deterioration in soil quality, New pest and disease outbreak, Diminishing water resources, Inadequate labour and inputs, Low agricultural production are the major problems facing by the farmers in India. GM crops are forecast to bring productivity and profitability in commercial agriculture for smoother progress in the future (Ruchir Raman, 2017) [8]. One potential application of GM technology is to improve the nutritional quality of crops and thereby improve human health (Royal Society, 2000). The future is very promising for GM technologies to enhance our efforts to meet the future global needs for food, feed and fiber in a sustainable and

responsible way (Melvin J. Oliver, 2014). Genetically, modified foods have various advantages like high yield, salinity tolerant, insect resistance etc. GM foods have a lot of health effects on living beings. As an example of benefits, insect-resistant Bt-expressing crops will reduce the number of pest insects feeding on these plants, but as there are fewer pests, farmers do not have to apply as much insecticide, which in turn tends to increase the number of non-pest insects in these fields. Other possible effects might come from the spread of genes from modified plants to unmodified relatives, which might produce species of weeds resistant to herbicides (Charu Verma *et al*, 2011) [1].

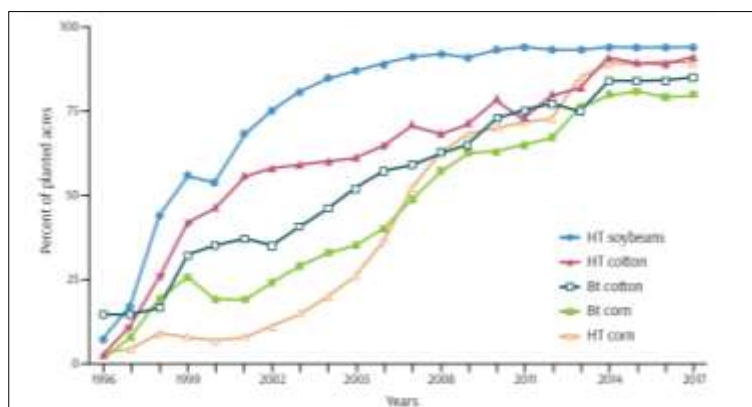


Fig 1

Fig.1 shows the area under various crops in United States from 1996-2017. The production of Bt cotton and corn is increasing gradually. In GM foods consumption, Americans stands first in

consuming GM foods. About 70 per cent of processed food products in the United States have ingredients derived from GM crops. The agriculture industry is projected to suffer significant

global setbacks (population growth, pest resistance and burden on natural resources) by 2050 (Ruchir Raman, 2017)^[8]. GM seeds may be least appropriate for farmers who are particularly reliant on a stable market. The uncertainty surrounding consumer acceptance of GM products, particularly in foreign markets, is a risk that may simply be unacceptable to some farmers (David Krufft, 2001)^[3]. In South Africa, permits have been issued for the commercial production of both white and yellow maize, soybean and cotton. White maize is usually produced for human consumption and yellow maize for animal feed and industrial use (Expert consultation Report and Selected Paper, 2006). No significant negative effects on health nor conclusive evidence of potential adverse effects associated with the novel proteins, toxins resulting from the GM construct or its expression (Sean A. Weaver and Michael A Morris, 2005). GM foods have both positive and negative effects. These may be either direct effects, on organisms that feed on or interact with the crops, or wider effects on food chains produced by increases or decreases in the numbers of other organisms (Charu Verma *et al*, 2011)^[1].

Genetically modified organisms (GMO's) refer to plants and animals containing genes transferred from other species to produce certain characters such as resistance to pest, disease and drought etc. GM crops commercially started grown during 1996. Genetic modification done in two major ways:

- (1) Introduce one or a few well-characterized genes into a plant species and
- (2) Introduce genes from any species into a plant.

GM Crops Indian Scenario

(GEAC) – Genetic Engineering Approval Committee looks over the issues regarding GM crops in India. The commercialization of Bt Cotton was in the year 2002. The approval for Bt Brinjal (1st GM food crop) in the year 2009 and later announced a moratorium on the release of Bt Brinjal. The Indian government revalidated 10 GM-based food crops and allowed field trials for them, including wheat, rice, and maize (March, 2014). Supreme Court technical expert committee commended an indefinite moratorium on the field trials of GM crops till the government comes out with a proper regulatory and safety mechanism (TOI, July, 2013). The Indian government allowed field trials for GM crops, including wheat, rice, and maize (March, 2014). India doesn't allow commercial cultivation of genetically modified (GM) crops but Indians may be consuming GM processed food - knowingly or un-knowingly (Parliamentary panel, March, 2014).

With these above backgrounds the following objectives were framed for the present study,

- To study the consumer awareness and attitude on GM crops/Foods,
- To study the consumer preferences towards GM crops/Foods,
- To study the factors influencing the consumer preferences towards GM crops/Foods.

2. Materials and Methods

Sampling Design

The research was carried out in Coimbatore district of Tamil Nadu state, India. The Coimbatore district was purposively taken for the present study, since the educational status and population (consumption) was higher in the district.

Consumer Survey

A brief note containing the present scenario, pros and cons of GM crops was prepared in both Regional language and English. The personal details of the researcher like name of the researcher, address with contact numbers also attached in the same note. The brief note on GM crops had been distributed to all sample households in the research area by directly met the sample respondents and also posted in the houses where the sample respondents are not available in the day time. After ten days of the distribution of brief note on GM crops, a personal interview using structured questionnaire was conducted. The questionnaire covered all the basic socio-economic particulars, consumption pattern and other necessary information of the sample respondents.

Tools of Analysis

Conventional Analysis

The conventional methods of analysis *viz.*, percentages and averages were carried out to estimate the level distribution of socio-economic variables of the respondents.

Probit model

The probit model was employed to know about the willingness and factors affecting the willingness of buying GM crops. The probit model allows the independent variable to take two values. The model follows;

$$I_i = \beta_1 + \beta_2 \text{ Age} + \beta_3 \text{ Edu} + \beta_4 \text{ Millets} + \beta_5 \text{ Organic} + \beta_6 \text{ Health awareness} + e$$

Where,

$I_i = Y = 1$, if the consumer willing to consume GM crops and 0 if the consumers are not willing to consume GM crops.

Age	:	Age of the head of the household (years).
Edn	:	Educational status of the consumers (Illiterate-1; Primary -2; Secondary-3, Diploma-4, College -5).
Millets	:	Millets consuming consumers
Organic	:	Organic foods consuming consumers
Health awareness	:	Health awareness-Regular health checkup, exercise
β_2 and β_6	:	Coefficients of independent variables
β_1	:	Intercept

3. Results and Discussion

Socio-economic Characters

The socio-economic characters like gender, age, educational level, income and other details of the sample respondents were analyzed using averages and percentages.

Table 1: Socio-economic Characters of the Respondents (n=90)

Variable	Category	Percentage
Gender	Male	42.22
	Female	57.78
Age group	<30	13.33

	31 to 40	46.67
	41 to 50	26.67
	>51	13.33
Educational Level	Illiterate	0
	Primary	13.33
	Secondary	13.33
	Diploma	15.55
	Degree	57.77
Income level (monthly)	Low (<20000)	4.44
	Average (>20000-30000)	60.00
	High (>30000)	35.56

Table.1 shows the socio-economic characters of the sample respondents. Among the sample respondents around 58 per cent of the sample respondents are female and 42 per cent sample respondents are male respondents. The female respondents are more in the research area because the consumer survey was taken up in the daytime and only female respondents are available in the houses because the male respondents were went for jobs. Even though the male respondents are not available, the consumption decision was mainly taken by the female respondents only. In case of age of the sample respondents' majority of the sample respondents are in between the age group of 31 to 40 years followed by 41 to 50 years of age group (26.67). While observing the educational level of the sample respondents, 58 per cent of the respondents are having a degree and there are no illiterates in the research area, since the literacy level is higher in the study area because it is one of the develop city in India. Majority (60 per cent) of the sample respondents are in the monthly income level of rupees 20,000 to 30,000. The above are the findings in the socio-economic characters of the sample respondents in the research area.

Consumers Awareness

The brief note containing the present scenario, and pros and cons of GM crops were distributed to all sample households in the research area. One of the objectives of the research is to know the awareness on the production and consumption of GM crops. The response from the sample households were depicted in the Diagram 1.

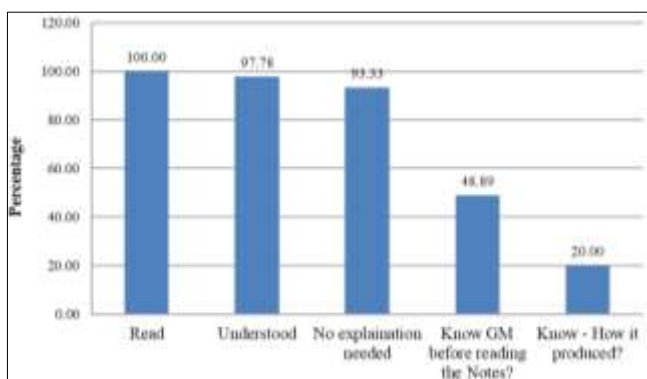


Diagram 1: Consumers Awareness about GM Crops

The awareness about the GM crops is the major concern in this research. All the sample respondents (100 per cent) in the study

area read the brief note containing the information about GM crops which was distributed / posted in the research area. About 98 per cent of the sample respondents were understood the brief note about the GM crops and around 5 per cent of the sample respondents needs further explanation on the brief note. It is interested that, nearby, half of the sample respondents were know about the GM crops well before and 20 per cent of the sample respondents were know about production details of the GM crops.

Consumers Preferences

The consumer preferences towards the consumption of GM crops were analyzed and the results were shown in diagram 2.

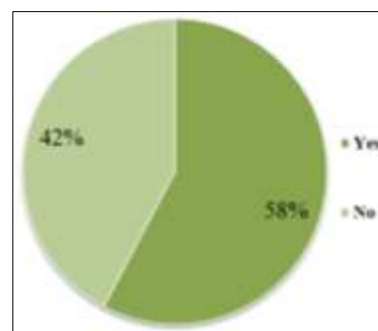


Diagram 2: Consumers Preference towards GM Foods

At the time of consumer data collection, the sample respondents are asked with various questions. The following question was placed before all the respondents. "If the state / government approved, will you consume the genetically modified crops? More than half of the sample respondents were positively responded and around 58 per cent of the respondents are willing on the consumption on GM crops, if government approved. Although the domestic market has generally responded positively to GM products, farmers fear that the uncertain effects of the products may "spook" domestic consumers. Most observers of the GM industry recognize that the domestic market has consumed GM products for years and, thus far, there have been no accompanying health impacts (David Krufft, 2001)^[3]. In other side, 42 percentage of the sample respondents are not willing to consume the GM crops even after government approval.

Factors determining the Preferences towards GM Foods

The factors' determining the preferences of GM crops was analyzed using probit model. The results were shown in Table 2.

Table 2: Factors determining the Preferences towards GM Foods – Results of Probit model

Sl. No	Variables	Regression Co-efficient	Standard Error	'P' value
1.	Intercept	-2.66595	1.39054	0.05521
2.	Age of the respondents	0.0703669***	0.026334	0.00754
3.	Education of the respondents	0.448971**	0.184799	0.01512
4.	Consumption of Millets	-1.09037**	0.461043	0.01803
5.	Consumption of Organic products	-1.92871***	0.48239	0.00006
6.	Health awareness	-0.0837557	0.413785	0.83959

To determine the preferences of GM crops the following factors were taken for the analysis viz. age of the respondents, education, consumption of millets, consumption of organic products and health awareness. Among all the factors the probability of accepting GM crops with the health awareness respondents is less. While observing the co-efficient of the educational status of the respondents the probability of accepting GM crops is high.

4. Conclusion and Policy Recommendation

The research was carried out in Coimbatore district of Tamil Nadu state, India. The results showed that majority of the sample respondents are female and around 87 per cent of the respondents are more than 30 years of age group. Majority of the sample respondents are having standard education. It is interested to know that all the sample respondents are read the brief note on GM crops which was distributed in the research area and nearby 50 per cent of the sample respondents were aware about GM crops/foods. There are about 20 per cent of the sample respondents know the production details of GM crops. More than half of the sample respondents are willing to consume GM foods if the government approves in support with strong evidences. The probability of accepting GM crops are low in health awareness but it was high with educated people. The following points were giving additional support for the consumption of GM crops. a) Majority of the respondents are female and, in many houses, the major decision makers are women in consumption. b) Around 87 % of the respondents are more than the age group of 31 years, hence, they are well experienced in consumption so the results are good, since the educational level also supports it. c) Majority of the sample households were well educated, so they are already known about the GM crops in general. d) About 50 % of the sample respondents are well aware to GM crops; this will support the results of willing to consumption.

Policy Recommendation

GE is in its infancy. It enhances human capability to deal with challenges posed by climate change, food security and environmental protection. It will be a major mistake to abandon GE technologies or heavily restrict their progress because of perceived risks. Instead, society should nurture these technologies and carefully evaluate and utilize them to the benefit of humanity and the environment (David Zilberman *et al*, 2018)^[4]. GM foods have the potential to solve many of the world's hunger and malnutrition problems and to help protect and preserve the environment by increasing yield and reducing reliance upon chemical pesticides. Long-term studies on potential bioaccumulation of toxins related to GMO-based foods are still missing (Georgina Catacora-Vargas, 2011)^[6]. Certainly, the largest controversy surrounding the regulation of GM foods has been labeling. (David Kruft, 2001)^[3]. To overcome the problems like Increasing population, Poverty and hunger, Shrinking area of

agricultural land, Climate change in agriculture, Deterioration in soil quality, New pest and disease outbreak, Diminishing water resources, Inadequate labour and inputs, Low agricultural production etc the genetically modified crops may bring into play. Yet, there are many challenges ahead for us and governments, especially in the areas of safety testing, regulation and food labeling.

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